

Specifications
for
**University of Toronto
Health & Wellness at Koffler**
Toronto, Ontario
January 31, 2025
Issued for Bid



PART 1 - THE CONSULTANTS

1.1. THE CONSULTANT

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- 1.5.1. Footprint S+A
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1.6. HARDWARE CONSULTANT

- 1.6.1. Upper Canada Specialty Hardware Limited
10 Brentcliffe Road, Unit 14
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1.7. CIVIL ENGINEERING CONSULTANT

- 1.7.1. MTE Consultants Inc.
1016 Sutton Drive, Unit A
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Web: mte85.com

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- 1.8.1. Henry Kortekaas & Associates Inc.
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END OF SECTION

| PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP | | | | | |
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| DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS | | | | | |
| INTRODUCTORY INFORMATION | | | | | |
| Section No. | Section Title | Rev. No. | Date | Consult. | Page No's |
| 00 00 01 | PROJECT TITLE PAGE | -- | 2025-01-31 | EAI | 1 Only |
| 00 01 05 | LIST OF CONSULTANTS | 00 | 2025-01-31 | EAI | 1 and 2 |
| 00 01 10 | TABLE OF CONTENTS | 00 | 2025-01-31 | EAI | 1 thru 7 |
| 00 01 15 | LIST OF DRAWINGS | 00 | 2025-01-31 | EAI | 1 and 2 |
| 00 01 20 | LIST OF SCHEDULES | 00 | 2025-01-31 | EAI | 1 Only |
| PROCUREMENT REQUIREMENTS | | | | | |
| 00 30 00 | AVAILABLE INFORMATION | 00 | 2025-01-31 | EAI | 1 and 2 |
| CONTRACTING REQUIREMENTS | | | | | |
| 00 65 37 | MAINTENANCE MATERIAL FORM (SPECIMEN) | 00 | 2025-01-31 | EAI | 1 Only |
| *00 70 00 | "AGREEMENT BETWEEN OWNER AND CONTRACTOR", "DEFINITIONS" AND "GENERAL CONDITIONS", STANDARD CONSTRUCTION DOCUMENT CCDC 2 - 2020 | | | | Not Enclosed |
| 00 71 00 | AMENDMENTS TO DEFINITIONS | 00 | 2025-01-31 | EAI | 1 and 2 |
| SPECIFICATIONS GROUP | | | | | |
| GENERAL REQUIREMENTS SUBGROUP | | | | | |
| DIVISION 01 – GENERAL REQUIREMENTS | | | | | |
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| *01 42 16 | HERITAGE DEFINITIONS | 00 | 2025-01-31 | EVOQ | 1 and 2 |
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| DIVISION 02 – EXISTING CONDITIONS | | | | | |
| 02 41 00 | DEMOLITION AND SALVAGE | 00 | 2025-01-31 | EAI | 1 thru 6 |
| *02 42 20 | REMOVAL AND SALVAGE OF HERITAGE MATERIALS | 00 | 2025-01-31 | EVOQ | 1 thru 5 |
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| *03 10 00 | CONCRETE FORMING | 04 | 2025-01-31 | EC | 1 thru 11 |
| *03 20 00 | CONCRETE REINFORCEMENT | 04 | 2025-01-31 | EC | 1 thru 7 |
| *03 30 00 | CAST-IN-PLACE CONCRETE | 04 | 2025-01-31 | EC | 1 thru 18 |
| *03 30 53 | MISCELLANEOUS CAST-IN-PLACE CONCRETE | 00 | 2025-01-31 | HKA | 1 thru 4 |

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| 03 35 13 | CONCRETE FLOOR FINISHING | 00 | 2025-01-31 | EAI | 1 thru 7 |
| 03 54 00 | CAST CEMENT UNDERLAYMENT | 00 | 2025-01-31 | EAI | 1 thru 5 |
| <i>DIVISION 04 – MASONRY</i> | | | | | |
| *04 03 01 | COMMON WORK RESULTS FOR HERITAGE MASONRY | 00 | 2025-01-31 | EVOQ | 1 thru 7 |
| *04 03 01.13 | HERITAGE MASONRY CLEANING | 00 | 2025-01-31 | EVOQ | 1 thru 9 |
| *04 03 05.13 | HERITAGE MORTARING | 00 | 2025-01-31 | EVOQ | 1 thru 7 |
| *04 03 05.21 | HERITAGE REPOINTING | 00 | 2025-01-31 | EVOQ | 1 thru 5 |
| *04 03 42.13 | HERITAGE STONE REPAIRING | 00 | 2025-01-31 | EVOQ | 1 thru 7 |
| *04 03 43.16 | HERITAGE STONE REPLACING | 00 | 2025-01-31 | EVOQ | 1 thru 3 |
| *04 03 43.19 | HERITAGE STONE DISMANTLING | 00 | 2025-01-31 | EVOQ | 1 thru 5 |
| *04 03 43.20 | HERITAGE STONE REBUILDING | 00 | 2025-01-31 | EVOQ | 1 thru 3 |
| 04 20 00 | MASONRY UNITS | 00 | 2025-01-31 | EAI | 1 thru 17 |
| <i>DIVISION 05 – METALS</i> | | | | | |
| *05 12 00 | STRUCTURAL STEEL | 04 | 2025-01-31 | EC | 1 thru 22 |
| *05 31 10 | STEEL DECK | 04 | 2025-01-31 | EC | 1 thru 8 |
| 05 41 00 | STRUCTURAL METAL STUD FRAMING SYSTEM | 00 | 2025-01-31 | EAI | 1 thru 11 |
| 05 50 00 | METAL FABRICATIONS | 00 | 2025-01-31 | EAI | 1 thru 8 |
| 05 51 00 | METAL STAIRS AND BALUSTRADES | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 05 73 13 | GLAZED DECORATIVE METAL RAILINGS | 00 | 2025-01-31 | EAI | 1 thru 10 |
| <i>DIVISION 06 – WOOD, PLASTICS AND COMPOSITES</i> | | | | | |
| 06 10 00 | ROUGH CARPENTRY | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 06 40 00 | ARCHITECTURAL WOODWORK | 00 | 2025-01-31 | EAI | 1 thru 7 |
| 06 61 16 | SOLID SURFACING FABRICATIONS | 00 | 2025-01-31 | EAI | 1 thru 7 |
| 06 90 00 | GENERAL INSTALLATIONS | 00 | 2025-01-31 | EAI | 1 thru 4 |
| <i>DIVISION 07 – THERMAL AND MOISTURE PROTECTION</i> | | | | | |
| 07 16 16 | CRYSTALLINE WATERPROOFING | 00 | 2025-01-31 | EAI | 1 thru 5 |
| 07 18 13 | MECHANICAL ROOM WATERPROOFING | 00 | 2025-01-31 | EAI | 1 thru 5 |
| 07 21 00 | BUILDING INSULATION | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 07 21 19 | FOAMED-IN-PLACE INSULATION | 00 | 2025-01-31 | EAI | 1 thru 3 |
| 07 21 29 | SPRAYED INSULATION | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 07 25 00 | MISCELLANEOUS AIR/VAPOUR BARRIERS | 00 | 2025-01-31 | EAI | 1 thru 7 |
| 07 42 44 | ALUMINUM MODULAR PLATE SYSTEM | 00 | 2025-01-31 | EAI | 1 thru 10 |
| 07 52 16 | MODIFIED BITUMINOUS MEMBRANE ROOFING | 00 | 2025-01-31 | EAI | 1 thru 16 |
| 07 62 00 | SHEET METAL FLASHING AND TRIM | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 07 81 00 | SPRAYED FIRE-RESISTIVE MATERIALS | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 07 81 23 | INTUMESCENT FIRE RESISTIVE COATINGS | 00 | 2025-01-31 | EAI | 1 thru 9 |
| 07 84 00 | FIRESTOPPING AND SMOKE SEALS | 00 | 2025-01-31 | EAI | 1 thru 13 |
| 07 92 00 | JOINT SEALANTS | 00 | 2025-01-31 | EAI | 1 thru 10 |
| 07 95 13 | EXPANSION JOINT ASSEMBLIES | 00 | 2025-01-31 | EAI | 1 thru 6 |

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| <i>DIVISION 08 – OPENINGS</i> | | | | | |
| *08 03 52.71 | HERITAGE WOOD WINDOW AND DOOR REHABILITATION | 00 | 2025-01-31 | EVOQ | 1 thru 6 |
| 08 06 80 | GLAZING SCHEDULE | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 08 11 13 | HOLLOW METAL DOORS AND FRAMES | 00 | 2025-01-31 | EAI | 1 thru 9 |
| 08 11 16 | ALUMINUM DOORS AND FRAMES | 00 | 2025-01-31 | EAI | 1 thru 7 |
| 08 15 00 | PLASTIC LAMINATE WOOD DOORS | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 08 31 13 | ACCESS DOORS AND FRAMES | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 08 33 25 | FIRE-RATED OVERHEAD COILING DOORS | 00 | 2025-01-31 | EAI | 1 thru 5 |
| 08 43 14 | ALUMINUM FRAMED FIRE-RATED STOREFRONTS | 00 | 2025-01-31 | EAI | 1 thru 10 |
| 08 44 13 | GLAZED ALUMINUM CURTAIN WALL | 00 | 2025-01-31 | EAI | 1 thru 30 |
| 08 51 13 | ALUMINUM WINDOWS | 00 | 2025-01-31 | EAI | 1 thru 16 |
| *08 71 00 | FINISH HARDWARE | 00 | 2025-01-31 | UCSH | 1 thru 9 |
| 08 71 13 | AUTOMATIC DOOR OPERATORS | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 08 80 00 | GLASS AND GLAZING | 00 | 2025-01-31 | EAI | 1 thru 9 |
| 08 91 00 | LOUVRES | 00 | 2025-01-31 | EAI | 1 thru 7 |
| <i>DIVISION 09 – FINISHES</i> | | | | | |
| *09 03 91 | HERITAGE PAINTING | 00 | 2025-01-31 | EVOQ | 1 thru 6 |
| 09 21 16 | GYPSUM BOARD ASSEMBLIES | 00 | 2025-01-31 | EAI | 1 thru 16 |
| 09 27 13 | GLASS-FIBRE-REINFORCED GYPSUM FABRICATIONS | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 09 30 00 | TILING | 00 | 2025-01-31 | EAI | 1 thru 11 |
| 09 51 13 | ACOUSTICAL PANEL CEILINGS | 00 | 2025-01-31 | EAI | 1 thru 8 |
| 09 60 13 | TACTILE WARNING SURFACING | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 09 62 19 | LAMINATE FLOORING | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 09 65 13 | RESILIENT BASE AND ACCESSORIES | 00 | 2025-01-31 | EAI | 1 thru 3 |
| 09 65 43 | LINOLEUM | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 09 84 13 | FIXED SOUND-ABSORPTIVE PANELS | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 09 91 00 | PAINTING | 00 | 2025-01-31 | EAI | 1 thru 16 |
| 09 96 03 | HIGH-PERFORMANCE INTERIOR COATINGS | 00 | 2025-01-31 | EAI | 1 thru 4 |
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| 10 22 26 | FOLDING PANEL OPERABLE PARTITIONS | 00 | 2025-01-31 | EAI | 1 thru 4 |
| 10 28 00 | WASHROOM ACCESSORIES | 00 | 2025-01-31 | EAI | 1 thru 5 |
| 10 51 13 | METAL LOCKERS | 00 | 2025-01-31 | EAI | 1 thru 4 |
| <i>DIVISION 12 – FURNISHINGS</i> | | | | | |
| 12 24 13 | MANUAL ROLLER WINDOW SHADES | 00 | 2025-01-31 | EAI | 1 thru 6 |
| 12 24 14 | MOTORIZED ROLLER WINDOW SHADES | 00 | 2025-01-31 | EAI | 1 thru 7 |
| 12 48 16 | ENTRANCE FLOOR GRILLES | 00 | 2025-01-31 | EAI | 1 thru 3 |
| *12 93 00 | SITE FURNISHINGS | 00 | 2025-01-31 | HKA | 1 Only |

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| <i>DIVISION 14 – CONVEYING EQUIPMENT</i> | | | | | |
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| *14 21 23 | MRL PASSENGER ELEVATOR | | 2025-01-31 | KJA | 1 thru 35 |
| *14 41 00 | PLATFORM LIFT | | 2025-01-31 | KJA | 1 thru 9 |
| *14900 | ELEVATORS: MAINTENANCE | | 2025-01-31 | KJA | 1 thru 21 |
| <i>FACILITY SERVICES SUBGROUP</i> | | | | | |
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| *20 05 01 | ABBREVIATIONS | 00 | 2025-01-31 | S+A | 1 thru 6 |
| *20 05 02 | AS-BUILT DRAWINGS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *20 05 03 | SHOP DRAWINGS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *20 05 05 | SELECTIVE DEMOLITION FOR MECHANICAL SERVICES | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *20 05 29 | HANGERS AND SUPPORTS | 00 | 2025-01-31 | S+A | 1 thru 5 |
| *20 05 48 | VIBRATION AND NOISE CONTROL | 00 | 2025-01-31 | S+A | 1 thru 6 |
| *20 05 53 | PIPE AND DUCTWORK IDENTIFICATION | 00 | 2025-01-31 | S+A | 1 and 2 |
| *20 05 54 | NAMEPLATES | 00 | 2025-01-31 | S+A | 1 Only |
| *20 05 55 | VALVE TAGS AND CHARTS | 00 | 2025-01-31 | S+A | 1 Only |
| *20 05 63 | ACCESS DOORS AND ACCESSIBILITY | 00 | 2025-01-31 | S+A | 1 and 2 |
| *20 05 73 | EXCAVATION AND BACKFILL FOR MECHANICAL WORK | 00 | 2025-01-31 | S+A | 1 and 2 |
| *20 05 83 | SLEEVES AND ESCUTCHEONS | 00 | 2025-01-31 | S+A | 1 thru 3 |
| *20 05 88 | CUTTING AND PATCHING | 00 | 2025-01-31 | S+A | 1 and 2 |
| *20 07 00 | INSULATION | 00 | 2025-01-31 | S+A | 1 thru 15 |
| *20 08 02 | CLEANING AND PROTECTION | 00 | 2025-01-31 | S+A | 1 Only |
| *20 08 03 | OPERATING AND MAINTENANCE INSTRUCTIONS | 00 | 2025-01-31 | S+A | 1 thru 3 |
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| *21 12 00 | STANDPIPE AND FIRE HOSE SYSTEM | 00 | 2025-01-31 | S+A | 1 and 2 |
| *21 12 26 | FIRE HOSE CABINETS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *21 13 00 | SPRINKLER SYSTEMS | 00 | 2025-01-31 | S+A | 1 thru 7 |
| *21 25 00 | PORTABLE FIRE EXTINGUISHERS | 00 | 2025-01-31 | S+A | 1 Only |
| <i>DIVISION 22 – PLUMBING</i> | | | | | |
| *22 05 76 | CLEANOUTS | 00 | 2025-01-31 | S+A | 1 Only |
| *22 11 13 | PIPES, VALVES AND FITTINGS (PLUMBING SYSTEM) | 00 | 2025-01-31 | S+A | 1 thru 9 |
| *22 11 23.29 | CIRCULATORS | 00 | 2025-01-31 | S+A | 1 Only |
| *22 13 19.13 | FLOOR DRAINS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *22 13 19.26 | INTERCEPTORS | 00 | 2025-01-31 | S+A | 1 Only |
| *22 42 00 | FIXTURES AND TRIM | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *22 42 46 | FIXTURE CARRIERS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *22 47 13 | REFRIGERATED DRINKING FOUNTAINS AND BOTTLE FILLERS | 00 | 2025-01-31 | S+A | 1 Only |

| <i>DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING</i> | | | | | |
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| *23 05 93.26 | TESTING AND BALANCING AIR SYSTEMS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *23 09 00 | BUILDING AUTOMATION SYSTEM (BAS) | 00 | 2025-01-31 | S+A | 1 thru 28 |
| *23 09 23 | SEQUENCE OF OPERATION FOR BAS | 00 | 2025-01-31 | S+A | 1 thru 5 |
| *23 21 13.23 | PIPING, VALVES & FITTINGS (EXCEPT PLUMBING) | 00 | 2025-01-31 | S+A | 1 thru 10 |
| *23 23 01 | REFRIGERANT PIPING | 00 | 2025-01-31 | S+A | 1 thru 5 |
| *23 25 26 | CLEANING AND FILLING | 00 | 2025-01-31 | S+A | 1 thru 3 |
| *23 31 13 | DUCTWORK AND SPECIALTIES | 00 | 2025-01-31 | S+A | 1 thru 12 |
| *23 34 53 | ROOM VENTILATORS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *23 36 16 | VARIABLE VOLUME BOXES | 00 | 2025-01-31 | S+A | 1 thru 3 |
| *23 37 13 | DIFFUSERS, GRILLES AND REGISTERS | 00 | 2025-01-31 | S+A | 1 thru 3 |
| *23 81 26 | UNITARY AIR CONDITIONING UNITS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *23 82 16 | COILS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *23 82 33 | CONVECTOR RADIATORS | 00 | 2025-01-31 | S+A | 1 and 2 |
| | *HEATING COIL SCHEDULE | | 2025-01-31 | S+A | 1 Only |
| | *VAV SCHEDULE | | 2025-01-31 | S+A | 1 Only |
| | *AC UNIT SCHEDULE | | 2025-01-31 | S+A | 1 Only |
| | *KITCHEN ECOLOGY UNIT SCHEDULE | | 2025-01-31 | S+A | 1 Only |
| | *FAN SCHEDULE | | 2025-01-31 | S+A | 1 Only |
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| *26 05 03 | AS-BUILT DRAWINGS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *26 05 04 | SUBMITTALS/SHOP DRAWINGS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *26 05 05 | MOUNTING HEIGHTS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *26 05 21 | WIRES AND CABLES UNDER 2000 V | 00 | 2025-01-31 | S+A | 1 thru 7 |
| *26 05 21.01 | PATIENT CARE WIRING | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *26 05 26 | GROUNDING + BONDING | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *26 05 29 | HANGERS AND SUPPORTS | 00 | 2025-01-31 | S+A | 1 Only |
| *26 05 31 | SPLITTERS, JUNCTION, PULL BOXES AND CABINETS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *26 05 32 | OUTLET BOXES, CONDUIT BOXES AND FITTINGS | 00 | 2025-01-31 | S+A | 1 and 2 |
| *26 05 34 | CONDUITS, CONDUIT FASTENERS AND FITTINGS | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *26 05 36 | CABLE TRAYS | 00 | 2025-01-31 | S+A | 1 thru 4 |
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| *26 05 53 | IDENTIFICATION | 00 | 2025-01-31 | S+A | 1 thru 5 |
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| *26 05 73 | ELECTRICAL POWER SYSTEM STUDIES | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *26 05 83 | SLEEVES | 00 | 2025-01-31 | S+A | 1 and 2 |
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| *26 27 26 | WIRING DEVICES | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *26 28 14 | FUSES LOW VOLTAGE | 00 | 2025-01-31 | S+A | 1 and 2 |
| *26 28 21 | MOULDED CASE AND INSULATED CASE CIRCUIT BREAKERS | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *26 28 23 | DISCONNECT SWITCHES - FUSED AND NON-FUSED | 00 | 2025-01-31 | S+A | 1 and 2 |
| *26 29 00 | MOTOR STARTERS TO 600 V | 00 | 2025-01-31 | S+A | 1 thru 6 |
| *26 51 13 | LIGHTING EQUIPMENT | 00 | 2025-01-31 | S+A | 1 thru 8 |
| *26 60 10 | SNOW MELTING SYSTEM | 00 | 2025-01-31 | S+A | 1 thru 4 |
| *26 60 30 | ROOF AND GUTTER DE-ICING SYSTEMS | 00 | 2025-01-31 | S+A | 1 thru 3 |
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| *27 08 00 | COMMISSIONING FOR TELECOMMUNICATIONS SECTIONS | 00 | 2025-01-31 | S+A | 1 thru 6 |
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| *27 15 00.19 | DATA TELECOMMUNICATIONS HORIZONTAL CABLING | 00 | 2025-01-31 | S+A | 1 thru 3 |
| *27 15 33.00 | TELECOMMUNICATIONS COAXIAL HORIZONTAL CABLING | 00 | 2025-01-31 | S+A | 1 and 2 |
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|--|---|----|------------|-----|-----------|
| *28 00 03 | ADMINISTRATIVE REQUIREMENTS | | 2025-01-31 | S+A | 1 thru 3 |
| *28 00 05.30 | CODES, STANDARDS, AND REGULATIONS | | 2025-01-31 | S+A | 1 thru 3 |
| *28 00 06 | FIRE STOPPING AND WATER PROOFING | | 2025-01-31 | S+A | 1 thru 4 |
| *28 01 00 | GENERAL INSTRUCTIONS FOR ESS SECTIONS | | 2025-01-31 | S+A | 1 thru 6 |
| *28 01 01 | OPERATION AND MAINTENANCE OF ELECTRONIC SAFETY AND SECURITY | | 2025-01-31 | S+A | 1 Only |
| *28 05 00 | RACEWAYS FOR SECURITY SYSTEM | 00 | 2025-01-31 | S+A | 1 Only |
| *28 05 00 | COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY | | 2025-01-31 | S+A | 1 and 2 |
| *28 05 03 | RECORD DRAWINGS | | 2025-01-31 | S+A | 1 thru 3 |
| *28 05 04 | SUBMITTALS - SHOP DRAWINGS | | 2025-01-31 | S+A | 1 and 2 |
| *28 05 05.20 | DEFINITIONS AND ABBREVIATIONS | | 2025-01-31 | S+A | 1 thru 6 |
| *28 05 13 | CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY | | 2025-01-31 | S+A | 1 thru 4 |
| *28 05 26 | GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY | | 2025-01-31 | S+A | 1 and 2 |
| *28 05 28 | PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY | | 2025-01-31 | S+A | 1 thru 3 |
| *28 05 53 | IDNETIFICATION FOR ELECTRONIC SAFETY AND SECURITY | | 2025-01-31 | S+A | 1 and 2 |
| *28 08 00 | COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY | | 2025-01-31 | S+A | 1 thru 3 |
| *28 31 02 | MULTIPLEX FIRE ALARM SYSTEM | 00 | 2025-01-31 | S+A | 1 thru 18 |
| <i>SITE AND INFRASTRUCTURE SUBGROUP</i> | | | | | |
| <i>DIVISION 32 – EXTERIOR IMPROVEMENTS</i> | | | | | |
| *32 13 13 | CONCRETE PAVING | 00 | 2025-01-31 | HKA | 1 thru 5 |
| *32 14 13 | UNIT PAVING | 00 | 2025-01-31 | HKA | 1 and 2 |
| *32 93 00 | PLANTING | 00 | 2025-01-31 | HKA | 1 thru 6 |

LEGEND

* - Specifications prepared by Consultants other than ENFORM Architects Inc. have been prefixed with an asterisk. These Specifications are not included under, nor governed by ENFORM Architects Inc.'s seal.

Consultant's Abbreviations:

| | | |
|------|---|------------------------------------|
| UofT | University of Toronto | Owner |
| EAI | ENFORM Architects Inc. | Architectural (A) |
| EC | Entuitive Corporation | Structural Consultant (S) |
| EVOQ | EVOQ Architecture | Heritage Consultant |
| UCSH | Upper Canada Specialty Hardware Limited | Hardware Consultant |
| S+A | Smith + Andersen | Mechanical Consultant (M) |
| S+A | Smith + Andersen | Electrical Consultant (E) |
| KJA | KJA Consultants Inc. | Vertical Transportation Consultant |
| MBII | Mulvey & Banani International Inc. | Security Consultant |
| HKA | Henry Kortekaas and Associates Inc. | Landscape Consultant (L) |

END OF SECTION

PART 1 - GENERAL

1.1. ARCHITECTURAL DRAWINGS

1.1.1. Architectural Drawings forming part of the Contract Documents are those listed on Drawing No. A-000 dated "January 31, 2025" with the following statement in the revision column:

1.1.1.1. "Issued for Bid".

1.2. STRUCTURAL DRAWINGS *

1.2.1. Structural Drawings forming part of the Contract Documents are those listed on Drawing No. S000 dated "January 31, 2025" with the following statement in the revision column:

1.2.1.1. "Issued for Bid".

1.3. MECHANICAL DRAWINGS *

1.3.1. Mechanical Drawings forming part of the Contract Documents are those listed on Drawing No. M000 dated "January 31, 2025" with the following statement in the revision column:

1.3.1.1. "Issued for Bid".

1.4. ELECTRICAL DRAWINGS *

1.4.1. Electrical Drawings forming part of the Contract Documents are those listed on Drawing No. E000 dated "January 31, 2025" with the following statement in the revision column:

1.4.1.1. "Issued for Bid".

1.5. A/V DRAWINGS *

1.5.1. A/V Drawings forming part of the Contract Documents are those listed on Drawing No. AV000 dated "January 31, 2025" with the following statement in the revision column:

1.5.1.1. "Issued for Reference".

1.6. HERITAGE DRAWINGS *

1.6.1. Heritage Drawings forming part of the Contract Documents are those listed on Drawing No. H-01 dated "January 31, 2025" with the following statement in the revision column:

1.6.1.1. "Issued for Bid".

1.7. LANDSCAPE DRAWINGS *

1.7.1. Landscape Drawings upon which the Bid and Contract are to be based include following:

| | <u>Dwg No.</u> | <u>Drawing Title</u> | <u>Date</u> |
|----------|----------------|----------------------|-------------|
| 1.7.1.1. | L-L1 | Landscape Plan | 2025-01-31 |
| 1.7.1.2. | L-D1 | Detail Plan | 2025-01-31 |

1.8. CIVIL DRAWINGS *

1.8.1. Civil Drawings upon which the Bid and Contract are to be based include following:

| | <u>Dwg No.</u> | <u>Drawing Title</u> | <u>Date</u> |
|----------|----------------|---|-------------|
| 1.8.1.1. | C2.1 | Grading & Erosion and Sediment Control Plan | 2025-01-31 |
| 1.8.1.2. | C2.2 | Existing Site Servicing and Public Utilities Plan | 2025-01-31 |
| 1.8.1.3. | C2.3 | Drainage Plan | 2025-01-31 |

LEGEND

** - Drawings prepared by Consultants other than ENFORM Architects Inc. have been prefixed by asterisks and are not included under, nor governed by, ENFORM Architects Inc.'s seal.*

*** - Drawings to be issued at a later date.*

END OF SECTION

PART 1 - GENERAL

1.1. DATES

- 1.1.1. Schedules are dated as indicated herein.

PART 2 - SCHEDULES (Bound with Specifications)

2.1. FINISHES SCHEDULE

- 2.1.1. Material and Finish Schedule (4 pages) dated 31 Jan 2025.

2.2. HARDWARE SCHEDULE **

- 2.2.1. Finish Hardware Schedule (59 pages) dated 31 Jan 2025.

LEGEND

** - Documents provided by the Owner have been prefixed by an asterisk and are not included under, nor governed by, ENFORM Architects Inc.'s seal.*

*** - Schedules prepared by Consultants other than ENFORM Architects Inc. have been prefixed by 2 asterisks and are not included under, nor governed by, ENFORM Architects Inc.'s seal.*

**** - Schedules to be issued at a later date.*

END OF SECTION

| MATERIAL AND FINISH SCHEDULE | | | | | | | |
|------------------------------|---------------------------------|-------------------------------|--|---|-------------------------------|---|--|
| TAG | DESCRIPTION | BASIS FOR DESIGN PRODUCT | COLOUR / FINISH | SIZE / FORMAT | BASIS FOR DESIGN MANUFACTURER | LOCATION (NOT LIMITED TO) | COMMENTS |
| Acoustic Ceiling Tile | | | | | | | |
| ACT-1 | 305x1220 Accoustic Ceiling Tile | USG Halcyon Healthcare Panels | suprafine, fine texture, white factory-painted exposed surface | 1" thick, SL edge with 15/16" DX Grid | CGC | See RCPs | NRC 0.95, CAC 20 |
| ACT-2 | 610x610 Accoustic Ceiling Tile | USG Halcyon Healthcare Panels | suprafine, fine texture, white factory-painted exposed surface | 1" thick, SL edge with 15/16" DX Grid | CGC | See RCP | NRC 0.95, CAC 20 |
| ACT-2a | 610x610 Accoustic Ceiling Tile | USG Mars Healthcare Panels | suprafine, fine texture, white factory-painted exposed surface | 3/4" thick, SLT edge with 15/16" DX Grid | CGC | See RCP | NRC 0.75, CAC 35 |
| ACT-3 | 610x1220 Accoustic Ceiling Tile | USG Halcyon Healthcare Panels | suprafine, fine texture, white factory-painted exposed surface | 1" thick, SL edge with 15/16" DX Grid | CGC | See RCP | NRC 0.95, CAC 20 |
| ACT-3a | 610x1220 Accoustic Ceiling Tile | USG Mars Healthcare Panels | suprafine, fine texture, white factory-painted exposed surface | 3/4" thick, SLT edge with 15/16" DX Grid | CGC | See RCP | NRC 0.75, CAC 35 |
| ACT-3b | 610x1220 Accoustic Ceiling Tile | USG Mars Healthcare Panels | fine texture, white factory-painted exposed surface | 3/4" thick, square edge, 15/16" DX Grid | CGC | See RCP | NRC 0.75, CAC 35 Service Rooms |
| ACT-4 | 610x1525 Accoustic Ceiling Tile | USG Halcyon Healthcare Panels | suprafine, fine texture, white factory-painted exposed surface | 1" thick, SL edge with 15/16" DX Grid | CGC | See RCP | NRC 0.95, CAC 20 |
| ACT-5 | 760x1525 Accoustic Ceiling Tile | USG Mars Healthcare Panels | suprafine, fine texture, white factory-painted exposed surface | 1" thick, FLB edge , Centricitee DXT grid | USG | Ground floor waiting area | NRC 0.95, CAC 20 |
| Ceiling Panel | | | | | | | |
| CP-2 | Wood Veneer Panel on MDF | N/A (Millwork) | WV-1 | 17mm thick | N/A (Millwork) | | To meet Can / ULC S102, Flame Spread Rating <25. Transparent Matte Finish |
| CP-3 | Wood Veneered acoustic ceiling | Mini-Micro | WV-1 | 17mm thick | Eomac | 2nd Floor MP RMs | To meet Can / ULC S102, Flame Spread Rating <25. Transparent Matte Finish. NRC 0.9 |
| CP-4 | Wood Slat Ceiling | Eomac Grill | WV-1 (White Oak) | 17x75 batten | Eomac | 1st Waiting Area | To meet Can / ULC S102, Flame Spread Rating <25. Complete with acoustic backer, Transparent Matte Finish |
| Wall Panel | | | | | | | |
| WP-1 | Ribbed Accoustic Wall Panel | Eomac RIBB | WV-1 | 26mm | Eomac | 1st floor corridor, 2nd floor MP | To meet Can / ULC S102, Flame Spread Rating <25. Transparent Matte Finish |
| WP-2 | Wood Veneer Panel on MDF | N/A | WV-1 | 17mm | N/A (Millwork) | | To meet Can / ULC S102, Flame Spread Rating <25. Transparent Matte Finish |
| WP-3 | Wood Veneered acoustic wall | Mini-Micro | WV-1 | 17mm | Eomac | 2nd Floor corridor, MP RMs, waiting areas | To meet Can / ULC S102, Flame Spread Rating <25. Transparent Matte Finish. NRC 0.9 |
| Plastic Laminate | | | | | | | |
| PLAM-1 | PLAM for millwork Type 1 | | White | | Abet Laminati | millwork | |
| PLAM-2 | PLAM for doors & millwork | | White Oak | | Abet Laminati | doors & millwork | |
| Solid Surface Material | | | | | | | |
| SSM-1 | Solid Surface for millwork | Everform | 416 Luna pewter | See Drawings | Formica | millwork | |
| SSM-2 | Solid Surface for millwork | Everform | 601 Bleached concrete | See Drawings | Formica | millwork | |
| SSM-3 | Solid Surface for millwork | Everform | Carbon Concrete | See Drawings | Corian | millwork - base | |
| Solid Wood | | | | | | | |
| WD-2 | Solid Wood | | White oak to match RIBB Sstem | | Transparent Matte Finish | | Solid wood edging for RIBB system, Transparent Matte Finish |
| WD-3 | Solid Wood | | White Oak to match WV-1 | | Transparent Matte Finish | | Solid Wood bases, Transparent Matte Finish |
| WD-4 | Solid Wood | | Paint Grade Hardwood | | | | Primed and painted |
| Wood Veneer | | | | | | | |
| WV-1 | White Oak Veneer | N/A | Transparent Matte Finish | See Drawings | N/A | Millwork, wall panels, ceilings | Quarter cut, Transparent Matte Finish |

| MATERIAL AND FINISH SCHEDULE | | | | | | | | |
|------------------------------|---|---|---|--------------------------------|-------------------------------|--|--|--|
| TAG | DESCRIPTION | BASIS FOR DESIGN PRODUCT | COLOUR / FINISH | SIZE / FORMAT | BASIS FOR DESIGN MANUFACTURER | LOCATION (NOT LIMITED TO) | COMMENTS | |
| Metal finishes | | | | | | | | |
| MTL-5 | Solid bronze | N/A | | | | | | |
| MTL-10 | Aluminum Plate Cladding on Elevator Shaft | DriDesign Anodized Aluminum Metal Plate Wall Panel | To match Linetec "LIGHT BRONZE" ANODIZED | See drawings | DriDesign | Atrium (interior) | Required Mock up to include (Typical Panel, Corner Panel, Panel Joint, Connection to Curtain Wall) | |
| Glass | | | | | | | | |
| GL-1 | Min. 2-6mm Laminated Glass Guard | | See Screen and Window Schedule | See Screen and Window Schedule | | | tempered, laminated, engineered as guard | |
| GL-2 | Min. 6mm Tempered Glass (3/8" glass for doors & sidelights with STC rating equal or grater than 35) | | See Screen and Window Schedule | See Screen and Window Schedule | | Interior door lites, sidelights, screens, all floors | tempered, laminated. 3/8" glass required where door / stidelight STC rating is equal or grater than 35 | |
| GL-10 | Double Glazed Unit | N/A | See Screen and Window Schedule | See Screen and Window Schedule | Vitro | Punched windows - various locations | | |
| GL-11 | Triple Glazed Unit | N/A | See Screen and Window Schedule | See Screen and Window Schedule | Vitro | Exterior Curtain Wall | | |
| GL-13 | Laminated Glass - Low Iron | N/A | See Screen and Window Schedule | See Screen and Window Schedule | Vitro | | tempered, SGP Interlayer. Engineered as guard | |
| GL-20 | Ceramic, Fire Rated Glass | FireFrames ClearView Assembly – with FireFrames Heat Barrier perimeter frames | TBD | See Drawings | TGP | | | |
| GL-21 | Ceramic, Fire Rated Glass | Firelite System | TBD | See Drawings | TGP | | | |
| GLWB-1 | Magnetic Glass Whiteboard | Float | White | 4x10' | Clarus | Ground Floor Large MP Room | Concealed mounting hardware, with integrated shelf | |
| Privacy Film | | | | | | | | |
| Film Type 1 | Privacy Film | Illumina SH2FGIM | Gradation | See Screen and Window Schedule | 3M | | | |
| Film Type 2 | Frosted Privacy Film | Fasara Frost/Matte | Frosted | See Screen and Window Schedule | 3M | | | |
| Film Type 3 | Frosted Slats | Fasara, SH2FGSL | Stripes | See Screen and Window Schedule | 3M | | | |
| Film Type 4 | Opaque White | DI-NOC | DG-503, Solid Colour | See Screen and Window Schedule | 3M | | | |
| Ceramic Tile | | | | | | | | |
| CT-1 | Ceramic Tiles, washrooms | Block | Bianco bright | see Washroom drawings | stone-tile | washroom walls | | |
| Porcelain Tile | | | | | | | | |
| PCT-1 | Porcelain Tiles | Set | Concrete Grey matte | 300x600mm | stone-tile | Elevator floor | weight limit 3lb/sf | |
| PCT-2 | Porcelain Tiles | STI Basaltine | Sand, matte | 600x600mm | stone-tile | Perimeter entrance vestibule off St. George | floor tiles at new grille | |
| PCT-3 | Porcelain Tiles | All Marble | Saint laurent, polished | 300x600mm, 10mm thick | stone-tile | Perimeter entrance vestibule off St. George | Wall base to replace partial existing wood and stone wall bast to match existing stonrr wall base | |
| PCT-4 | Feature wall | Costa Nova | Terra, Onda Matte (ribbed) | 200x50 | Centura | Elevator Surround / feature wall | grout colour TBD | |
| PCT-5 | Feature wall | Costa Nova | White, Onda Matte (ribbed) | 200x50 | Centura | Elevator Surround / feature wall | grout colour TBD | |
| PCT-6 | Detectable Warning | Dome - Tactile Seties | TBD | 300x300 | Olympia Tile | | | |
| Vinyl Wall Base | | | | | | | | |
| VIN-1 | Vinyl Base | tightlock vinyl wall base for resilient flooring | 20 Characoal WG | 4" high | Johnsonite | Per drawings | | |

| MATERIAL AND FINISH SCHEDULE | | | | | | | |
|------------------------------|--|--|--|---------------|-------------------------------|--|--|
| TAG | DESCRIPTION | BASIS FOR DESIGN PRODUCT | COLOUR / FINISH | SIZE / FORMAT | BASIS FOR DESIGN MANUFACTURER | LOCATION (NOT LIMITED TO) | COMMENTS |
| Resilient Sheet Flooring | | | | | | | |
| RF-1 | Resilient Sheet Flooring Type 1 | Marmoleum | SATELLITE | Sheet | Forbo | | Refer to RFS (Room Finish Schedule) Integrated cove where indicated (FORBO ArmorCove) |
| RF-2 | Resilient Sheet Flooring Type 2 | Marmoleum | PANNACOTTA | Sheet | Forbo | | Refer to RFS (Room Finish Schedule). Integrated cove where indicated (FORBO ArmorCove) |
| RF-4 | Detectable warning indicator tile | Tactile Walking Surface Indicator with Truncated Domes | Smokey Grey | 305x305x3mm | EON Flooring | | |
| RF-5 | Resilient Sheet Flooring for Wet Areas | Eternal step aqua SR (wetroom) | TBD | Sheet | Forbo | WC with shower | Inc. Waterproofing per manufacturers standard details. Integrated cove where indicated (FORBO ArmorCove) |
| PVC Free Plank Flooring | | | | | | | |
| LVT-1 | Plank Flooring Type 1 | Proxy | MANNINGTON TERRA OAK | 7.25x48" | Mannington Commercial | | Refer to RFS (Room Finish Schedule) |
| Paint | | | | | | | |
| PT-1 | Paint Type 1 | | OC-65 Chantilly Lace, Eggshell | | Benjamin Moore | Walls | |
| PT-2 | Paint Type 2 | | Rocky Coast, Dark Gray, Semi-Gloss | | Benjamin Moore | HM door frames for WR doors, Exam Rooms, Offices, Counselling rooms. Use Epoxy Paint for all Hollow Metal Door Frames and Hollow Metal Doors | |
| PT-3 | Paint Type 3 | | OC-65 Chantilly Lace, Matte | | Benjamin Moore | Ceilings, exposed ceiling mounted ducts, pipes, conduits, bulkheads, and doors | |
| PT-4 | Paint Type 4 | | Spring Meadow, Eggshell | | Benjamin Moore | Accent Wall #1 | |
| PT-5 | Paint Type 5 | | TBD, Semi-Gloss | | Benjamin Moore | 3rd floor trusses | |
| EPT-1 | Epoxy Paint | | See PT-2 | | | All Hollow Metal Door Frames and Hollow Metal Doors | |
| High Performance Coating | | | | | | | |
| HPC-1 | High Performance Coating | PPG Duranar XL | To match Alumicor "Medium BRONZE ANODIZED" | See Dwgs | PPG | | |
| HPC-2 | High Performance Coating | PPG Duranar XL | To match Alumicor "Medium BRONZE ANODIZED" | See Dwgs | PPG | | |
| HPC-3 | High Performance Coating | PPG Duranar XL | Kuala White | See Dwgs | PPG | | |
| HPC-4 | High Performance Coating | PPG Duranar XL | To match Existing Windows | See Dwgs | PPG | | |
| HPC-5 | High Performance Coating | PPG Duranar XL | Black | See Dwgs | PPG | | |
| Natural Stone | | | | | | | |
| STO-1 | Natural Stone | Picasso Granite | Flamed | 50mm | Polycor | Landscaping @ Entrance | |

| MATERIAL AND FINISH SCHEDULE | | | | | | | |
|-------------------------------|---|-------------------------------|---------------------|---------------|-------------------------------|---|--|
| TAG | DESCRIPTION | BASIS FOR DESIGN PRODUCT | COLOUR / FINISH | SIZE / FORMAT | BASIS FOR DESIGN MANUFACTURER | LOCATION (NOT LIMITED TO) | COMMENTS |
| Precast | | | | | | | |
| PC-1 | Precast Concrete | N/A | Sand Blasted, Beige | See Dwgs | N/A | Landscaping @ Entrance | |
| Fabrics | | | | | | | |
| FB-1 | Partition Divider | | Grey Whale 1145 | See Dwgs | Clean Impact Textiles | See Dwgs | |
| Epoxy | | | | | | | |
| EPO-1 | Epoxy Floor Coating | | | | | | |
| Carpet Tile | | | | | | | |
| CPT-1 | Carpet to match existing | Ruffian II, Liason Entryway | Blue Balance (3601) | 2x2' | Mannington Commercial | Ground floor entrance | to match existing |
| Edge Trim / Stair Nosing Trim | | | | | | | |
| TR-1 | TREP-V | Textured Stair Profile Nosing | TBD | | Schluter | Stair Nosing | |
| Misc | | | | | | | |
| TR-1 | Textured Stair Profile Nosing | TREP-V | TBD | | Schluter | Stair Nosing for tile | |
| TR-2 | Transition from tile to thinner flooring material | RENO-U | SS | | Schluter | Floor Transitions, Tile to other thinner flooring | |
| TR-3 | Stair Step Edge Profile | KS-D | A3 / Bronze | | Kuberit | Stair nosing for resilient flooring | |
| FRP | Fibre Reinforced Plastic Panels | | | | | Shower Wall Enclosure, Exam Room backsplash | |
| RC | Radiator Cover | RF-2 | White | | Runtall | | Supply complete with all trims to extend wall to wall and enclose piping |

Finish Hardware Schedule

University of Toronto Koffler Health and Wellness Centre

Job No. 22760

Coordinator

Jillian Young
Tel: 905-940-8358 x229
Fax: 905-940-8362
Email: jilliany@ucsh.com

Consultant

Boyd Robertson A.H.C.
Tel: 905-940-2314
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E-Mail: boydr@ucsh.com

Submittal Date: **January 31, 2025**

**UPPER
CANADA
SPECIALTY
HARDWARE
LIMITED**

Upper Canada Specialty Hardware
7100 Warden Ave. Unit 1
Markham, Ontario, L3R 8B5

University of Toronto
Koffler Health and Wellness Centre
Job No. 22760

Submittal Date: January 31, 2025

Openings Schedule

| Hardware Group | Qty | Opening Number(s) | Location 1 | To/ From | Location 2 | Hand | Door Type | Nominal Width | Nominal Height | Door Thickness | Door Mat1 | Frame Mat1 | STC Rating | Label | Remarks |
|----------------|-----|-------------------|------------------------------------|----------|--------------------------------------|----------|-----------|---------------|----------------|----------------|-----------|------------|------------|--------|--|
| 001 | 1 | 100V | EXTERIOR | FROM | VESTIBULE 100V | LHR/RHR | EX-AA/EX | 965, 965 | 2286 | 64 | EX | EX | - | - | DOOR AND FRAME TO BE REFINISHED - GLASS TO BE REPLACED |
| 002 | 1 | 101V | VESTIBULE 100V | FROM | LOBBY 101V | LHR/RHR | EE/F2 | 987, 987 | 2160 | 45 | AL | AL | - | - | SEE DETAIL 1/A008 FOR FULL FRAME ELEVATION |
| 003 | 1 | 106.1 | ATRIUM 105V | FROM | WAITING AREA 106 | LHR | E.1/F3 | 965 | 2135 | 45 | HM | HM | - | - | RE & REAS REQUIRED TO SUIT CONSTRUCTION |
| 004 | 1 | 106.2 | LOBBY 101V | FROM | WAITING AREA 106 | RHR | A/F1 | 915 | 2135 | 45 | HM | HM | - | 60 MIN | |
| 005 | 1 | 107 | WAITING AREA 106 | TO | RECEPTION/REGISTRATION 107 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | - | - | |
| 006 | 1 | 107B | COPY 107A | FROM | ELEC 107B | RHR | A/F2 | 965 | 2135 | 45 | HM | HM | - | - | DUCT AND SMOKE SEAL |
| 007 | 1 | 112 | CORRIDOR 115K | TO | MEDIUM MP ROOM/SMUDGING 112 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 008 | 1 | 113 | CORRIDOR 115K | TO | COMP CARE OFFICE/SAFE QUIET ROOM 113 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 007 | 1 | 114 | CORRIDOR 115K | TO | LARGE MP ROOM 114 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 009 | 1 | 115K | VEST 120V | FROM | CORRIDOR 115K | LHR | A/F1 | 965 | 2030 | 45 | HM | HM | - | 0 MIN | |
| 010 | 1 | 115.1 | CORRIDOR 115K | TO | WORK ROOM 115 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 010 | 1 | 115.2 | CORRIDOR 115K | TO | WORK ROOM 115 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 011 | 1 | 118 | VEST 115V | TO | BF WC/NURSING 118 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 012 | 1 | 118A | VEST 115V | TO | WC 118A | RH | A/F1 | 915 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 010 | 1 | 119 | CORRIDOR 115K | TO | KITCHEN 119 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 013 | 1 | 120S | EXTERIOR | FROM | STAIRS 120S | LHR | EX-AA/EX | 1150 | 2134 | 45 | EX | EX | - | EX | EXISTING DOOR C/W HARDWARE |
| 014 | 1 | 120V | VEST 120V | FROM | CORRIDOR 132K | LHR | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 015 | 1 | 122 | STAFF ACCESS 122V | TO | IT CLOSET 122 | RH | A/F1 | 965 | 2135 | 45 | HM | HM | - | - | |
| 016 | 1 | 124 | WORK AREA 125 | TO | CLOSET 124 | BI-FOLD | G/- | 419, 419 | 2135 | 45 | HC | HM | - | - | |
| 017 | 1 | 125 | STAFF ACCESS 122V | FROM | WORK AREA 125 | RHR | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 018 | 1 | 126 | WORK AREA 125 | TO | STORAGE 126 | LH | A/F1 | 965 | 2135 | 45 | HM | HM | 35 | - | |
| 019 | 1 | 126A | WORK AREA 125 | TO | WC 126A | LH | A/F1 | 915 | 2135 | 45 | SC | HM | 35 | - | |
| 020 | 1 | 126B | WORK AREA 125 | FROM | ELEC 126B | LHR/RHRA | AA/F2 | 610, 610 | 2440 | 45 | SC | HM | - | - | BI-FOLD DOOR |
| 021 | 1 | 130 | CORRIDOR 131K | TO | CUSTODIAL 130 | LH | A/F1 | 965 | 2030 | 45 | HM | HM | - | 0 MIN | KICK PLATE |
| 021 | 1 | 131B | STORAGE 131A | TO | CUSTODIAL 131B | LH | A/F1 | 965 | 2030 | 45 | HM | HM | - | 0 MIN | KICK PLATE |
| 022 | 1 | 202 | EXISTING 201S | TO | OFFICE 202 | RH | EX-C/EX | 762 | 2170 | 45 | EX | EX | - | - | |
| 023 | 1 | 202A.1 | LOBBY 201K | TO | OFFICE 202A | RH | EX-C.2/EX | 915 | 2170 | 45 | EX | EX | - | - | SOUND SEAL |
| 022 | 1 | 202A.2 | OFFICE 202 | TO | OFFICE 202A | RH | EX-C.6/EX | 1016 | 2170 | 45 | EX | EX | - | - | |
| 022 | 1 | 202B | EX CORRIDOR 202K | TO | OFFICE 202B | RH | EX-C/EX | 762 | 2170 | 45 | EX | EX | - | - | |
| 022 | 1 | 202C | EX CORRIDOR 202K | TO | OFFICE 202C | LH | EX-C/EX | 762 | 2170 | 45 | EX | EX | - | - | |
| 022 | 1 | 202D | EX CORRIDOR 202K | TO | OFFICE 202D | RH | EX-C/EX | 762 | 2170 | 45 | EX | EX | - | - | |
| 024 | 1 | 202W | EX CORRIDOR 202K | TO | WR 202W | RH | EX-C/EX | 762 | 2170 | 45 | EX | EX | - | - | |
| 025 | 1 | 230K | LOBBY 201K | FROM | CORRIDOR 230K | LHR/RHR | EE/F5 | 915, 915 | 2440 | 45 | AL | AL | - | - | OVERHEAD CONCEALED OPERATOR |
| 026 | 1 | 231 | CORRIDOR 230K | FROM | MULTI-PURPOSE ROOM #1/SMUDGING 231 | LHR/RHR | BB/F2 | 965, 965 | 2440 | 45 | SC | WD | 35 | - | KICK PLATE |
| 027 | 1 | 231A | MULTI-PURPOSE ROOM #1/SMUDGING 231 | FROM | STORAGE 231A | LHR/RHRA | AA/F2 | 915, 915 | 2440 | 45 | SC | HM | - | 90 MIN | |
| 028 | 1 | 231B | CORRIDOR 230K | FROM | ELEC 231B | LHR/RHR | AA/F5 | 965, 965 | 2440 | 45 | SC | WD | - | - | DUST & SMOKE SEAL |
| 029 | 1 | 231.1 | MULTI-PURPOSE ROOM #1/SMUDGING 231 | TO | MULTI-PURPOSE ROOM #2 233 | -/- | - | 5090 | 45 | - | - | - | - | - | FOLDING ACOUSTIC PARTITION, FIELD VERIFY DIMENSIONS |
| 026 | 1 | 233 | CORRIDOR 230K | FROM | MULTI-PURPOSE ROOM #2 233 | LHR/RHR | BB/F2 | 965, 965 | 2440 | 45 | SC | WD | 35 | - | KICK PLATE |
| 028 | 1 | 233A | CORRIDOR 230K | FROM | ELEC 233A | LHR/RHR | AA/F5 | 965, 965 | 2440 | 45 | SC | WD | - | - | DUST & SMOKE SEAL |
| 026 | 1 | 235 | CORRIDOR 230K | FROM | MULTI-PURPOSE ROOM #3 235 | LHR/RHRA | BB/F2 | 965, 965 | 2440 | 45 | SC | WD | 35 | - | KICK PLATE |
| 028A | 1 | 236 | CORRIDOR 230K | FROM | STORAGE 236 | LHR/RHR | AA/F5 | 965, 965 | 2440 | 45 | SC | WD | - | - | |
| 030 | 1 | 237 | LOBBY 240K | FROM | LOUNGE 237 | LHR | E/F1 | 965 | 2135 | 45 | AL | AL | - | 90 MIN | |
| 031 | 1 | 237A | LOUNGE 237 | TO | UNI WC 237A | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 032 | 1 | 237B | LOUNGE 237 | TO | BF WC 237B | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 033 | 1 | 237C | LOUNGE 237 | TO | WC 237C | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 034 | 1 | 238 | LOUNGE 237 | TO | IT CL 238 | RH | E/F1 | 915 | 2135 | 45 | HM | HM | - | - | |
| 035 | 1 | 240 | LOBBY 240K | FROM | WAITING AREA 240 | LHR/RHR | EE/F2 | 972, 972 | 2188 | 45 | AL | AL | - | 90 MIN | |
| 036 | 1 | 241 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 241 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 037 | 1 | | RESERVED HEADING FOR FUTURE USE | | | | | | | | | | | | |
| 038 | 1 | 242 | PUBLIC CORRIDOR 245K | TO | RECEPTION 242 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 243 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 243 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 039 | 1 | 244 | PUBLIC CORRIDOR 245K | TO | OFFICE 244 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 245 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 245 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 246 | PUBLIC CORRIDOR 245K | TO | COMP CARE/MED COUNS ROOM 246 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |

**UPPER
CANADA
SPECIALTY
HARDWARE
LIMITED**

Upper Canada Specialty Hardware
7100 Warden Ave. Unit 1
Markham, Ontario, L3R 8B5

University of Toronto
Koffler Health and Wellness Centre
Job No. 22760

Submittal Date: January 31, 2025

| Hardware Group | Qty | Opening Number(s) | Location 1 | To/ From | Location 2 | Hand | Door Type | Nominal Width | Nominal Height | Door Thickness | Door Mat'l | Frame Mat'l | STC Rating | Label | Remarks |
|----------------|-----|-------------------|-------------------------|----------|-----------------------------------|----------|-----------|---------------|----------------|----------------|------------|-------------|------------|---------------------------------|------------|
| 036 | 1 | 247 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 247 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 248 | PUBLIC CORRIDOR 245K | TO | COMP CARE/MED COUNS ROOM 248 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 249 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 249 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 040 | 1 | 250 | PUBLIC CORRIDOR 245K | TO | CUST 250 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 041 | 1 | 251 | PUBLIC CORRIDOR 245K | TO | BF WC 251 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 042 | 1 | 253 | PUBLIC CORRIDOR 245K | TO | MEETING ROOM 253 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 036 | 1 | 255 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 255 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 257 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 257 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 043 | 1 | 258 | PUBLIC CORRIDOR 245K | TO | LG COUNS ROOM 258 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 259 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 259 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 261 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 261 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 262 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 262 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 263 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 263 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 264 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 264 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 265 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 265 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 266 | PUBLIC CORRIDOR 245K | TO | FLEX SPACE 266 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 267 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 267 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 268 | PUBLIC CORRIDOR 245K | TO | FLEX SPACE 268 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 269 | PUBLIC CORRIDOR 245K | TO | COUNS ROOM 269 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 270 | PUBLIC CORRIDOR 245K | TO | FLEX SPACE 270 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 039 | 1 | 271 | PUBLIC CORRIDOR 245K | TO | DIRECTOR OFFICE/LG COUNS ROOM 271 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 036 | 1 | 272 | PUBLIC CORRIDOR 245K | TO | FLEX SPACE 272 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 039 | 1 | 273 | PUBLIC CORRIDOR 245K | TO | OFFICE 273 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 044 | 1 | 274 | PUBLIC CORRIDOR 245K | TO | ELEC 274 | RH | A/F1 | 965 | 2135 | 45 | HM | HM | 35 | - | KICK PLATE |
| 045 | 1 | 276.1 | PUBLIC CORRIDOR 245K | FROM | ELEC CLOSET 276 | LHR/RHR | AAF2 | 915, 915 | 2135 | 45 | HM | HM | 90 MIN | DUST & SMOKE SEAL | |
| 045 | 1 | 276.2 | PUBLIC CORRIDOR 245K | FROM | ELEC CLOSET 276 | LHR/RHRA | AAF2 | 915, 915 | 2135 | 45 | HM | HM | 90 MIN | DUST & SMOKE SEAL | |
| 046 | 1 | 277 | STAFF CORRIDOR 277K | TO | IT 277 | LH | A/F1 | 965 | 2135 | 45 | HM | HM | 35 | - | KICK PLATE |
| 047 | 1 | 277K | PUBLIC CORRIDOR 245K | FROM | STAFF CORRIDOR 277K | RHR | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | HOLD OPEN |
| 048 | 1 | 301 | PUBLIC CORRIDOR 305K | FROM | CUST 301 | LHR | E/F1 | 915 | 2135 | 45 | HM | HM | - | - | |
| 049 | 1 | 301V | LOBBY NO 1 301V | FROM | PUBLIC CORRIDOR 305K | LHR/RHRA | EE/F2 | 965, 965 | 2135 | 45 | SC | HM | 90 MIN | HOLD OPEN | |
| 050 | 1 | 303 | PUBLIC CORRIDOR 305K | TO | BF WC 303 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 051 | 1 | 304 | PUBLIC CORRIDOR 305K | TO | HEALTH PROMOTION OFFICE 304 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 052 | 1 | 305 | PUBLIC CORRIDOR 305K | FROM | ELEC 305 | LHR/RHR | AAF2 | 965, 965 | 2440 | 45 | SC | HM | - | - | |
| 053 | 1 | 306 | PUBLIC CORRIDOR 305K | TO | HEALTH PROMOTION OFFICE 306 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 054 | 1 | 308 | LOUNGE 307 | FROM | ADMIN/OFFICE FITOUT | LHR | E/F1 | 915 | 2135 | 45 | HM | HM | - | - | |
| 051 | 1 | 320 | STAFF CORRIDOR 320K | TO | OFFICE 320 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 055 | 1 | 320K.1 | LOUNGE 307 | TO | STAFF CORRIDOR 320K | RH | A/F1 | 915 | 2135 | 45 | SC | HM | - | - | |
| 056 | 1 | 320K.2 | STAFF CORRIDOR 320K | TO | ELEVATOR VESTIBULE 325V | RHR | A/F1 | 915 | 2135 | 45 | SC | HM | - | - | |
| 057 | 1 | 321 | STAFF CORRIDOR 320K | TO | CALL ROOM 321 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 051 | 1 | 322 | STAFF CORRIDOR 320K | TO | OFFICE 322 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 058 | 1 | 323 | STAFF CORRIDOR 320K | TO | WORK ROOM 323 | LH | A/F1 | 915 | 2135 | 45 | SC | HM | - | - | |
| 051 | 1 | 324 | STAFF CORRIDOR 320K | TO | OFFICE 324 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 059 | 1 | 325A | ELEVATOR VESTIBULE 325V | FROM | ELEC 325A | RHR | E/F1 | 915 | 2135 | 45 | HM | HM | - | - | |
| 060 | 1 | 325B | ELEVATOR VESTIBULE 325V | FROM | IT 325B | LHR | A/F1 | 965 | 2135 | 45 | HM | HM | 35 | - | |
| 061 | 1 | 325S | STAIR NO 3 325S | FROM | ELEVATOR VESTIBULE 325V | RHR | EX-C/EX | 762 | 2170 | 45 | EX | EX | 90 MIN | EXISTING DOOR & FRAME TO REMAIN | |
| 061 | 1 | 326 | ELEVATOR VESTIBULE 325V | TO | MECH 326 | LH | EX-C/EX | 762 | 2170 | 45 | EX | EX | - | - | |
| 062 | 1 | 327 | ELEVATOR VESTIBULE 325V | TO | CUSTODIAL 327 | RH | E/F1 | 915 | 2135 | 45 | HM | HM | - | - | |
| 054 | 1 | 328 | ELEVATOR VESTIBULE 325V | FROM | ADMIN/OFFICE FITOUT | RHR | E/F1 | 915 | 2135 | 45 | HM | HM | - | - | |
| 063 | 1 | 340 | CORRIDOR 340K | TO | COUNS ROOM 340 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 064 | 1 | 340K | PUBLIC CORRIDOR 305K | FROM | CORRIDOR 340K | RHR | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 341 | CORRIDOR 340K | TO | COUNS ROOM 341 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 342 | CORRIDOR 340K | TO | COUNS ROOM 342 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 343 | CORRIDOR 340K | TO | COUNS ROOM 343 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 345 | CORRIDOR 340K | TO | COUNS ROOM 345 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 346 | CORRIDOR 340K | TO | COUNS ROOM 346 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 347 | CORRIDOR 340K | TO | COUNS ROOM 347 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 348 | CORRIDOR 340K | TO | COUNS ROOM 348 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 349 | CORRIDOR 340K | TO | COUNS ROOM 349 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 350 | CORRIDOR 340K | TO | COUNS ROOM 350 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 351 | CORRIDOR 340K | TO | COUNS ROOM 351 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 353 | CORRIDOR 340K | TO | COUNS ROOM 353 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 354 | CORRIDOR 340K | TO | COUNS ROOM 354 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 355 | CORRIDOR 340K | TO | COMP CARE/SMUDGING 355 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 063 | 1 | 356 | CORRIDOR 340K | TO | COUNS ROOM 356 | RH | E/F3 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 065 | 1 | 357K.1 | EXIT CORRIDOR 357K | FROM | PUBLIC CORRIDOR 305K | LHR | E/F1 | 965 | 2135 | 45 | AL | AL | 90 MIN | - | |
| 065A | 1 | 357K.2 | EXIT CORRIDOR 357K | FROM | SUB-WAITING AREA 357 | LHR | E/F1 | 965 | 2135 | 45 | AL | AL | 90 MIN | - | |

| Hardware Group | Qty | Opening Number(s) | Location 1 | To/ From | Location 2 | Hand | Door Type | Nominal Width | Nominal Height | Door Thickness | Door Mat'l | Frame Mat'l | STC Rating | Label | Remarks |
|----------------|-----|-------------------|----------------------|----------|-------------------------|---------|-----------|---------------|----------------|----------------|------------|-------------|------------|--------|--|
| 066 | 1 | 358 | SUB-WAITING AREA 357 | TO | WC 358 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 067 | 1 | 360 | LOBBY 360V | FROM | WAITING AREA 360 | LHR/RHR | EE/F2 | 972, 972 | 2134 | 45 | AL | AL | | 90 MIN | DUST & SMOKE SEAL |
| 068 | 1 | 362 | CORRIDOR 370K | TO | WC 362 | RHR | A/F1 | 965 | 2135 | 45 | SC | HM | | - | |
| 069 | 1 | 363.1 | CORRIDOR 370K | TO | RECEPTION 363 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 070 | 1 | 363.2 | RECEPTION 363 | FROM | STAFF ACCESS 365K | RHR | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 071 | 1 | 364 | CORRIDOR 370K | TO | BF EXAM RM 364 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 072 | 1 | 365 | STAFF ACCESS 365K | TO | CENTRAL SUPPLY 365 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | | - | KICK PLATE |
| 073 | 1 | 365K.1 | WAITING AREA 360 | FROM | STAFF ACCESS 365K | RHR | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 074 | 1 | 365K.2 | NURSING STATIONS 381 | TO | STAFF ACCESS 365K | LH | A/F1 | 965 | 2135 | 45 | SC | HM | | - | |
| 075 | 1 | 366 | CORRIDOR 370K | TO | EXAM ROOM 366 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 076 | 1 | 367.1 | CORRIDOR 370K | TO | MEDICATION 367 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 077 | 1 | 367.2 | MEDICATION 367 | FROM | STAFF ACCESS 365K | LHR | A/F1 | 965 | 2135 | 45 | SC | HM | | - | KICK PLATE |
| 075 | 1 | 368 | CORRIDOR 370K | TO | EXAM ROOM 368 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 078 | 1 | 369 | CORRIDOR 370K | TO | AUTOClave/ISOLED 369 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 370 | CORRIDOR 370K | TO | EXAM RM/ISOLATION 370 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 078A | 1 | 371 | CORRIDOR 370K | TO | WC/SAMPLES 371 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 079 | 1 | 372 | CORRIDOR 370K | TO | ELEC 372 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 080 | 1 | 374 | CORRIDOR 370K | TO | MEETING ROOM 374 | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | |
| 075 | 1 | 376 | CORRIDOR 370K | TO | EXAM ROOM 376 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 378 | CORRIDOR 370K | TO | EXAM ROOM 378 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 380 | CORRIDOR 370K | TO | EXAM ROOM 380 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 081 | 1 | 381 | CORRIDOR 370K | TO | NURSING STATIONS 381 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 382 | CORRIDOR 370K | TO | EXAM ROOM 382 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 082 | 1 | 382A | LOCKERS 399 | TO | WC & SHOWER 399A | RH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 083 | 1 | 382B | LOCKERS 399 | TO | WC 399B | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 084 | 1 | 382C | LOCKERS 399 | TO | IT 399C | RH | A/F1 | 965 | 2135 | 45 | HM | HM | | 0 MIN | KICK PLATE |
| 084A | 1 | 382D | LOCKERS 399 | TO | ELEC 399D | RH | A/F1 | 965 | 2135 | 45 | HM | HM | | 0 MIN | KICK PLATE |
| 075 | 1 | 383 | CORRIDOR 370K | TO | MINOR PROC/COL ROOM 383 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 384 | CORRIDOR 370K | TO | EXAM ROOM 384 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 385 | CORRIDOR 370K | TO | EXAM ROOM 385 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 386 | CORRIDOR 370K | TO | EXAM ROOM 386 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 387 | CORRIDOR 370K | TO | EXAM ROOM 387 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 388 | CORRIDOR 370K | TO | EXAM ROOM 388 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 389 | CORRIDOR 370K | TO | EXAM ROOM 389 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 390 | CORRIDOR 370K | TO | EXAM ROOM 390 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 391 | CORRIDOR 370K | TO | EXAM ROOM 391 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 392 | CORRIDOR 370K | TO | EXAM ROOM 392 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 393 | CORRIDOR 370K | TO | EXAM ROOM 393 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 394 | CORRIDOR 370K | TO | EXAM ROOM 394 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 395 | CORRIDOR 370K | TO | EXAM ROOM 395 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 075 | 1 | 396 | CORRIDOR 370K | TO | EXAM ROOM 396 | LH | A/F1 | 965 | 2135 | 45 | SC | HM | 35 | - | KICK PLATE |
| 085 | 1 | 397S.1 | STAIR NO 1 397S | FROM | CORRIDOR 397K | RHR | F/F1 | 889 | 2120 | 45 | HM | HM | | 90 MIN | TEMPERATURE-RISE, NEW SECURITY DEVICES & POWER SUPPLY INSIDE STAIR |
| 086 | 1 | 397S.2 | STAIR NO 1 397S | FROM | MEETING/LUNCH 398 | LHR | F/F1 | 889 | 1891 | 45 | HM | HM | | 90 MIN | TEMPERATURE-RISE, NEW SECURITY DEVICES & POWER SUPPLY INSIDE STAIR |
| 087 | 1 | 398 | CORRIDOR 397K | TO | MEETING/LUNCH 398 | LH | E/F3 | 965 | 2135 | 45 | SC | HM | | - | |

Hardware Schedule

Heading #001

1 Pair of doors 100V, EXTERIOR FROM VESTIBULE 100V

LHRA/RHR

Type: EX-AA/EX, 965, 965 x 2286 x 64 - EX DR x EX FR - -

EXISTING DOOR, FRAME AND HARDWARE TO REMAIN, EXCEPT FOR THE FOLLOWING:

| | | | |
|---|--------------------|--|------|
| 2 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail | |
| 2 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 2 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | NB 31 53 55 56-8763 PTB LHR LC C10B 965 x 2286 x 64 Thick Door | C10B |
| 1 | Exit Device | NB 31 53 55 56-8763 PTB RHR LC C10B 965 x 2286 x 64 Thick Door | C10B |
| 1 | Auto Operator | S4100 FE Pair (Push Side Mount) 690 | 690 |
| 2 | Touchless Actuator | CM-324/3S | 630 |
| 4 | Presence Sensor | Superscan | |
| 2 | Surface Door Loop | SDL-6" BA (1 Per 2 Superscans) | BA |
| 2 | Bollard | Bollard - To Later Detail | |
| 1 | Weatherstripping | W-20S-BA 1 @ 1930mm + 2 @ 2286mm | BA |
| 1 | Astragal | 305DN x 305DN x 2440mm (Trim to Suit Opening On Site) | D |
| 2 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

DOOR AND FRAME TO BE REFINISHED
GLASS TO BE REPLACED.

NOTES:
REMOVE EXISTING EXIT DEVICES AND TRIMS. REMOVE EXISTING MULLION.



Upper Canada Specialty Hardware
7100 Warden Ave. Unit 1
Markham, Ontario, L3R 8B5

University of Toronto
Koffler Health and Wellness Centre
Job No. 22760

Submittal Date: January 31, 2025

Heading #002

1 Pair of doors 101V, VESTIBULE 100V FROM LOBBY 101V

LHRA/RHR

Type: EE/F2, 987, 987 x 2160 x 45 - AL DR x AL FR - -

DOOR AND FRAME, BY ALUMINUM OPENING SUPPLIER

| | | | |
|---|----------------------|--|------|
| 2 | Continuous Hinge | SL11 BR HD x 2108 | |
| 2 | Offset Door Pull Set | GSH 165F x 165F x 72" OA x 56" CTC x 1-1/4" DIA #5 Mtg. C10B | C10B |
| 1 | Auto Operator | S4100 FE Pair (Push Side Mount) 690 | 690 |
| 2 | Touchless Actuator | CM-324/3S | 630 |
| 4 | Presence Sensor | Superscan | |
| 2 | Surface Door Loop | SDL-6" BA (1 Per 2 Superscans) | BA |
| 2 | Overhead Door Stop | 1-336 613 (90 Degrees) | 613 |
| 2 | Bollard | Bollard - To Later Detail | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

HARDWARE SUPPLIER

REVIEW AND COORDINATE HARDWARE WITH APPROVED ALUMINUM SHOP DRAWINGS REQUIRED

Heading #003

1 Single door 106.1, ATRIUM 105V FROM WAITING AREA 106

LHR

Type: E.1/F3, 965 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|--------------------|--|------|
| 1 | Electric Hinge | TA786 127 x 114 C10B NRP CC8 - LHR | C10B |
| 2 | Standard Hinge | TA786 127 X 114 C10B NRP | C10B |
| 1 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 55 56-8804 J ETJ LHR LC C10B 965 | C10B |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Push Side Mount) 690 | 690 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Overhead Door Stop | 1-336 613 | 613 |
| 1 | Kick Plate | GSH 80A C10B (250 x 925) TM B4E | C10B |
| 1 | Weatherstripping | W-20S-BA 1 @ 965mm + 2 @ 2135mm | BA |
| 1 | Auto Door Bottom | CT-54 x 965mm | |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #004

1 Single door 106.2, LOBBY 101V FROM WAITING AREA 106

RHR

Type: A/F1, 915 x 2135 x 45 - HM DR x HM FR - 60 MIN

EXIT ONLY

| | | | |
|---|--------------------|-------------------------------------|------|
| 3 | Standard Hinge | TA786 127 X 114 C10B NRP | C10B |
| 1 | Exit Device | 12-8810 F RHR C10B 915 | C10B |
| 1 | Surface Closer | 1431 PS EB LH | EB |
| 1 | Overhead Door Stop | 1-336 613 | 613 |
| 1 | Kick Plate | GSH 80A C10B (250 x 925) TM B4E | C10B |
| 1 | Weatherstripping | W-20S-BA 1 @ 965mm + 2 @ 2135mm | BA |
| 1 | Auto Door Bottom | CT-54 x 965mm | |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Request to Exit | Motion Request to Exit - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

NOTE:

- UFT TO CONFIRM IF ALARM IS REQUIRED

Heading #005

1 Single door 107, WAITING AREA 106 TO RECEPTION/REGISTRATION 107

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 X 114 C10B | C10B |
| 1 | Salto Entrance Escutcheon | AJ660A00NE38W RH | NE |
| 1 | Salto Lockbody | LA1T0570A21NE8 RH | NE |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |



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Heading #006

1 Single door 107B, COPY 107A FROM ELEC 107B

RHR

Type: A/F2, 965 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C10B NRP | C10B |
| 1 | Storeroom Lockset | 8204 WTJ C10B RHR LC | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 1431 PS EB LH (Push Side) | EB |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-BA x 965mm | BA |

Heading #007

1 Single door 112, CORRIDOR 115K TO MEDIUM MP ROOM/SMUDGING 112

LH

1 Single door 114, CORRIDOR 115K TO LARGE MP ROOM 114

RH

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 6 | Standard Hinge | TA714 127 x 114 C10B | C10B |
| 1 | Salto Entrance Escutcheon | AJ660A00NE38W LH | NE |
| 1 | Salto Entrance Escutcheon | AJ660A00NE38W RH | NE |
| 1 | Salto Lockbody | LA1T0570A21NE8 LH | NE |
| 1 | Salto Lockbody | LA1T0570A21NE8 RH | NE |
| 2 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 2 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 2 | Keying | Keying through U of T Lock Shop | |
| 2 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 2 | Weatherstripping | W-20S-BA 1 @ 965mm + 2 @ 2135mm | BA |
| 2 | Auto Door Bottom | CT-53-BLA x 965mm | BLA |



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Heading #008

1 Single door 113, CORRIDOR 115K TO COMP CARE OFFICE/SAFE QUIET ROOM 113

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|-----------|
| 1 | Continuous Hinge | SL11 CL HD x 2108 (1/2 TORX-WS x 1/2 TORX-MS) ATW-8 | |
| 1 | Hinge Cap | TIPIT CG GRY TORX | |
| 1 | Electronic Locking Device | 36 60 LX RX-8271-24V BHL C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Cylinder Collar | 1SB-2 C32D | C32D |
| 1 | Surface Closer | 36-351 POT EN RH (Push Side) | EN |
| 1 | Floor Stop | GSH 282 BLACK | BLACK |
| 1 | Weatherstripping | 303AV 1 @ 965mm + 2 @ 2135mm (Torx Screws) | A |
| 1 | Auto Door Bottom | CT-53 x 965mm TORX | |
| 1 | Door Viewer | DV180-26D | -26D/-26D |
| 1 | Panic Button | Panic Button - By Others | |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Salto Card Reader | WRDJ0A4B | |
| 1 | Controller | CU42E0US | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #009

1 Single door 115K, VEST 120V FROM CORRIDOR 115K

LHR

Type: A/F1, 965 x 2030 x 45 - HM DR x HM FR - 0 MIN

| | | | |
|---|----------------------|--|------|
| 1 | Electric Hinge | TA786 127 x 114 C10B NRP CC8 - LHR | C10B |
| 2 | Standard Hinge | TA786 127 X 114 C10B NRP | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 54 55-8876-24V J ETJ 24v LHR LC LD C10B 965 | C10B |
| 1 | Surface Closer | 351 P10 EB RH (Push Side) | EB |
| 1 | Kick Plate | GSH 80A C10B (250 x 925) TM B4E | C10B |
| 1 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 1 | Weatherstripping | W-20S-BA 1 @ 965mm + 2 @ 2135mm | BA |
| 1 | Auto Door Bottom | CT-53-BLA x 965mm | BLA |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Salto Card Reader | WRDJ0A4B | |
| 1 | Controller | CU42E0US | |
| 2 | Alarm and Signage | Alarm and Signage - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

ACCESS BY KEY. LEVER MONITORING SHUNTS ALARM.
EGRESS BY PRESENTING VALID CARD READER CREDENTIALS.
ALARM WILL TRIGGER WITHOUT VALID CREDENTIALS.
FIRE OR LOSS OF POWER, OPENING IS FREE EGRESS.

SECURITY NOTES IF THIS DOOR IS HELP OPEN OR IF THE DOOR IS OPENED WITHOUT A VALID CREDENTIAL BEING PRESENTED AT THE CARD READER, THE ALARM SETS OFF. THE DOOR SHOULD NOT BE HELD OPEN FOR LONG.



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Heading #010

| | |
|---|----|
| 1 Single door 115.1, CORRIDOR 115K TO WORK ROOM 115 | RH |
| 1 Single door 115.2, CORRIDOR 115K TO WORK ROOM 115 | LH |
| 1 Single door 119, CORRIDOR 115K TO KITCHEN 119 | LH |

Type: Varies, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 9 | Standard Hinge | TA786 127 X 114 C10B | C10B |
| 2 | MELR Lockset | 56 RX-8204 WTJ C10B LH LC | C10B |
| 1 | MELR Lockset | 56 RX-8204 WTJ C10B RH LC | C10B |
| 3 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 3 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 3 | Keying | Keying through U of T Lock Shop | |
| 3 | Auto Operator | S4100 (Set to LE) Series Single (Pull Side Mount) 690 | 690 |
| 6 | Actuator | 6R3 630 | 630 |
| 3 | Overhead Door Stop | 1-336 613 (90 Degrees) | 613 |
| 3 | Kick Plate | GSH 80A C10B (250 x 925) TM B4E | C10B |
| 3 | Weatherstripping | W-20S-BA 1 @ 965mm + 2 @ 2135mm | BA |
| 3 | Auto Door Bottom | CT-53-BLA x 965mm | BLA |
| 3 | Door Contact | N1178 DPDT | |
| 3 | Salto Card Reader | WRDJ0A4B | |
| 3 | Controller | CU42E0US | |
| 3 | Power Supply | Central Power | |
| 3 | S.I.P. Box | B994 Standard | |
| 3 | Wire Harness | UCA-W192W8P | |
| 3 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #011

1 Single door 118, VEST 115V TO BF WC/NURSING 118

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------------|--|---------|
| 3 | Standard Hinge | TA786 127 X 114 C10B | C10B |
| 1 | Storeroom Lockset | 8204 WTJ C10B LH LC | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Electric Strike | 1006-F-24V-613-LBM KM-613 | 613-LBM |
| 1 | Auto Operator | S7100 LE Single (Pull Side Mount) 690 | 690 |
| 1 | Washroom Control Kit | CX-WC13AXSM (Less Door Contact) | |
| 1 | Door Contact | N1178 SPST (WR Sequence Reset) | |
| 1 | Transformer | CX-TRX-2024 | |
| 1 | Relay | iTi-200S | |
| 1 | LED Annunciator | CM-AF501SO | |
| 1 | LED Dome Light | CM-AF141SO | |
| 1 | Signage | CM-SE21A | |
| 3 | NexGen Emergency Strip | 7600-SP-2976-1 | |
| 1 | Kick Plate | GSH 80A C10B (250 x 925) TM B4E | C10B |
| 1 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53-BLA x 965mm | BLA |
| 1 | Power Supply | BPS-24-2 | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #012

1 Single door 118A, VEST 115V TO WC 118A

RH

Type: A/F1, 915 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------|--|------|
| 3 | Standard Hinge | TA786 114 X 101 C10B | C10B |
| 1 | Privacy Set | 49 OI-8265 WTJ C10B RH | C10B |
| 1 | Kick Plate | GSH 80A C10B (250 x 875) TM B4E | C10B |
| 1 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53-BLA x 915mm | BLA |



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Heading #013

1 Single door 120S, EXTERIOR FROM STAIRS 120S

LHR

Type: EX-A/EX, 1150 x 2134 x 45 - EX DR x EX FR - EX

EXISTING DOOR, FRAME AND HARDWARE TO REMAIN, EXCEPT THE FOLLOWING

| | | | |
|---|--------------|------------|--|
| 1 | Door Contact | N1178 DPDT | |
|---|--------------|------------|--|

Heading #014

1 Single door 120V, VEST 120V FROM CORRIDOR 132K

LHR

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 1 | Continuous Hinge | EL CH-953 x 2111 8 WIRE 32D LHR | C32D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C32D LHR LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #015

1 Single door 122, STAFF ACCESS 122V TO IT CLOSET 122

RH

Type: A/F1, 965 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #016

1 Pair of doors 124, WORK AREA 125 TO CLOSET 124

BI-FOLD

Type: G/-, 419, 419 x 2135 x 45 - HC DR x HM FR - -

| | | | |
|---|----------------|----------------------|------|
| 3 | Standard Hinge | TA714 114 x 101 C26D | C26D |
| 1 | Track / Hanger | CF-515 x 36" 2DR KIT | |
| 1 | Flush Pull | GSH 960 C26D | C26D |



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Heading #017

1 Single door 125, STAFF ACCESS 122V FROM WORK AREA 125

RHR

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D NRP | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W RHR | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 RHR | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |

Heading #018

1 Single door 126, WORK AREA 125 TO STORAGE 126

LH

Type: A/F1, 965 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-CA x 965mm | CA |

Heading #019

1 Single door 126A, WORK AREA 125 TO WC 126A

LH

Type: A/F1, 915 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Privacy Set | 49 OI-8265 WTJ C32D LH | C32D |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #020

1 Pair of doors 126B, WORK AREA 125 FROM ELEC 126B

LHR/RHRA

Type: AA/F2, 610, 610 x 2440 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 8 | Standard Hinge | TA714 127 x 114 C26D NRP | C26D |
| 1 | Flush Bolt | FB458 C26D 610mm (Top Bolt) | C26D |
| 1 | Flush Bolt | FB458 C26D 305mm (Bottom Bolt) | C26D |
| 1 | Dust Proof Strike | DP1 C10B | C10B |
| 1 | Storeroom Lockset | 8204 WTJ C10B RHR LC | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 1431 PS EB LH (Push Side) | EB |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-BA x 965mm | BA |

Heading #021

1 Single door 130, CORRIDOR 131K TO CUSTODIAL 130

LH

1 Single door 131B, STORAGE 131A TO CUSTODIAL 131B

LH

Type: A/F1, 965 x 2030 x 45 - HM DR x HM FR - 0 MIN

| | | | |
|---|---------------------------|--|------|
| 6 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 2 | Salto Entrance Escutcheon | AJ660A00IM38W LH | IM |
| 2 | Salto Lockbody | LA1T0570A21IM8 LH | IM |
| 2 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 2 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 2 | Keying | Keying through U of T Lock Shop | |
| 2 | Surface Closer | TB-351 O EN LH (Pull Side) | EN |
| 2 | Overhead Door Stop | 1-336 630 (90 Degrees) | 630 |
| 2 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 2 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 2 | Door Sweep | W-24S-CA x 965mm | CA |



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Heading #022

| | |
|---|----|
| 1 Single door 202, EXISTING 201S TO OFFICE 202 | RH |
| 1 Single door 202A.2, OFFICE 202 TO OFFICE 202A | RH |
| 1 Single door 202B, EX CORRIDOR 202K TO OFFICE 202B | RH |
| 1 Single door 202C, EX CORRIDOR 202K TO OFFICE 202C | LH |
| 1 Single door 202D, EX CORRIDOR 202K TO OFFICE 202D | RH |

Type: Varies, Opening sizes vary - EX DR x EX FR - -

EXISTING DOOR, FRAME AND HARDWARE TO REMAIN

Heading #023

| | |
|---|----|
| 1 Single door 202A.1, LOBBY 201K TO OFFICE 202A | RH |
|---|----|

Type: EX-C.2/EX, 915 x 2170 x 45 - EX DR x EX FR - -

EXISTING DOOR, FRAME AND HARDWARE TO REMAIN EXCEPT THE FOLLOW

| | | | |
|---|------------------|---|----|
| 1 | Weatherstripping | W-20S-BA x 1 @ Door Width x 2 @ Door Height | BA |
| 1 | Auto Door Bottom | CT-52-BA x Door Width | BA |

OPENING DIMENSIONS REQUIRED

Heading #024

| | |
|---|----|
| 1 Single door 202W, EX CORRIDOR 202K TO WR 202W | RH |
|---|----|

Type: EX-C/EX, 762 x 2170 x 45 - EX DR x EX FR - -

EXISTING DOOR, FRAME AND HARDWARE TO REMAIN



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Heading #025

1 Pair of doors 230K, LOBBY 201K FROM CORRIDOR 230K

LHRA/RHR

Type: EE/F5, 915, 915 x 2440 x 45 - AL DR x AL FR - -

DOOR AND FRAME, BY ALUMINUM OPENING SUPPLIER

| | | | |
|---|----------------------|---|------|
| 1 | Auto Operator | S4800 (Concealed) FE Pair 690 (Includes Top and Bottom Pivots) | 690 |
| 2 | Touchless Actuator | CM-324/3S | 630 |
| 2 | Presence Sensor | Superscan | |
| 2 | Bollard | Bollard - To Later Detail (Mount Bollards on Pull Side of RHR Leaf and on Push Side on LHR Leaf) | |
| 2 | Surface Door Loop | SDL-6" BA (For Superscans on Active Leaf and Exit Devices on Both Leaves) | BA |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 55 56 NB-AD8410 F C10B 915 x 2440 Door RHR | C10B |
| 1 | Exit Device | 53 55 56 NB-AD8410 F 106 x Less Pull LHR LC C10B 915 x 2440 Door | C10B |
| 2 | Glass Bead Shim Kit | 589 EB | EB |
| 2 | Door Pull | GSH 165F x 72" OA x 56" CTC x 1-3/4" DIA #4 Mtg. C10B | C10B |
| 2 | Overhead Door Stop | 1-336 613 (90 Degrees) | 613 |
| 1 | Weatherstripping | Weatherstripping - By Door Supplier | |
| 2 | Door Sweep | Door Sweep - By Door Supplier | |
| 2 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | S.I.P. Box | B994 Standard | |
| 2 | Wire Harness | UCA-W6W8P | |
| 2 | Wire Harness | UCA-W915 + 150mm W8P | |
| 2 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

HARDWARE SUPPLIER:

REVIEW AND COORDINATE HARDWARE WITH APPROVED ALUMINUM SHOP DRAWINGS REQUIRED



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Heading #026

1 Pair of doors 231, CORRIDOR 230K FROM MULTI-PURPOSE ROOM #1/SMUDGING 231
 1 Pair of doors 233, CORRIDOR 230K FROM MULTI-PURPOSE ROOM #2 233
 1 Pair of doors 235, CORRIDOR 230K FROM MULTI-PURPOSE ROOM #3 235

LHRA/RHR
 LHRA/RHR
 LHR/RHRA

Type: BB/F2, 965, 965 x 2440 x 45 - SC DR x WD FR - -

| | | | |
|----|--------------------------|--|------|
| 3 | Electric Hinge | TA786 127 x 114 C10B NRP CC8 - LHR | C10B |
| 3 | Electric Hinge | TA786 127 x 114 C10B NRP CC8 - RHR | C10B |
| 18 | Standard Hinge | TA786 127 X 114 C10B NRP | C10B |
| 3 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 3 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 3 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 55 56 NB-WD8610 J ETJ LHR LC C10B Door 96 965 x 2440 Door | C10B |
| 2 | Exit Device | 53 55 56 NB-WD8610 J ETJ RHR LC C10B Door 96 965 x 2440 Door | C10B |
| 2 | Exit Device | 53 55 56 NB-WD8606 J ETJ LHR LC C10B Door 96 965 x 2440 Door | C10B |
| 1 | Exit Device | 53 55 56 NB-WD8606 J ETJ RHR LC C10B Door 96 965 x 2440 Door | C10B |
| 2 | Surface Closer | 351 P10 EB LH (Push Side) | EB |
| 1 | Surface Closer | 351 P10 EB RH (Push Side) | EB |
| 3 | Auto Operator | S4100 (Set to LE) Series Single (Push Side Mount) 690 | 690 |
| 6 | Actuator | 6R3 630 | 630 |
| 6 | Kick Plate | GSH 80A C10B (250 x 940) TM B4E | C10B |
| 6 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 3 | Weatherstripping | W-20S-BA 1 @ 1930mm + 2 @ 2440mm | BA |
| 6 | Auto Door Bottom | CT-53-BLA x 965mm | BLA |
| 3 | Adjustable Meeting Stile | 354D/DS x 2438 (TKSP) | D/DS |
| 6 | Door Contact | N1178 DPDT | |
| 3 | Salto Card Reader | WRDJ0A4B | |
| 3 | Controller | CU42E0US | |
| 3 | Power Supply | Central Power | |
| 3 | S.I.P. Box | B994 Standard | |
| 6 | Wire Harness | UCA-W192W8P | |
| 6 | Wire Harness | UCA-W965 + 150mm W8P | |
| 6 | Wire Harness | UCA-W6W8P | |
| 3 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #027

1 Pair of doors 231A, MULTI-PURPOSE ROOM #1/SMUDGING 231 FROM STORAGE 231A

LHR/RHRA

Type: AA/F2, 915, 915 x 2440 x 45 - SC DR x HM FR - 90 MIN

CLADDING ON FRAME AND DOOR

| | | | |
|---|-------------------|------------------------------|----------|
| 8 | Wide Throw Hinge | TA2798 114 x 152 BSP (SS) | BSP (SS) |
| 2 | Flush Bolt | FB458 C10B 305mm | C10B |
| 1 | Dust Proof Strike | DP2 C10B | C10B |
| 1 | Latchset | 31-8215 WTJ C10B RHR | C10B |
| 1 | Surface Closer | 1431 PS EB LH (Push Side) | EB |
| 1 | Surface Closer | 1431 PS EB RH (Push Side) | EB |

Heading #028

1 Pair of doors 231B, CORRIDOR 230K FROM ELEC 231B

LHRA/RHR

1 Pair of doors 233A, CORRIDOR 230K FROM ELEC 233A

LHRA/RHR

Type: AA/F5, 965, 965 x 2440 x 45 - SC DR x WD FR - -

CLADDING ON FRAME AND DOOR

| | | | |
|----|----------------------|--|------|
| 16 | | TE 540 3D A8 107 | |
| 2 | Flush Bolt | FB458 C10B 610mm (Top Bolt) | C10B |
| 2 | Flush Bolt | FB458 C10B 305mm (Bottom Bolt) | C10B |
| 2 | Dust Proof Strike | DP2 C10B | C10B |
| 2 | Storeroom Lockset | 31-8204 WTJ C10B LHR LC | C10B |
| 2 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 2 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 2 | Keying | Keying through U of T Lock Shop | |
| 4 | Overhead Door Stop | 1-336 613 (110 Degrees) | 613 |



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Heading #028A

1 Pair of doors 236, CORRIDOR 230K FROM STORAGE 236

LHRA/RHR

Type: AA/F5, 965, 965 x 2440 x 45 - SC DR x WD FR - -

CLADDING ON FRAME AND DOOR

| | | | |
|---|---------------------------|--|------|
| 8 | | TE 540 3D A8 107 | |
| 1 | Flush Bolt | FB458 C10B 610mm (Top Bolt) | C10B |
| 1 | Flush Bolt | FB458 C10B 305mm (Bottom Bolt) | C10B |
| 1 | Dust Proof Strike | DP2 C10B | C10B |
| 1 | Salto Entrance Escutcheon | AJ660A00NE38W LHR x CLADDING | NE |
| 1 | Salto Lockbody | LA1T0570A21NE8 LHR | NE |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 2 | Overhead Door Stop | 1-336 613 (110 Degrees) | 613 |

Heading #029

1 Elevation 231.1, MULTI-PURPOSE ROOM #1/SMUDGING 231 TO MULTI-PURPOSE ROOM #2 233

Type: -/-, __ x 5090 x 45 - HM DR x HM FR - -

FOLDING ACOUSTIC PARTITION. DOOR, FRAME AND HARDWARE BY DOOR SUPPLIER.



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Heading #030

1 Single door 237, LOBBY 240K FROM LOUNGE 237

LHR

Type: E/F1, 965 x 2135 x 45 - AL DR x AL FR - 90 MIN

FIRE RATED DOOR, FRAME AND HARDWARE, BY OPENINGS DOOR SUPPLIER (TGP)

| | | |
|---|--------------------|--|
| 3 | Hinges | Hinges By Door Supplier |
| 1 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail |
| 1 | Keying | Keying through U of T Lock Shop |
| 1 | Exit Device | Rim Exit Device and Trim - By Door Supplier |
| 1 | Electric Strike | Electric Strike - By Door Supplier |
| 1 | Door Closer | Door Closer - By Door Supplier |
| 1 | Overhead Door Stop | Overhead Stop - By Door Supplier |
| 1 | Weatherstripping | Weatherstripping - By Door Supplier |
| 1 | Door Sweep | Door Sweep - By Door Supplier |
| 1 | Door Contact | N1178 DPDT |
| 1 | Card Reader | Honeywell Card Reader - By Others |
| 1 | Power Supply | Central Power |
| 1 | S.I.P. Box | B994 Mini |
| 1 | Junction Box | 4X4 Junction Box - By Others |
| 1 | Wire Harness | UCA-W192W8P |
| 1 | Opening Schematic | Opening Schematic - To Later Detail |
| 1 | Note: | Hardware consultant and supplier to coordinate and review shop drawings provided by the door supplier. |



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Heading #031

1 Single door 237A, LOUNGE 237 TO UNI WC 237A

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------------|--|---------|
| 3 | Standard Hinge | TA786 114 X 101 C10B | C10B |
| 1 | Storeroom Lockset | 8204 WTJ C10B LH LC | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Electric Strike | 1006-F-24V-613-LBM KM-613 | 613-LBM |
| 1 | Auto Operator | S7100 LE Single (Pull Side Mount) 690 | 690 |
| 1 | Washroom Control Kit | CX-WC13AXSM (Less Door Contact) | |
| 1 | Door Contact | N1178 SPST (WR Sequence Reset) | |
| 1 | Transformer | CX-TRX-2024 | |
| 1 | Relay | iTi-200S | |
| 1 | LED Annunciator | CM-AF501SO | |
| 1 | LED Dome Light | CM-AF141SO | |
| 1 | Signage | CM-SE21A | |
| 3 | NexGen Emergency Strip | 7600-SP-2976-1 | |
| 1 | Kick Plate | GSH 80A C10B (250 x 875) TM B4E | C10B |
| 1 | Floor Door Stop | GSH 209 C10B | C10B |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53-BLA x 915mm | BLA |
| 1 | Power Supply | BPS-24-2 | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #032

1 Single door 237B, LOUNGE 237 TO BF WC 237B

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------------|--|---------|
| 3 | Standard Hinge | TA786 127 X 114 C10B | C10B |
| 1 | Storeroom Lockset | 8204 WTJ C10B LH LC | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Electric Strike | 1006-F-24V-613-LBM KM-613 | 613-LBM |
| 1 | Auto Operator | S7100 LE Single (Pull Side Mount) 690 | 690 |
| 1 | Washroom Control Kit | CX-WC13AXSM (Less Door Contact) | |
| 1 | Door Contact | N1178 SPST (WR Sequence Reset) | |
| 1 | Transformer | CX-TRX-2024 | |
| 1 | Relay | iTi-200S | |
| 1 | LED Annunciator | CM-AF501SO | |
| 1 | LED Dome Light | CM-AF141SO | |
| 1 | Signage | CM-SE21A | |
| 3 | NexGen Emergency Strip | 7600-SP-2976-1 | |
| 1 | Kick Plate | GSH 80A C10B (250 x 925) TM B4E | C10B |
| 1 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53-BLA x 965mm | BLA |
| 1 | Power Supply | BPS-24-2 | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #033

1 Single door 237C, LOUNGE 237 TO WC 237C

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------|--|------|
| 3 | Standard Hinge | TA786 114 X 101 C10B | C10B |
| 1 | Privacy Set | 49 OI-8265 WTJ C10B RH | C10B |
| 1 | Surface Closer | 351 O EB RH (Pull Side) | EB |
| 1 | Kick Plate | GSH 80A C10B (250 x 875) TM B4E | C10B |
| 1 | Wall Door Stop | GSH 240 C10B (GC to Reinforce Wall for Wall Stop) | C10B |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53-BLA x 915mm | BLA |



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Heading #034

1 Single door 238, LOUNGE 237 TO IT CL 238

RH

Type: E/F1, 915 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C10B RH LC | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EB RH | EB |
| 1 | Kick Plate | GSH 80A C10B (250 x 875) TM B4E | C10B |
| 1 | Wall Door Stop | GSH 240 C10B | C10B |
| | | (GC to Reinforce Wall for Wall Stop) | |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W915 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #035

1 Pair of doors 240, LOBBY 240K FROM WAITING AREA 240

LHRA/RHR

Type: EE/F2, 972, 972 x 2188 x 45 - AL DR x AL FR - 90 MIN

FIRE RATED DOOR, FRAME AND HARDWARE, BY OPENINGS DOOR SUPPLIER (TGP)

| | | | |
|---|--------------------|--|--|
| 6 | Hinges | Hinges By Door Supplier | |
| 2 | Exit Device | Nrw Rim Exit Device w/Elec. Trim x RX in Rail - By Door Supplier | |
| 2 | Door Closer | Door Closer - By Door Supplier | |
| 2 | Overhead Door Stop | Overhead Stop - By Door Supplier | |
| 1 | Weatherstripping | Weatherstripping - By Door Supplier | |
| 2 | Door Sweep | Door Sweep - By Door Supplier | |
| 2 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |
| 1 | Note: | Hardware consultant and supplier to coordinate and review shop drawings provided by the door supplier. | |



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Heading #036

| | |
|---|----|
| 1 Single door 241, PUBLIC CORRIDOR 245K TO COUNS ROOM 241 | RH |
| 1 Single door 243, PUBLIC CORRIDOR 245K TO COUNS ROOM 243 | RH |
| 1 Single door 245, PUBLIC CORRIDOR 245K TO COUNS ROOM 245 | RH |
| 1 Single door 246, PUBLIC CORRIDOR 245K TO COMP CARE/MED COUNS ROOM 246 | RH |
| 1 Single door 247, PUBLIC CORRIDOR 245K TO COUNS ROOM 247 | RH |
| 1 Single door 248, PUBLIC CORRIDOR 245K TO COMP CARE/MED COUNS ROOM 248 | RH |
| 1 Single door 249, PUBLIC CORRIDOR 245K TO COUNS ROOM 249 | RH |
| 1 Single door 255, PUBLIC CORRIDOR 245K TO COUNS ROOM 255 | LH |
| 1 Single door 257, PUBLIC CORRIDOR 245K TO COUNS ROOM 257 | LH |
| 1 Single door 259, PUBLIC CORRIDOR 245K TO COUNS ROOM 259 | LH |
| 1 Single door 261, PUBLIC CORRIDOR 245K TO COUNS ROOM 261 | LH |
| 1 Single door 262, PUBLIC CORRIDOR 245K TO COUNS ROOM 262 | LH |
| 1 Single door 263, PUBLIC CORRIDOR 245K TO COUNS ROOM 263 | LH |
| 1 Single door 264, PUBLIC CORRIDOR 245K TO COUNS ROOM 264 | LH |
| 1 Single door 265, PUBLIC CORRIDOR 245K TO COUNS ROOM 265 | LH |
| 1 Single door 266, PUBLIC CORRIDOR 245K TO FLEX SPACE 266 | LH |
| 1 Single door 267, PUBLIC CORRIDOR 245K TO COUNS ROOM 267 | LH |
| 1 Single door 268, PUBLIC CORRIDOR 245K TO FLEX SPACE 268 | LH |
| 1 Single door 269, PUBLIC CORRIDOR 245K TO COUNS ROOM 269 | LH |
| 1 Single door 270, PUBLIC CORRIDOR 245K TO FLEX SPACE 270 | LH |
| 1 Single door 272, PUBLIC CORRIDOR 245K TO FLEX SPACE 272 | LH |

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|----|----------------------|--|------|
| 63 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 14 | Office Lockset | 8256 WTJ C32D LH LC | C32D |
| 7 | Office Lockset | 8256 WTJ C32D RH LC | C32D |
| 21 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 21 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 21 | Keying | Keying through U of T Lock Shop | |
| 21 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 21 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 21 | Auto Door Bottom | CT-53 x 965mm | |

Heading #037

1 Elevation, RESERVED HEADING FOR FUTURE USE

__ x __ x __ - HM DR x HM FR

REVERSED HEADING FOR FUTURE USE



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Heading #038

1 Single door 242, PUBLIC CORRIDOR 245K TO RECEPTION 242

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W RH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 RH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |

Heading #039

1 Single door 244, PUBLIC CORRIDOR 245K TO OFFICE 244

RH

1 Single door 271, PUBLIC CORRIDOR 245K TO DIRECTOR OFFICE/LG COUNS ROOM 271

LH

1 Single door 273, PUBLIC CORRIDOR 245K TO OFFICE 273

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 9 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W LH | IM |
| 2 | Salto Entrance Escutcheon | AJ660A00IM38W RH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 LH | IM |
| 2 | Salto Lockbody | LA1T0570A21IM8 RH | IM |
| 3 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 3 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 3 | Keying | Keying through U of T Lock Shop | |
| 3 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 3 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 3 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #040

1 Single door 250, PUBLIC CORRIDOR 245K TO CUST 250

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W LH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 LH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | TB-351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #041

1 Single door 251, PUBLIC CORRIDOR 245K TO BF WC 251

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------------|--|---------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Electric Strike | 1006-F-24V-630-LBM KM-630 | 630-LBM |
| 1 | Auto Operator | S7100 LE Single (Pull Side Mount) 689 | 689 |
| 1 | Washroom Control Kit | CX-WC13AXSM (Less Door Contact) | |
| 1 | Door Contact | N1178 SPST (WR Sequence Reset) | |
| 1 | Transformer | CX-TRX-2024 | |
| 1 | Relay | iTi-200S | |
| 1 | LED Annunciator | CM-AF501SO | |
| 1 | LED Dome Light | CM-AF141SO | |
| 1 | Signage | CM-SE21A | |
| 3 | NexGen Emergency Strip | 7600-SP-2976-1 | |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Power Supply | BPS-24-2 | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #042

1 Single door 253, PUBLIC CORRIDOR 245K TO MEETING ROOM 253

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | MELR Lockset | 56 RX-8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Salto Card Reader | WRDJ0A4B | |
| 1 | Controller | CU42E0US | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #043

1 Single door 258, PUBLIC CORRIDOR 245K TO LG COUNS ROOM 258

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | MELR Lockset | 56 RX-8204 WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #044

1 Single door 274, PUBLIC CORRIDOR 245K TO ELEC 274

RH

Type: A/F1, 965 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 1431 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-54 x 965mm | |

Heading #045

1 Pair of doors 276.1, PUBLIC CORRIDOR 245K FROM ELEC CLOSET 276

LHRA/RHR

1 Pair of doors 276.2, PUBLIC CORRIDOR 245K FROM ELEC CLOSET 276

LHR/RHRA

Type: AA/F2, 915, 915 x 2135 x 45 - HM DR x HM FR - 90 MIN

| | | | |
|----|----------------------|--|------|
| 12 | Standard Hinge | TA714 114 x 101 C26D NRP | C26D |
| 4 | Flush Bolt | FB458 C26D 305mm | C26D |
| 2 | Dust Proof Strike | DP2 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D LHR LC | C32D |
| 1 | Storeroom Lockset | 8204 WTJ C32D RHR LC | C32D |
| 2 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 2 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 2 | Keying | Keying through U of T Lock Shop | |
| 2 | Surface Closer | 1431 P10 EN LH (Push Side) | EN |
| 2 | Surface Closer | 1431 P10 EN RH (Push Side) | EN |
| 4 | Overhead Door Stop | 10-336 630 | 630 |
| 2 | Weatherstripping | W-22-BL x 20'-4" (6198mm) | BL |
| 4 | Door Sweep | W-24S-CA x 915mm | CA |
| 2 | Astragal Seal | S771BL7 | BL |



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Heading #046

1 Single door 277, STAFF CORRIDOR 277K TO IT 277

LH

Type: A/F1, 965 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-54 x 965mm | |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #047

1 Single door 277K, PUBLIC CORRIDOR 245K FROM STAFF CORRIDOR 277K

RHR

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|-------------------|--|-----------|
| 1 | Continuous Hinge | EL CH-953 x 2111 8 WIRE 32D RHR | C32D |
| 1 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 55 56-8804 J ETJ RHR LC C26D/C32D 965 | C26D/C32D |
| 1 | Auto Operator | S4100 FE Single w/Hold Open (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 2 | Presence Sensor | Superscan | |
| 1 | Surface Door Loop | SDL-6" AL (1 Per 2 SuperScans) | AL |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Salto Card Reader | WRDJ0A4B | |
| 1 | Controller | CU42E0US | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #048

1 Single door 301, PUBLIC CORRIDOR 305K FROM CUST 301

LHR

Type: E/F1, 915 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W LHR | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 LHR | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | TB-351 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #049

1 Pair of doors 301V, LOBBY NO 1 301V FROM PUBLIC CORRIDOR 305K

LHR/RHRA

Type: EE/F2, 965, 965 x 2135 x 45 - SC DR x HM FR - 90 MIN

FIRE RATED DOOR, FRAME AND HARDWARE, BY OPENINGS DOOR SUPPLIER (TGP)

| | | |
|---|----------------------|--|
| 6 | Hinges | Hinges By Door Supplier |
| 2 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail |
| 2 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail |
| 2 | Keying | Keying through U of T Lock Shop |
| 2 | Exit Device | Rim Exit Device and Trim - By Door Supplier |
| 2 | Door Closer | Door Closer - By Door Supplier |
| 2 | Overhead Door Stop | Overhead Stop - By Door Supplier |
| 1 | Weatherstripping | Weatherstripping - By Door Supplier |
| 2 | Door Sweep | Door Sweep - By Door Supplier |
| 1 | Note: | Hardware consultant and supplier to coordinate and review shop drawings provided by the door supplier. |



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Heading #050

1 Single door 303, PUBLIC CORRIDOR 305K TO BF WC 303

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------------|--|---------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Electric Strike | 1006-F-24V-630-LBM KM-630 | 630-LBM |
| 1 | Auto Operator | S7100 LE Single (Pull Side Mount) 689 | 689 |
| 1 | Washroom Control Kit | CX-WC13AXSM (Less Door Contact) | |
| 1 | Door Contact | N1178 SPST (WR Sequence Reset) | |
| 1 | Transformer | CX-TRX-2024 | |
| 1 | Relay | iTi-200S | |
| 1 | LED Annunciator | CM-AF501SO | |
| 1 | LED Dome Light | CM-AF141SO | |
| 1 | Signage | CM-SE21A | |
| 3 | NexGen Emergency Strip | 7600-SP-2976-1 | |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Power Supply | BPS-24-2 | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #051

| | |
|--|----|
| 1 Single door 304, PUBLIC CORRIDOR 305K TO HEALTH PROMOTION OFFICE 304 | RH |
| 1 Single door 320, STAFF CORRIDOR 320K TO OFFICE 320 | RH |
| 1 Single door 322, STAFF CORRIDOR 320K TO OFFICE 322 | LH |
| 1 Single door 324, STAFF CORRIDOR 320K TO OFFICE 324 | LH |

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|----|---------------------------|--|------|
| 12 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 2 | Salto Entrance Escutcheon | AJ660A00IM38W LH | IM |
| 2 | Salto Entrance Escutcheon | AJ660A00IM38W RH | IM |
| 2 | Salto Lockbody | LA1T0570A21IM8 LH | IM |
| 2 | Salto Lockbody | LA1T0570A21IM8 RH | IM |
| 4 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 4 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 4 | Keying | Keying through U of T Lock Shop | |
| 4 | Wall Door Stop | GSH 240 C26D | C26D |
| | | (GC to Reinforce Wall for Wall Stop) | |
| 4 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 4 | Auto Door Bottom | CT-53 x 965mm | |

Heading #052

| | |
|---|----------|
| 1 Pair of doors 305, PUBLIC CORRIDOR 305K FROM ELEC 305 | LHRA/RHR |
|---|----------|

Type: AA/F2, 965, 965 x 2440 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 8 | Standard Hinge | TA714 127 x 114 C26D NRP | C26D |
| 1 | Flush Bolt | FB458 C26D 610mm | C26D |
| | | (Top Bolt) | |
| 1 | Flush Bolt | FB458 C26D 305mm | C26D |
| | | (Bottom Bolt) | |
| 1 | Dust Proof Strike | DP1 C10B | C10B |
| 1 | Storeroom Lockset | 8204 WTJ C10B LHR LC | C10B |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 1431 PS EB RH | EB |
| | | (Push Side) | |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-BA x 965mm | BA |



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Heading #053

1 Single door 306, PUBLIC CORRIDOR 305K TO HEALTH PROMOTION OFFICE 306

RH

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | MELR Lockset | 56 RX-8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Salto Card Reader | WRDJ0A4B | |
| 1 | Controller | CU42E0US | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #054

1 Single door 308, LOUNGE 307 FROM ADMIN/OFFICE FITOUT LHR
1 Single door 328, ELEVATOR VESTIBULE 325V FROM ADMIN/OFFICE FITOUT RHR

Type: E/F1, 915 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|----------------------|--|------------|
| 1 | Continuous Hinge | EL CH-953 x 2111 8 WIRE 32D LHR | C32D |
| 1 | Continuous Hinge | EL CH-953 x 2111 8 WIRE 32D RHR | C32D |
| 2 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 2 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 2 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 55-8876-24V F ETJ 24v LHR LC C26D/US32D 915 | C26D/US32D |
| 1 | Exit Device | 53 55-8876-24V F ETJ 24v RHR LC C26D/US32D 915 | C26D/US32D |
| 1 | Surface Closer | 351 P10 EN LH | EN |
| 1 | Surface Closer | 351 P10 EN RH | EN |
| 2 | Kick Plate | GSH 80A C32D (250 x 875) TM B4E | C32D |
| 2 | Wall Door Stop | GSH 240 C26D | C26D |
| | | (GC to Reinforce Wall for Wall Stop) | |
| 2 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 2 | Door Sweep | W-24S-CA x 915mm | CA |
| 2 | Door Contact | N1178 DPDT | |
| 2 | Card Reader | Future Honeywell Card Reader - By others | |
| 2 | Power Supply | Central Power | |
| 2 | S.I.P. Box | B994 Mini | |
| 2 | Junction Box | 4X4 Junction Box - By Others | |
| 2 | Wire Harness | UCA-W192W8P | |
| 2 | Wire Harness | UCA-W915 + 150mm W8P | |
| 2 | Wire Harness | UCA-W6W8P | |
| 2 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #055

1 Single door 320K.1, LOUNGE 307 TO STAFF CORRIDOR 320K

RH

Type: A/F1, 915 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 1 | Continuous Hinge | CH-953 x 2111 32D RH | C32D |
| 1 | MELR Lockset | 56 RX-8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Push Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W915 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #056

1 Single door 320K.2, STAFF CORRIDOR 320K TO ELEVATOR VESTIBULE 325V

RHR

Type: A/F1, 915 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|-------------------|--|-----------|
| 1 | Continuous Hinge | EL CH-953 x 2111 8 WIRE 32D RHR | C32D |
| 1 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 55 56-8804 J ETJ RHR LC C26D/C32D 915 | C26D/C32D |
| 1 | Auto Operator | S4100 FE Single w/Hold Open (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 2 | Presence Sensor | Superscan | |
| 1 | Surface Door Loop | SDL-6" AL (1 Per 2 SuperScans) | AL |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W915 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #057

1 Single door 321, STAFF CORRIDOR 320K TO CALL ROOM 321

RH

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W RH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 RH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



Upper Canada Specialty Hardware
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Heading #058

1 Single door 323, STAFF CORRIDOR 320K TO WORK ROOM 323

LH

Type: A/F1, 915 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | MELR Lockset | 56 RX-8204 WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Salto Card Reader | WRDJ0A4B | |
| 1 | Controller | CU42E0US | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #059

1 Single door 325A, ELEVATOR VESTIBULE 325V FROM ELEC 325A

RHR

Type: E/F1, 915 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 114 x 101 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D RHR LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 1431 PS EN RHR | EN |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-CA x 915mm | CA |



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Heading #060

1 Single door 325B, ELEVATOR VESTIBULE 325V FROM IT 325B

LHR

Type: A/F1, 965 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C32D LHR LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 P10 EN RH (Push Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-54 x 965mm | |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #061

1 Single door 325S, STAIR NO 3 325S FROM ELEVATOR VESTIBULE 325V

RHR

1 Single door 326, ELEVATOR VESTIBULE 325V TO MECH 326

LH

Type: EX-C/EX, 762 x 2170 x 45 - EX DR x EX FR - EX

EXISTING DOOR, FRAME AND HARDWARE TO REMAIN



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Heading #062

1 Single door 327, ELEVATOR VESTIBULE 325V TO CUSTODIAL 327

RH

Type: E/F1, 915 x 2135 x 45 - HM DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W RH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 RH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |

Heading #063

1 Single door 340, CORRIDOR 340K TO COUNS ROOM 340

RH

1 Single door 341, CORRIDOR 340K TO COUNS ROOM 341

RH

1 Single door 342, CORRIDOR 340K TO COUNS ROOM 342

RH

1 Single door 343, CORRIDOR 340K TO COUNS ROOM 343

RH

1 Single door 345, CORRIDOR 340K TO COUNS ROOM 345

RH

1 Single door 346, CORRIDOR 340K TO COUNS ROOM 346

LH

1 Single door 347, CORRIDOR 340K TO COUNS ROOM 347

RH

1 Single door 348, CORRIDOR 340K TO COUNS ROOM 348

LH

1 Single door 349, CORRIDOR 340K TO COUNS ROOM 349

RH

1 Single door 350, CORRIDOR 340K TO COUNS ROOM 350

RH

1 Single door 351, CORRIDOR 340K TO COUNS ROOM 351

RH

1 Single door 353, CORRIDOR 340K TO COUNS ROOM 353

RH

1 Single door 354, CORRIDOR 340K TO COUNS ROOM 354

LH

1 Single door 355, CORRIDOR 340K TO COMP CARE/SMUDGING 355

RH

1 Single door 356, CORRIDOR 340K TO COUNS ROOM 356

RH

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|----|----------------------|--|------|
| 45 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 3 | Office Lockset | 8256 WTJ C32D LH LC | C32D |
| 12 | Office Lockset | 8256 WTJ C32D RH LC | C32D |
| 15 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 15 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 15 | Keying | Keying through U of T Lock Shop | |
| 15 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 15 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 15 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #064

1 Single door 340K, PUBLIC CORRIDOR 305K FROM CORRIDOR 340K

RHR

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|-------------------|--|-----------|
| 1 | Continuous Hinge | EL CH-953 x 2111 8 WIRE 32D RHR | C32D |
| 1 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 53 55 56-8804 J ETJ RHR LC C26D/C32D 965 | C26D/C32D |
| 1 | Auto Operator | S4100 FE Single w/Hold Open (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 2 | Presence Sensor | Superscan | |
| 1 | Surface Door Loop | SDL-6" AL (1 Per 2 SuperScans) | AL |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #065

1 Single door 357K.1, EXIT CORRIDOR 357K FROM PUBLIC CORRIDOR 305K

LHR

Type: E/F1, 965 x 2135 x 45 - AL DR x AL FR - 90 MIN

FIRE RATED DOOR, FRAME AND HARDWARE, BY OPENINGS DOOR SUPPLIER (TGP)

| | | | |
|---|----------------------|--|--|
| 3 | Hinges | Hinges By Door Supplier | |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | Rim Exit Device and Trim - By Door Supplier | |
| 1 | Door Closer | Door Closer - By Door Supplier | |
| 1 | Overhead Door Stop | Overhead Stop - By Door Supplier | |
| 1 | Weatherstripping | Weatherstripping - By Door Supplier | |
| 1 | Door Sweep | Door Sweep - By Door Supplier | |
| 1 | Note: | Hardware consultant and supplier to coordinate and review shop drawings provided by the door supplier. | |



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Heading #065A

1 Single door 357K.2, EXIT CORRIDOR 357K FROM SUB-WAITING AREA 357

LHR

Type: E/F1, 965 x 2135 x 45 - AL DR x AL FR - 90 MIN

| | | |
|---|----------------------|--|
| 3 | Hinges | Hinges By Door Supplier |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail |
| 1 | Keying | Keying through U of T Lock Shop |
| 1 | Exit Device | Rim Exit Device and Less Trim - By Door Supplier |
| 1 | Door Closer | Door Closer - By Door Supplier |
| 1 | Overhead Door Stop | Overhead Stop - By Door Supplier |
| 1 | Weatherstripping | Weatherstripping - By Door Supplier |
| 1 | Door Sweep | Door Sweep - By Door Supplier |
| 1 | Door Contact | N1178 DPDT |
| 1 | Request to Exit | Motion Request to Exit - By Others |
| 1 | Power Supply | Central Power |
| 1 | Opening Schematic | Opening Schematic - To Later Detail |
| 1 | Note: | Hardware consultant and supplier to coordinate and review shop drawings provided by the door supplier. |

NOTE:

- UFT TO CONFIRM IF ALARM IS REQUIRED

Heading #066

1 Single door 358, SUB-WAITING AREA 357 TO WC 358

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------|--|------|
| 3 | Standard Hinge | TA786 114 x 101 C26D | C26D |
| 1 | Privacy Set | 49 OI-8265 WTJ C32D LH | C32D |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #067

1 Pair of doors 360, LOBBY 360V FROM WAITING AREA 360

LHRA/RHR

Type: EE/F2, 972, 972 x 2134 x 45 - AL DR x AL FR - 90 MIN

FIRE RATED DOOR, FRAME AND HARDWARE, BY OPENINGS DOOR SUPPLIER (TGP)

| | | |
|---|--------------------|--|
| 6 | Hinges | Hinges By Door Supplier |
| 2 | Exit Device | Nrw Rim Exit Device w/Elec. Trim x RX in Rail - By Door Supplier |
| 2 | Door Closer | Door Closer - By Door Supplier |
| 2 | Overhead Door Stop | Overhead Stop - By Door Supplier |
| 1 | Weatherstripping | Weatherstripping - By Door Supplier |
| 2 | Door Sweep | Door Sweep - By Door Supplier |
| 2 | Door Contact | N1178 DPDT |
| 1 | Card Reader | Honeywell Card Reader - By Others |
| 1 | Power Supply | Central Power |
| 1 | S.I.P. Box | B994 Mini |
| 1 | Junction Box | 4X4 Junction Box - By Others |
| 1 | Wire Harness | UCA-W192W8P |
| 1 | Opening Schematic | Opening Schematic - To Later Detail |
| 1 | Note: | Hardware consultant and supplier to coordinate and review shop drawings provided by the door supplier. |

Heading #068

1 Single door 362, CORRIDOR 370K TO WC 362

RHR

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Privacy Set | 49 OI-8265 WTJ C32D RHR | C32D |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #069

1 Single door 363.1, CORRIDOR 370K TO RECEPTION 363

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W RH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 RH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Floor Door Stop | GSH 209 C26D | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |

Heading #070

1 Single door 363.2, RECEPTION 363 FROM STAFF ACCESS 365K

RHR

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------|----------------------------|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D NRP | C26D |
| 1 | Latchset | 8215 WTJ C32D RHR | C32D |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Floor Door Stop | GSH 209 C26D | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #071

1 Single door 364, CORRIDOR 370K TO BF EXAM RM 364

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | MELR Lockset | 56 RX-8204 WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #072

1 Single door 365, STAFF ACCESS 365K TO CENTRAL SUPPLY 365

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|-----------------|---------------------------------|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Latchset | 8215 WTJ C32D LH | C32D |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Floor Door Stop | GSH 209 C26D | C26D |



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Heading #073

1 Single door 365K.1, WAITING AREA 360 FROM STAFF ACCESS 365K

RHR

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 1 | Continuous Hinge | CH-953 x 2111 32D RHR | C32D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W RHR | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 RHR | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 P10 EN LH (Push Side) | EN |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |

Heading #074

1 Single door 365K.2, NURSING STATIONS 381 TO STAFF ACCESS 365K

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W LH | NE |
| 1 | Salto Lockbody | LA1T0570A21IM8 LH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |



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Heading #075

| | |
|---|----|
| 1 Single door 366, CORRIDOR 370K TO EXAM ROOM 366 | LH |
| 1 Single door 368, CORRIDOR 370K TO EXAM ROOM 368 | LH |
| 1 Single door 370, CORRIDOR 370K TO EXAM RM/ISOLATION 370 | LH |
| 1 Single door 376, CORRIDOR 370K TO EXAM ROOM 376 | LH |
| 1 Single door 378, CORRIDOR 370K TO EXAM ROOM 378 | LH |
| 1 Single door 380, CORRIDOR 370K TO EXAM ROOM 380 | LH |
| 1 Single door 382, CORRIDOR 370K TO EXAM ROOM 382 | LH |
| 1 Single door 383, CORRIDOR 370K TO MINOR PROC/COL ROOM 383 | LH |
| 1 Single door 384, CORRIDOR 370K TO EXAM ROOM 384 | LH |
| 1 Single door 385, CORRIDOR 370K TO EXAM ROOM 385 | LH |
| 1 Single door 386, CORRIDOR 370K TO EXAM ROOM 386 | LH |
| 1 Single door 387, CORRIDOR 370K TO EXAM ROOM 387 | LH |
| 1 Single door 388, CORRIDOR 370K TO EXAM ROOM 388 | LH |
| 1 Single door 389, CORRIDOR 370K TO EXAM ROOM 389 | LH |
| 1 Single door 390, CORRIDOR 370K TO EXAM ROOM 390 | LH |
| 1 Single door 391, CORRIDOR 370K TO EXAM ROOM 391 | LH |
| 1 Single door 392, CORRIDOR 370K TO EXAM ROOM 392 | LH |
| 1 Single door 393, CORRIDOR 370K TO EXAM ROOM 393 | LH |
| 1 Single door 394, CORRIDOR 370K TO EXAM ROOM 394 | LH |
| 1 Single door 395, CORRIDOR 370K TO EXAM ROOM 395 | LH |
| 1 Single door 396, CORRIDOR 370K TO EXAM ROOM 396 | LH |

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|----|----------------------|--|------|
| 63 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 21 | Office Lockset | 8256 WTJ C32D LH LC | C32D |
| 21 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 21 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 21 | Keying | Keying through U of T Lock Shop | |
| 21 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 21 | Wall Door Stop | GSH 240 C26D | C26D |
| | | (GC to Reinforce Wall for Wall Stop) | |
| 21 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 21 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #076

1 Single door 367.1, CORRIDOR 370K TO MEDICATION 367

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #077

1 Single door 367.2, MEDICATION 367 FROM STAFF ACCESS 365K

LHR

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C32D LHR LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #078

1 Single door 369, CORRIDOR 370K TO AUTOCLAVE/SOILED 369

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W LH | NE |
| 1 | Salto Lockbody | LA1T0570A21IM8 LH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 1431 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Job No. 22760

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Heading #078A

1 Single door 371, CORRIDOR 370K TO WC/SAMPLES 371

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------------|--|---------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Electric Strike | 1006-F-24V-630-LBM KM-630 | 630-LBM |
| 1 | Auto Operator | S7100 LE Single (Pull Side Mount) 689 | 689 |
| 1 | Washroom Control Kit | CX-WC13AXSM (Less Door Contact) | |
| 1 | Door Contact | N1178 SPST (WR Sequence Reset) | |
| 1 | Transformer | CX-TRX-2024 | |
| 1 | Relay | iTi-200S | |
| 1 | LED Annunciator | CM-AF501SO | |
| 1 | LED Dome Light | CM-AF141SO | |
| 1 | Signage | CM-SE21A | |
| 3 | NexGen Emergency Strip | 7600-SP-2976-1 | |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Power Supply | BPS-24-2 | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #079

1 Single door 372, CORRIDOR 370K TO ELEC 372

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | TB-351 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-CA x 965mm | CA |



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Heading #080

1 Single door 374, CORRIDOR 370K TO MEETING ROOM 374

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W RH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 RH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |

Heading #081

1 Single door 381, CORRIDOR 370K TO NURSING STATIONS 381

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Salto Entrance Escutcheon | AJ660A00IM38W LH | IM |
| 1 | Salto Lockbody | LA1T0570A21IM8 LH | IM |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Overhead Door Stop | 1-336 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Weatherstripping | W-20S-CA 1 @ 965mm + 2 @ 2135mm | CA |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #082

1 Single door 382A, LOCKERS 399 TO WC & SHOWER 399A

RH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------------|--|---------|
| 3 | Standard Hinge | TA386 127 x 114 C32D | C32D |
| 1 | Storeroom Lockset | 8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Electric Strike | 1006-F-24V-630-LBM KM-630 | 630-LBM |
| 1 | Auto Operator | S7100 LE Single (Pull Side Mount) 689 | 689 |
| 1 | Washroom Control Kit | CX-WC13AXSM (Less Door Contact) | |
| 1 | Door Contact | N1178 SPST (WR Sequence Reset) | |
| 1 | Transformer | CX-TRX-2024 | |
| 1 | Relay | iTi-200S | |
| 1 | LED Annunciator | CM-AF501SO | |
| 1 | LED Dome Light | CM-AF141SO | |
| 1 | Signage | CM-SE21A | |
| 3 | NexGen Emergency Strip | 7600-SP-2976-1 | |
| 1 | Overhead Door Stop | 1-336 630 (90 Degree Dead Stop) | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |
| 1 | Power Supply | BPS-24-2 | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #083

1 Single door 382B, LOCKERS 399 TO WC 399B

LH

Type: A/F1, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Privacy Set | 49 OI-8265 WTJ C32D LH | C32D |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Auto Door Bottom | CT-53 x 965mm | |



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Heading #084

1 Single door 382C, LOCKERS 399 TO IT 399C

RH

Type: A/F1, 965 x 2135 x 45 - HM DR x HM FR - 0 MIN

| | | | |
|---|---------------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Electronic Locking Device | LX RX-8271-24V WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Wire Harness | UCA-W965 + 150mm W8P | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |

Heading #084A

1 Single door 382D, LOCKERS 399 TO ELEC 399D

RH

Type: A/F1, 965 x 2135 x 45 - HM DR x HM FR - 0 MIN

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA786 127 x 114 C26D | C26D |
| 1 | Storeroom Lockset | 8204 WTJ C32D RH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Surface Closer | 351 O EN RH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-CA x 965mm | CA |



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Heading #085

1 Single door 397S.1, STAIR NO 1 397S FROM CORRIDOR 397K

RHR

Type: F/F1, 889 x 2120 x 45 - HM DR x HM FR - 90 MIN

| | | | |
|---|-------------------|--|-----------|
| 1 | Continuous Hinge | EL CH-953 x 2097 8 WIRE C32D RHR | C32D |
| 1 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 12 53 55-8876-24V F ETJ 24v RHR LC C26D/C32D 889 | C26D/C32D |
| 1 | Surface Closer | 351 O EN LH (Pull Side) | EN |
| 1 | Kick Plate | GSH 80A C32D (250 x 850) TM B4E | C32D |
| 1 | Floor Door Stop | GSH 209 C26D | C26D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-CA x 889mm | CA |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Wire Harness | UCA-W889 + 150mm W8P | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #086

1 Single door 397S.2, STAIR NO 1 397S FROM MEETING/LUNCH 398

LHR

Type: F/F1, 889 x 1891 x 45 - HM DR x HM FR - 90 MIN

| | | | |
|---|--------------------|--|-----------|
| 1 | Continuous Hinge | EL CH-953 x 1868 8 WIRE 32D LHR | C32D |
| 1 | LFIC Rim Housing | Sargent LFIC Rim Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Exit Device | 12 53 55-8876-24V F ETJ 24v LHR LC C26D/C32D 889 | C26D/C32D |
| 1 | Surface Closer | 351 O EN RH (Pull Side) | EN |
| 1 | Overhead Door Stop | 1-236 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 850) TM B4E | C32D |
| 1 | Weatherstripping | W-22-BL x 17'-2" (5233mm) | BL |
| 1 | Door Sweep | W-24S-CA x 889mm | CA |
| 1 | Door Contact | N1178 DPDT | |
| 1 | Card Reader | Honeywell Card Reader - By Others | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Mini | |
| 1 | Junction Box | 4X4 Junction Box - By Others | |
| 1 | Wire Harness | UCA-W6W8P | |
| 1 | Wire Harness | UCA-W889 + 150mm W8P | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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Heading #087

1 Single door 398, CORRIDOR 397K TO MEETING/LUNCH 398

LH

Type: E/F3, 965 x 2135 x 45 - SC DR x HM FR - -

| | | | |
|---|----------------------|--|------|
| 3 | Standard Hinge | TA714 127 x 114 C26D | C26D |
| 1 | MELR Lockset | 56 RX-8204 WTJ C32D LH LC | C32D |
| 1 | LFIC Mortise Housing | Sargent LFIC Mortise Housing c/w Plastic Core - To Later Detail | |
| 1 | Permanent Core | Permanent LFIC Core "0" Bitted w/ 2 Blank Keys - To Later Detail | |
| 1 | Keying | Keying through U of T Lock Shop | |
| 1 | Auto Operator | S4100 (Set to LE) Series Single (Pull Side Mount) 689 | 689 |
| 2 | Actuator | 6R3 630 | 630 |
| 1 | Kick Plate | GSH 80A C32D (250 x 925) TM B4E | C32D |
| 1 | Wall Door Stop | GSH 240 C26D (GC to Reinforce Wall for Wall Stop) | C26D |
| 1 | Door Contact | N1178 DPDT BRN | BRN |
| 1 | Salto Card Reader | WRDJ0A4B | |
| 1 | Controller | CU42E0US | |
| 1 | Power Supply | Central Power | |
| 1 | S.I.P. Box | B994 Standard | |
| 1 | Wire Harness | UCA-W192W8P | |
| 1 | Opening Schematic | Opening Schematic - To Later Detail | |



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PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. AVAILABLE INFORMATION AVAILABLE TO BIDDERS *

- 1.2.1. Following Available Information is bound in Specifications appended to this Section.
- 1.2.2. Following Reports are for information only. Neither Consultant nor Owner assumes any liability for items extracted from Reports.
- 1.2.3. Available Information forms part of Contract Documents.

1.3. REPORTS *

- 1.3.1. Geotechnical Investigation Reports:
 - 1.3.1.1. A copy of a geotechnical investigation reports and related letter, prepared by Owner's consultant for the Place of the Work are bound herein. Refer to following:
 - 1.3.1.1.1. "214 College Street, Toronto, Ontario Koffler Student Services Centre - Proposed Renovation (P143-19-100) Geotechnical Investigation", dated November 5, 2020, prepared by EXP Services Inc.
 - 1.3.1.1.2. Letter "Re: Interior Investigation: Boreholes/Test Pit/ Compressive Strength of Existing Column Koffler Student Services Centre -Proposed Renovation (P143-19-100) 214 College Street, Toronto, Ontario" dated March 5, 2021, prepared by EXP Services Inc.
 - 1.3.1.1.3. "Koffler Student Services Centre, 214 College Street Toronto, Ontario M5T 3A1 Foundation Drainage Report", dated August 16, 2021, prepared by EXP Services Inc.
 - 1.3.1.2. Geotechnical investigation documents are not guaranteed to be representative of actual subsurface conditions.
 - 1.3.1.3. When calculating soil volumes for bidding purposes, assume flat plane geometric layers formed by straight lines drawn between subgrade elevations, for each material identified in soils report.
- 1.3.2. Heritage Investigation Report:
 - 1.3.2.1. A copy of a heritage investigation report prepared by Owner's consultant for the Place of the Work is bound herein. Refer to following:
 - 1.3.2.1.1. "Heritage Impact Assessment Koffler Health and Wellness Centre Renovation and Addition", dated November 15, 2024, prepared by EVOQ Architecture Inc.
- 1.3.3. Acoustics Investigation Reports:
 - 1.3.3.1. A copy of acoustics investigation reports prepared by the Owner's consultant for the Place of the Work are bound herein. Refer to following:
 - 1.3.3.1.1. "Health & Wellness Centre at Koffler Renovation Toronto, ON 24011017 Acoustic, Noise and Vibration Control Basis of Design Report", dated January 9, 2025, prepared by Thornton Tomasetti.

- 1.3.4. Code Report:
 - 1.3.4.1. A copy of a code report prepared by Owner's consultant for the Place of the Work is bound herein. Refer to following:
 - 1.3.4.1.1. "Fire Protection and Life Safety Building Code Outline Report University of Toronto – Koffler Health & Wellness Centre Interior Renovations 214 College St. Toronto, ON", dated October 30, 2024, prepared by LMDG.
- 1.3.5. Sprayed Fire-Resistive Material Memo:
 - 1.3.5.1. A copy of a sprayed fire-resistive material memo, prepared by the Owner's consultant for the Place of the Work is bound herein. Refer to following:
 - 1.3.5.1.1. Memo: "Re: UofT - Koffler Health and Wellness, 214 College Street, Toronto ON", dated August 19, 2024, prepared by Cafco Industries Inc.
- 1.3.6. Signage and Wayfinding Program:
 - 1.3.6.1. A copy of a signage and wayfinding program prepared by Owner's consultant for the Place of the Work is bound herein. Refer to following:
 - 1.3.6.1.1. "Signage & Wayfinding Program UofT - Health & Wellness Centre", dated January 31, 2025, prepared by entro.
- 1.3.7. Submit a Base Bid Price which includes and accommodates work implied in, or reasonably inferable from, investigation documents. Owner's investigation consultant will be interpreter of documents. Consultant will be arbiter of a change to Construction Cost and/or Contract Time.

LEGEND

** - Documents provided by the Owner have been prefixed by an asterisk and are not included under, nor governed by, ENFORM Architects Inc.'s, seal.*

END OF SECTION



214 College Street, Toronto, Ontario

Koffler Student Services Centre -Proposed Renovation (P143-19-100)

Type of Document:

Geotechnical Investigation

Project Name:

Koffler Student Services Centre -Proposed Renovation (P143-19-100)
214 College Street, Toronto, Ontario

Project Number:

BRM-00607558- A0

Prepared By:

EXP Services Inc.
1595 Clark Boulevard, Brampton, ON L6T 4V1
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Date Submitted:

November 5, 2020

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1. Introduction

This report presents the results of a geotechnical investigation carried out for a proposed renovation project at 214 College Street in Toronto, Ontario. The work was authorized by University of Toronto (U of T).

The project site with municipal address 214 College street is located on the north side of College Street and west side of St George Street within the St. George Campus of University of Toronto.

It is understood that a two-storey addition (approximately 20m X 21m in size) has been proposed within northern portion of the Koffler Student Services Centre building on top of existing single storey portion of the building.

As per scope of work, three (3) boreholes, designated as BH1 to BH3, were drilled for subject geotechnical investigation. Since interior boreholes were not allowed, it should be noted that boreholes were positioned within close possible exterior area of the proposed two-storey addition. In two of the three boreholes – BH2 and BH3 monitoring wells were installed to determine groundwater level.

The purpose of the current investigation was to determine the subsurface conditions at the subject site by drilling a limited number of sampled boreholes and based on the factual borehole data, to provide geotechnical engineering guidelines for the design and construction of the proposed development. Specifically, recommendations and / or comments regarding foundation type, allowable bearing capacities, excavation and groundwater control, shoring, permanent drainage requirements, lateral earth pressure, unheated garages, floor slab construction, elevator pits and earthquake considerations were to be provided. Since the boreholes are not advanced within the footprint of the proposed addition, the findings are to be assumed to be representative as to what is present within the proposed renovation areas.

The comments and recommendations given in this report are based on the terms of reference presented above and on the assumption that design will be in accordance with applicable codes and standards. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or the requirement of additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description and History

The project site with municipal address 214 College street is located on the north side of College Street and west side of St George Street within the St. George Campus of University of Toronto.

The project site is developed with one 1 to 3 storey building with partial basement level which is known "Koffler Student Services Centre (Koffler Building)".

It is understood that a two-storey addition (approximately 20m X 21m in size) has been proposed within northern portion of the Koffler Student Services Centre building on top of existing single storeyed portion of the building.

The area of the proposed addition is surrounded by 3-storeys to the existing Koffler Building on the north, south and east sides. To the west side, area of the proposed addition abuts, existing single storey portion of the Koffler Building, followed by Bahen Centre for Information Technology building which has 4 levels of underground parking structure is located.

The subject area with the proposed addition has a partial basement, with the lowest floor level approximately 2.5 m below the existing main level floor slab grade.

Based on the information provided to EXP by U of T, the Koffler Building was constructed in four major phases in years 1906, 1928, 1959 and 1984. The area with the proposed addition was constructed in year 1928.

3. Investigation Procedures - Boreholes

For the current investigation, a total of three (3) boreholes (BH1 to BH3) were drilled to depths ranged from of 3.7 to 8.2 m below existing ground. The approximate borehole locations of the investigation are shown on the attached Borehole Location Plan (Drawing No. 1).

Monitoring wells were installed in Boreholes BH2 and BH3 to record depth to the groundwater table.

Drilling and sampling operations, carried out on October 9, 2020, were completed by a combination of auger and split-spoon techniques using track mounted equipment (GeoProbe 7822) owned and operated by a specialist contractor. Due to limited access at borehole BH3, a portable drilling equipment “Mini Beaver” was employed.

Prior to the commencement of drilling operations, public utility companies were contacted to provide service clearance for the borehole drilling. In addition, a private locator was employed to scan around each borehole location to minimize the risk of contacting any buried services during the drilling operations.

A representative of EXP was present throughout the fieldwork operation to monitor and direct the drilling and test pit operations, and to record information revealed. In the drilling operation, representative samples of the subsurface soils were recovered at regular intervals using conventional 50 mm O.D. split spoon sampling equipment driven in accordance with Standard Penetration Test procedures (ASTM D1586). Laboratory testing included moisture content and unit weight determinations on selected samples.

The number of boreholes and their locations were specified by the client. The locations and ground surface elevation of the boreholes were determined in the field by EXP. The ground surface elevation of each borehole was referenced to the front concrete porch located at the east side entrance; with its geodetic elevation of 105.7 m taken from the survey drawing provided to EXP by U of T (dated August 16, 1999) .

The detail soil profiles encountered in each borehole and the results of laboratory moisture content determinations are indicated on the attached borehole logs. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change.

4. Subsurface Conditions

The detailed soil profiles encountered in each borehole and the results of geotechnical laboratory testing are indicated on the attached borehole logs (Drawing Nos. 2 to 4). It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change.

Notes on Sample Description (Drawing No. 1A) preceding the borehole logs form an integral part of and should be read in conjunction with this report.

The following is a brief description of the subsurface conditions encountered during the current investigation.

4.1 Soil Conditions

Concrete Slab/ Asphaltic Concrete

The surficial cover at Boreholes BH1 and BH2 comprised of ~150 mm thick concrete slab. In Borehole BH3, asphaltic concrete ~ 65 mm in thickness was encountered at the surface.

Fill

Fill materials were encountered underneath the concrete slab/ asphaltic concrete in all three boreholes.

The upper portion of the fill in Boreholes BH 1 and BH2 was generally sand and gravel as granular base under the concrete slab. The lower portion of the fill in Boreholes BH 1 and BH2 was sandy silt to silty sand with minor organic inclusion and/or brick fragments. The fill directly below the asphaltic concrete in Borehole BH3 consists of clayey silt with some sand seams and minor brick inclusions. The fill materials were generally brown in colour. Some black staining was noted in the fill samples from BH2 and BH3.

The fill layer extended to depths ranged from approximately 0.6 to 1.5 m below the existing ground surface. The fill materials were in a loose to compact state of compaction based on SPT N-values ranging from 8 and 19 blows/0.3 m. The moisture contents within these fills were found to range from 10 to 20 percent of dry weight, indicating a moist condition.

Clayey Silt Till

A native clayey silt till deposit underlying the fill was encountered in all boreholes. The clayey silt till contains trace to some sand and trace gravel and was brown to grey in colour. The deposit existed in very stiff to hard state based on the SPT N-values obtained in this stratum which varied from 16 to 90 blows/0.3 m. The recorded natural moisture contents ranging from about 7 to 22 percent of dry weight.

This deposit extended to depths of 2.3 to 3.0 m below existing grade.

Sandy Silt

A sandy silt deposit underlying the clayey silt till deposit was encountered in all three boreholes. The brown to grey sandy silt existed in a very dense state with N-values ranging from 53 to 95 blows/0.3 m. The sand silt contains trace clayey pockets. This deposit was moist with some wet seams. A wet silty sand layer was noted at depth between 4.5 and 5.0 m below existing grade in Borehole BH1. The natural moisture contents for the samples from sandy silt deposit were recorded as ranging from about 11 to 16 percent of dry weight.

This deposit extended to depths of 3.7 to 5.7 m below existing grade. Boreholes BH3 was terminated in the sandy silt deposit.

Sandy Silt Till

A sandy silt till deposit was encountered underlying the sandy silt deposit in Boreholes BH1 and BH2. The sandy silt till deposit contains trace gravel and existed in dense to very dense state with N-values ranging from 37 to 61 blows/0.3 m. A silt layer with wet seams was noted in Borehole BH2 near the termination depth of the boreholes. The natural moisture contents were recorded as ranging from about 8 to 15 percent of dry weight.

The boreholes BH1 and BH2 were terminated in this deposit at a depth approximately 8.2 m below existing grade.

4.2 Groundwater Conditions

Groundwater conditions were assessed by taking readings in open holes during the course of the fieldwork and in monitoring wells installed in the boreholes. Short-term observations in the monitoring wells are recorded on the attached borehole logs and summarized in Table 1 below.

Table 1: Observed Groundwater Levels

| Borehole No. | Well Installation Date | Depth (m) | Date of Groundwater Level Measurement | Depth to Groundwater Level Below Existing Grade /Geodetic water level (m) |
|--------------|------------------------|-----------|---------------------------------------|---|
| 2 | October 9, 2020 | 7.7 | October 14, 2020 | 5.4 / 99.62 |
| 3 | October 9, 2020 | 3.1 | October 14, 2020 | Dry |

These observations may not represent the long-term groundwater table at the site, due to the short period of observation. In the long term, it should be noted that the groundwater levels can vary seasonally and are subject to fluctuations in response to major weather events.

5. Geotechnical Recommendations

It is understood that a two-storey addition (approximately 20m X 21m in size) has been proposed within northern portion of the Koffler Student Services Centre building on top of existing single storeyed portion of the building. The area of the proposed addition is surrounded by 3-storeys of the existing Koffler Building on the north, south and east sides. To the west side, area of the proposed addition abuts, existing single storey portion of the Koffler Building. Further to the east, Bahen Centre for Information Technology building which has 4 levels of underground parking structure is located.

The subject area with the proposed addition has a partial basement, with the lowest floor level approximately 2.5 m below the existing main level floor slab grade. Based on the ground floor elevation of 105.7 m, the basement floor is near Elevation 103.2 m and the existing footings are founded near Elevation 102.2 m.

Based on the Foundation Plan dated October 1928 provided to EXP by U of T, the subject area of the proposed addition is currently supported by combination of wall and column footings (conventional strip and spread footings). The design bearing pressure for the existing footings is unknown.

5.1 Foundations Considerations

It is understood that the plan to provide foundation support to the proposed two-storey additions will be via enlargement of the existing wall and /or column footings in combination with installation of micro piles under each existing footing. Based on the information obtained in the three boreholes drilled nearby, if the soil conditions are similar, it would be possible to enlarge the footings to support the additional loading from the proposed addition. The recommended SLS geotechnical reaction and ULS factored geotechnical resistance derived from SPT N-values are summarized in following Table 2.

**Table 2: Highest Founding Depths / Elevations and Allowable Bearing Pressures
for New Spread and Strip Footings**

| Borehole No. | Highest Founding Depth / Elevation (m) | Bearing Pressure SLS / ULS (kPa) | Soil Type |
|--------------|--|----------------------------------|------------------------------|
| 1 | 1.5 / 104.0 | 200 / 300 | Clayey silt till, very stiff |
| | 2.5 / 103.0 | 400/ 600 | Clayey silt till, hard |
| 2 | 1.5 / 103.5 | 200 / 300 | Clayey silt till, very stiff |
| | 2.5 / 103.0 | 400/ 600 | Clayey silt till, hard |
| 3 | 1.0 / 103.9 | 400 / 600 | Clayey silt till, hard |

Since the existing footings have undergone the settlements from the current loading, if new loads are placed on an enlarged footing, there would be further settlement of the existing column and wall footings. The engineer should determine if such additional settlement can be tolerated by the existing walls and columns. The settlements from the additional loads can be reduced by lowering the design bearing pressure on the supporting soil. The anticipated settlement can be assumed to be linear with the bearing pressure, i.e., at the maximum design pressure noted in the table, the anticipated maximum settlement is ~25 mm and if half of this bearing pressure is used, e.g., the settlement can be linearly interpolated to be ~12 mm.

Based on the soil conditions, the use of micropiles may not be required. If desired, micropiles can be installed in the hard clayey silt till and/or very dense sandy silt and dense sandy silt till below elev. 102.5 m (approximately 3.0 m below the finish floor level) to carry the additional load from the added storeys. The micro piles foundation should be designed and installed by a specialist contractor. A design load test should be carried out to confirm the design capacity. As per the building code requirements, all deep foundations should be monitored on a full time basis.

5.2 Foundations General

Footings/micro piles placed at different elevations should be located such that higher footing is set below a line drawn up at 10 Horizontal to 7 Vertical from the near edge of the lower footing/micro pile. This concept should also be applied to excavations for new foundations in relation to existing footings or underground services. Where possible, enlarged footings should be placed at the same elevation as the existing footings.

The total settlement of well designed and constructed new footings in accordance with the above recommendations due to recompression of the soil, are expected to be less than 25 mm.

The recommended bearing capacities have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, it should be appreciated that modifications to bearing levels may be required if unforeseen subsoil conditions are revealed after the excavation is exposed to full view or if final design decisions differ from those assumed in this report. For this reason, this office should be retained to review final foundation drawings and to provide field inspections during the construction stage.

5.3 Excavation and Groundwater Control

Excavation will be limited to the area around the existing footings for enlargement of the footings. Being interior and due to limited access, excavation may have to be carried out utilizing portable excavation equipment which may be less productive.

All excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). The soil encountered at this site can be classified as follows:

- Fill: Type 3
- Clayey Silt till: Type 3
- Sandy Silt: Type 3

Based on the groundwater reading from the monitoring well in Borehole BH2, the groundwater table is at elevation ~99.6 m (~ 6.0 m below the finished floor of Koffler building which is at 105.7 m). No excavation below water table will be required for the subject construction.

5.4 Backfill Considerations

Backfill used to satisfy underfloor slab requirements, in footings and service trenches, etc., should be compactible fill, i.e., inorganic soil with its moisture content close to its optimum moisture content determined in the standard Proctor maximum dry density test. For ease of compaction and quality control in confined areas, sand fill, such as Ontario Provincial Standard Specifications (OPSS) 1010 Granular 'B' is recommended. The backfill should be placed in lifts not more than 200 mm thick in the loose state, each lift being compacted to at least 95 per cent Standard Proctor maximum dry density, before subsequent lifts are placed. The degree of compaction achieved in the field should be checked by in-place density tests.

5.5 Floor Slabs and Underfloor Drainage

In order to facilitate the new footing construction or enlarging the existing footings, it is likely that the existing floor slab will be demolished. Normal slab on grade construction is considered feasible at the current basement level. Any existing underfloor drains, if present, should be reviewed and replaced if they are damaged or deteriorated. A 200 mm thick 19 mm clear stone moisture barrier is recommended to be placed below the new floor slab.

5.6 Earthquake Considerations

The recommendations for the geotechnical aspects to determine the earthquake loading for design using the Ontario Building Code (OBC) 2012 are presented below.

Subsoil Conditions

The subsoil and groundwater information at this site have been examined in relation to Section 4.1.8.4 of the OBC. The subsoils at this subject site generally consist of general fill material, clayey silt till, sandy silt, sandy silt till. It is anticipated that the proposed structures will be founded on very stiff to hard clayey silt till or very dense sandy silt till.

Depth of Boreholes

Table 4.1.8.4.A Site Classification for Seismic Site Response of the OBC indicated that to determine the site classification, the average properties in the top 30 m (below the lowest basement level) are to be used. The deepest borehole advanced at this site was at about 8.2 m in depth below existing grade. Therefore, the site classification recommendation would be based on the available information from boreholes drilled in the vicinity of this site.

Site Classification

Based on the above assumptions, interpretations and the general understanding of soil conditions of the area, the seismic class for the proposed new footing construction at this site is Class C, as per the Table 4.1.8.4.A of the OBC. Accordingly, the foundation factors F_a and F_v can be obtained from Tables 4.1.8.4.B and 4.1.8.4.C of the OBC, respectively, for the design of the structure.

6. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an overall assessment of the geotechnical conditions of the subject property. The conclusions presented in this report reflect site conditions existing at the time of the investigation.

EXP Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

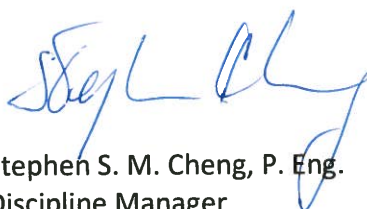
More specific information, with respect to the conditions between samples, or the lateral and vertical extent of materials, may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, EXP Services Inc. should be contacted to assess the situation and additional testing and reporting may be required. EXP Services Inc. has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours truly,
EXP Services Inc.

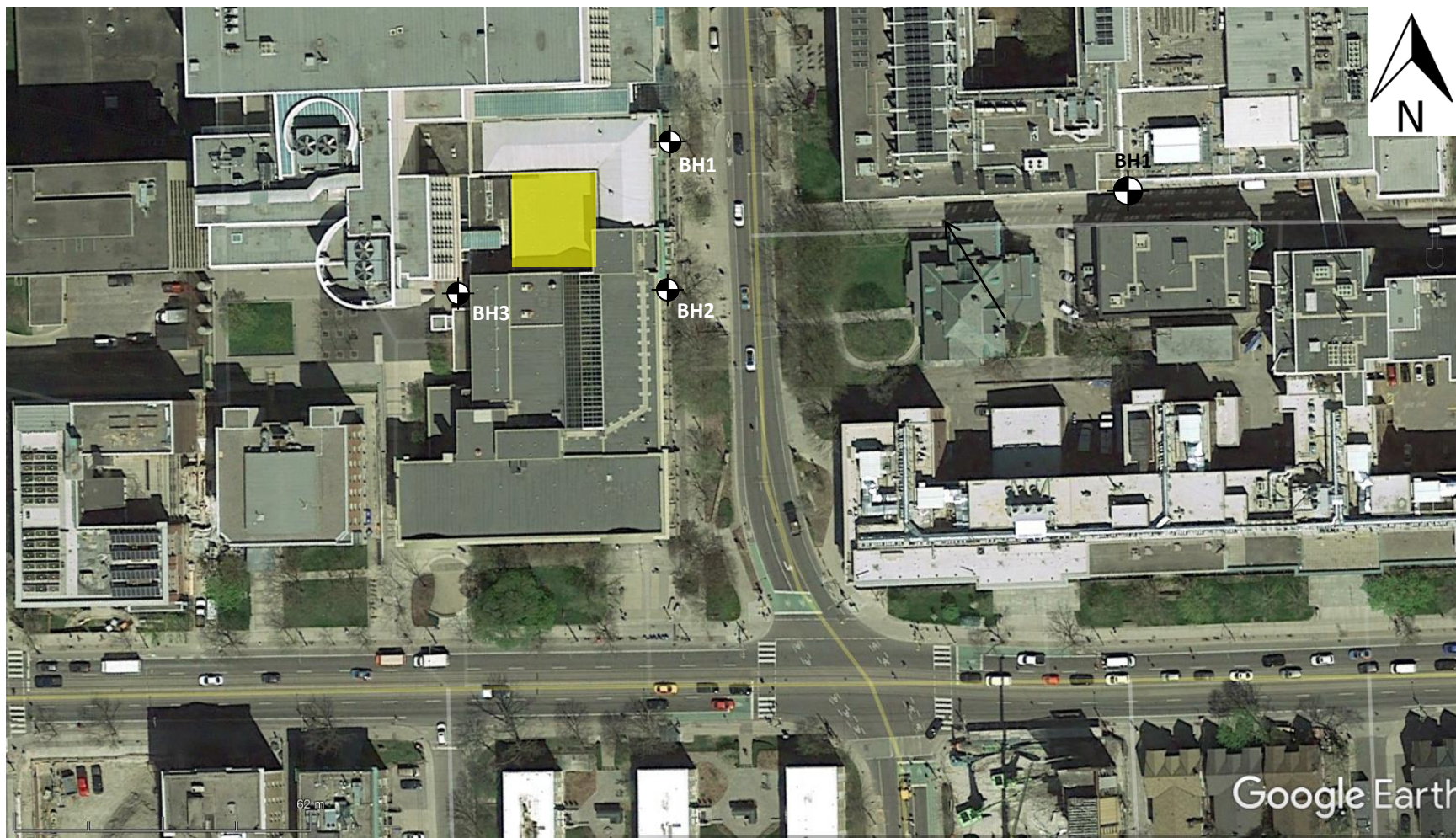
Aamna Arora, P. Eng.
Project Manager
Earth & Environmental




Stephen S. M. Cheng, P. Eng.
Discipline Manager
Geotechnical Division

Drawings

Borehole Location Plans
Notes on Sample Descriptions
Borehole Logs



Borehole Location



Proposed 2- storey Addition



exp Services Inc.
1595 Clark Boulevard
Brampton, Ontario
L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

SCALE: As Shown

DATE:
November 2020

DWN.: AA

CHKD.:

BOREHOLE LOCATION PLAN
Proposed Koffler Building Renovations
214 College Street
Toronto, Ontario

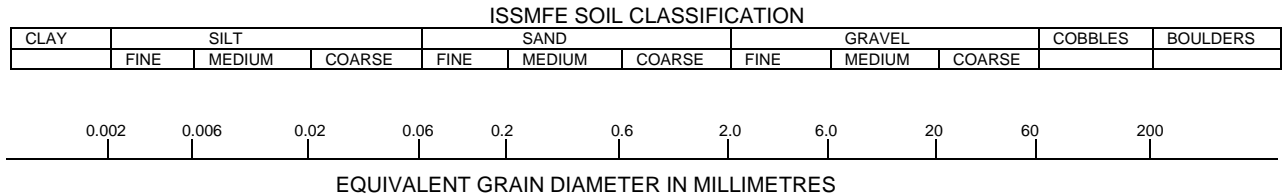
PROJECT NO.:
BRM-00607558-A0

DRAWING NO.: 1

Notes On Sample Descriptions

Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by exp Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.



| CLAY (PLASTIC) TO SILT (NONPLASTIC) | FINE | MEDIUM | CRS. | FINE | COARSE |
|--|------|--------|------|--------|--------|
| | SAND | | | GRAVEL | |

UNIFIED SOIL CLASSIFICATION

2. **Fill:** Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.
3. **Till:** The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH 1

Project No. BRM-00607558-A0

Drawing No. 2

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

Date Drilled: October 9, 2020

Auger Sample

SPT (N) Value

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

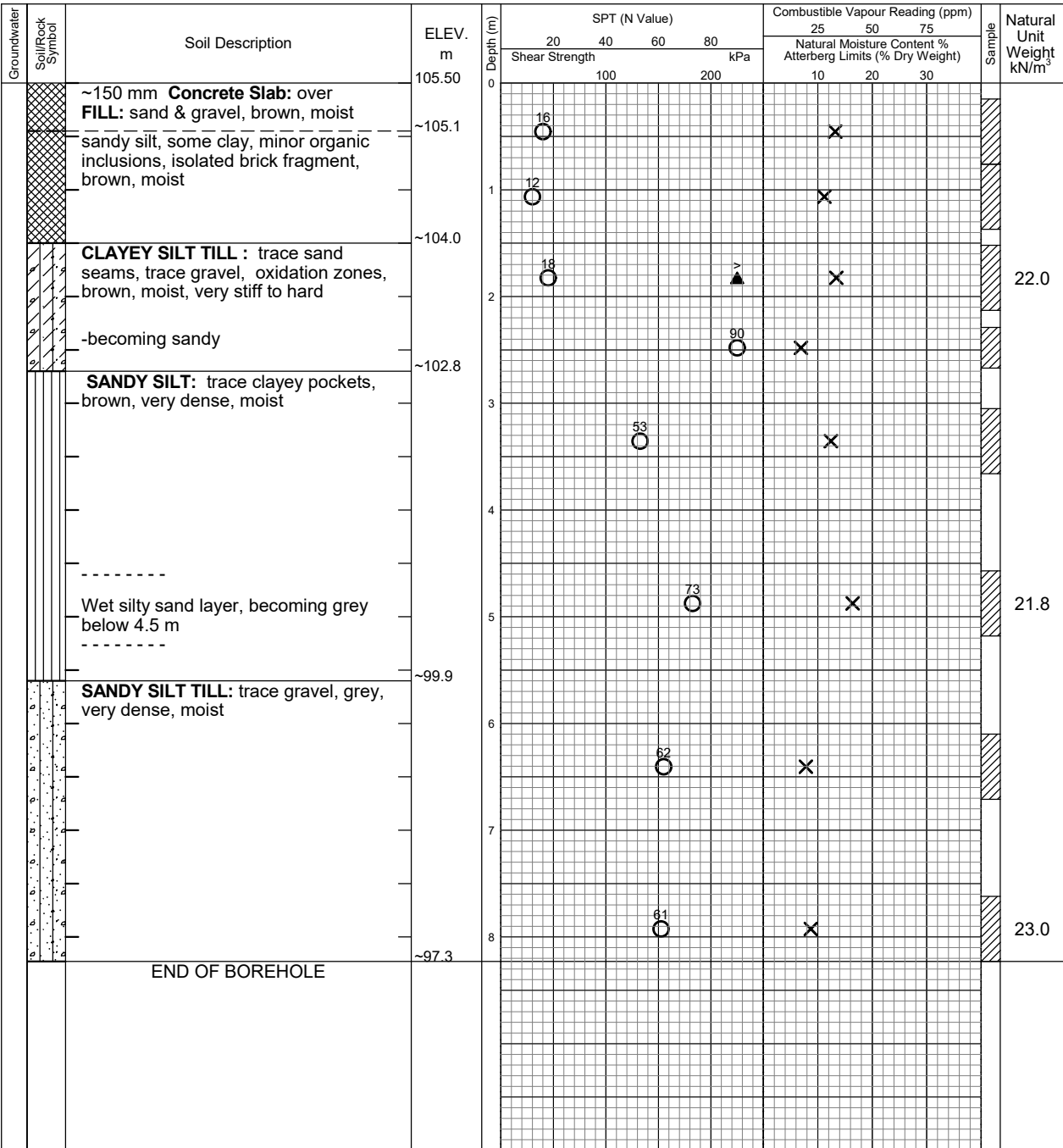
Undrained Triaxial at

% Strain at Failure

Penetrometer

Drill Type: Solid Stem Auger Geoprobe 7822 Truck Mount

Datum: Geodetic



LAGWGL02EXP 214 COLLEGE ST - BH LOGS.GPJ NEW.GDT 10/21/20

Notes:

- Borehole advanced to completion at ~8.2 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
- This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607558-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

Brampton

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---------------|-----------------|------------------|
| on completion | Dry | |

Log of Borehole BH 2

Project No. BRM-00607558-A0

Drawing No. 3

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

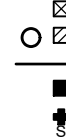
Date Drilled: October 9, 2020

Auger Sample

SPT (N) Value

Shelby Tube

Field Vane Test



Combustible Vapour Reading

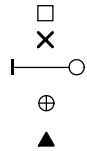
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

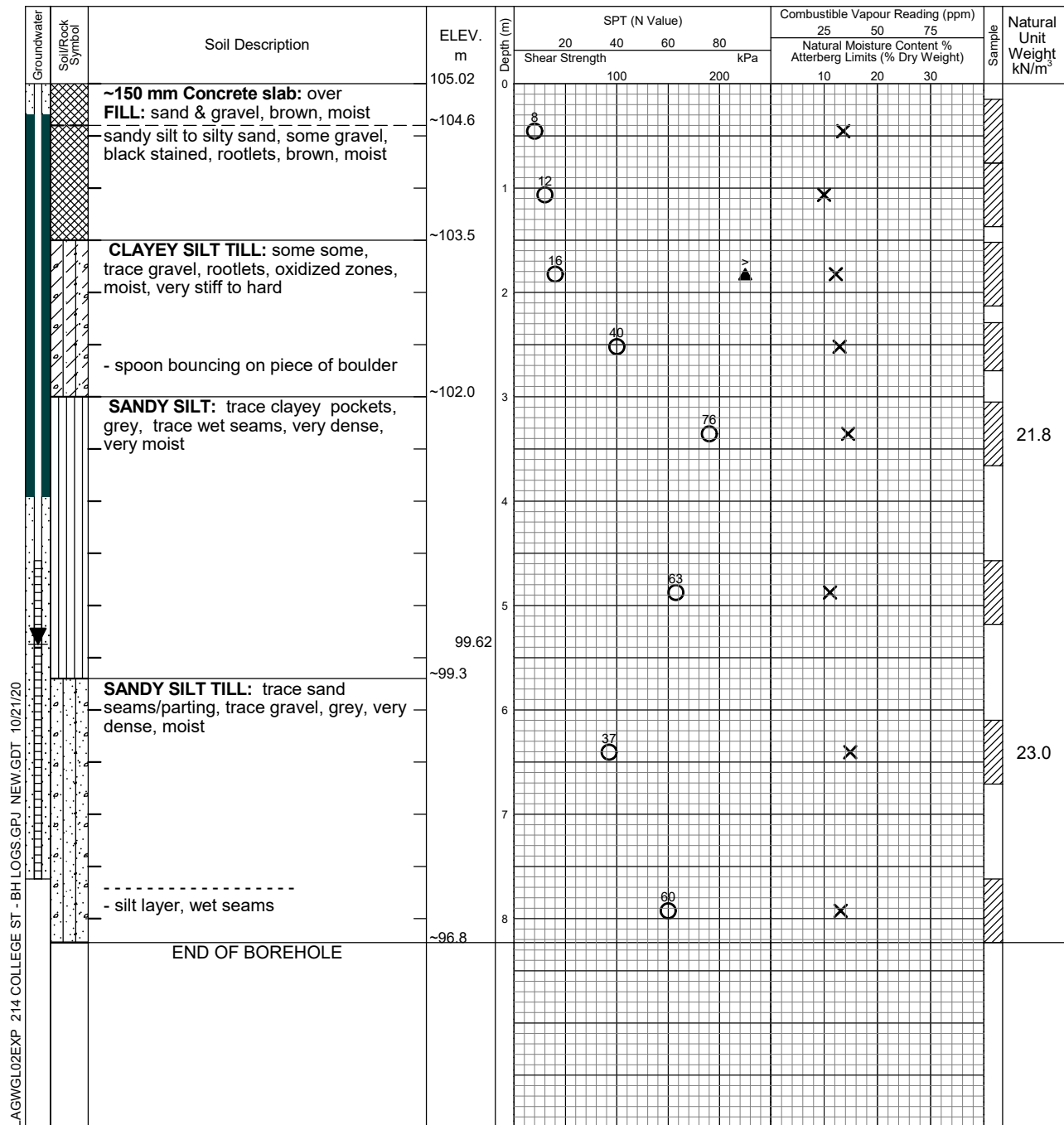
% Strain at Failure

Penetrometer



Drill Type: Solid Stem Auger Geoprobe 7822 Truck Mount

Datum: Geodetic



Notes:

- Borehole advanced to completion at ~8.2 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
- This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607558-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

Brampton

Elapsed Time

on completion
October 14, 2020

Water Level (m)

6.2
5.4

Hole Open to (m)

Log of Borehole BH 3

Project No. BRM-00607558-A0

Drawing No. 4

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

Date Drilled: October 9, 2020

Drill Type: Solid Stem Auger Little Beaver

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

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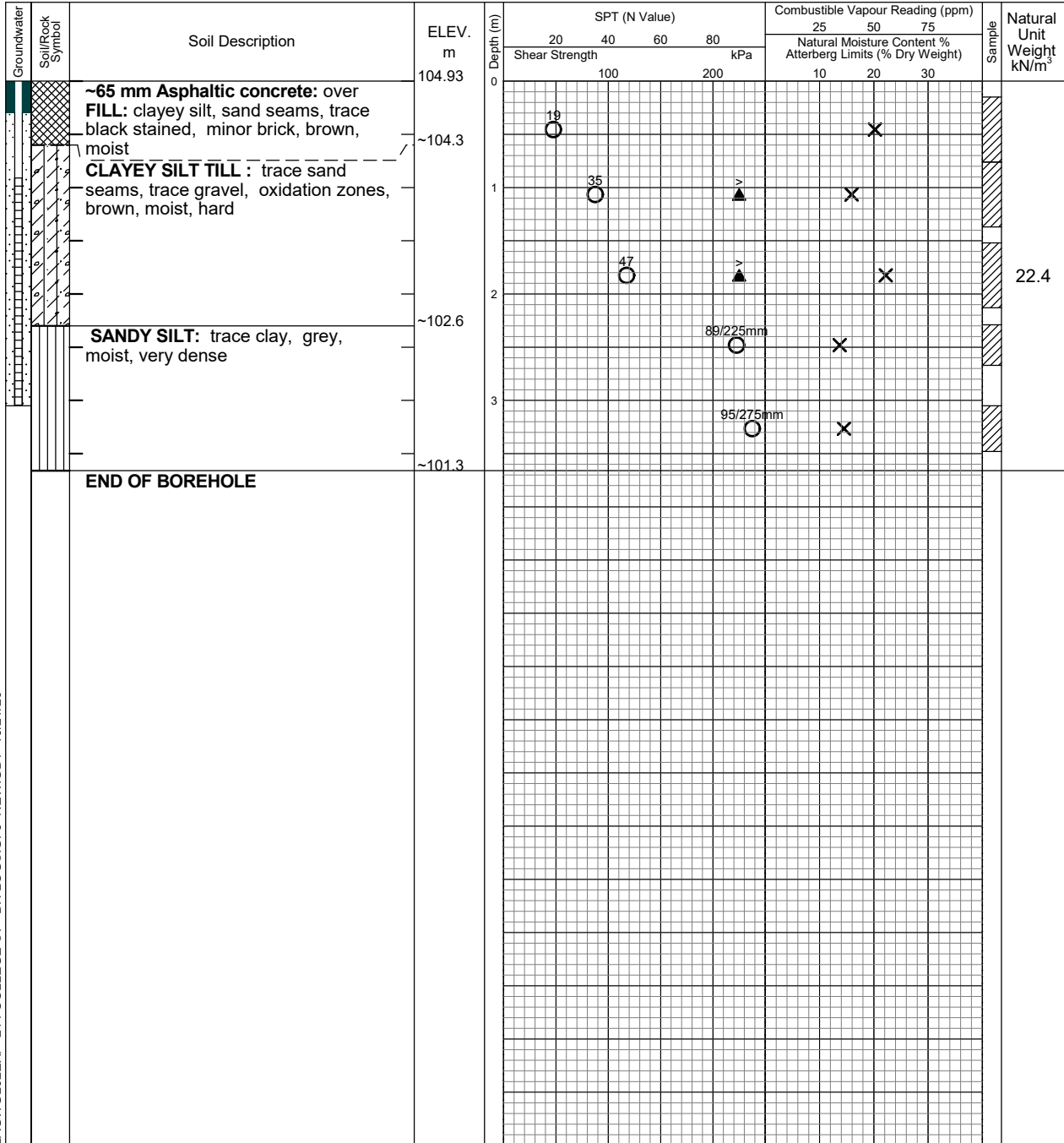
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Notes:

- Borehole advanced to completion at ~3.7 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
- This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607558-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

Elapsed Time

on completion
October 14, 2020

Water Level (m)

Dry
Dry

Hole Open to (m)

Brampton



EXP Services Inc.

1595 Clark Boulevard
Brampton, Ontario
L6T 4V1

Telephone: (905) 793-9800
Facsimile: (905) 793-0641

Reference: BRM-00607558-A0

February 12, 2021(Revised March 5, 2021)

University of Toronto
University Planning, Design & Construction
255 McCaul Street, 4th Floor
Toronto, Ontario
M5T 1W7

Attention: Ms. Melissa Lao

Email: melissa.lao@utoronto.ca

**Re: Interior Investigation: Boreholes/Test Pit/ Compressive Strength of Existing Column
Koffler Student Services Centre -Proposed Renovation (P143-19-100)
214 College Street, Toronto, Ontario**

1 Introduction

This letter report presents the findings from our interior investigation carried out at the above captioned project site. It is understood that a two-storey addition (approximately 20m X 21m in size) has been proposed within northern portion of the Koffler Student Services Centre building on top of existing single storey portion of the building. The area of the proposed addition is surrounded by 3-storeys to the existing Koffler Building on the north, south and east sides. To the west side, the area of the proposed addition abuts an existing single storey portion of the Koffler Building and followed by Bahen Centre for Information Technology building which has 4 levels of underground parking.

The subject area with the proposed addition has a partial basement, with the lowest floor level approximately 2.5 m below the existing main level floor slab grade.

Previously, three (3) exterior boreholes designated as BH1 to BH3 were drilled as part of geotechnical investigation for the subject project. The findings from the exterior boreholes are presented in our geotechnical report dated November 5, 2020.

2 Scope of Work

Our scope of work under current investigation included following items:

- Advance two (2) interior boreholes within the area of proposed two-storey addition to confirm the allowable soil bearing capacity.
- Advance one test pit within the partial basement to expose the existing footings.
- Retrieve cores from two existing concrete columns selected by the client to carry out compressive strength testing.

3 Fieldwork

Locations for the Boreholes/Testpit/Concrete Cores were selected in consultation with the client. A location plan showing location of the Boreholes/Testpit/Concrete Cores is included as Drawing 1.

Prior to any excavation work, mandatory public locates were obtained by calling Ontario-1- call. A private contractor was retained to scan the investigation areas for any buried private utilities as well carried out Ground penetration Radar (GPR) scan using hand held concrete scanner to locate rebar location.

The findings from our current interior investigation are summarized in the following paragraphs.

3.1 Interior Boreholes- BH101 and BH102

Two interior boreholes BH101 and BH102 were advanced for the current investigation. Drilling and sampling operations, carried out on January 29, 2021, were completed by portable sampling equipment owned and operated by a specialist contractor.

At borehole BH101, continuous samples of the subsurface soils were recovered using a split spoon sampling equipment "RAM Sounder" driven in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586). However, due to limited headroom available at borehole BH102, SPT could not be performed. At borehole BH102 continuous samples of the subsurface soils were recovered using another specialized portable sampling equipment "Poinjar System". The consistency /compactness of the samples from BH102 were determined using pocket penetrometer reading and /or effort by sampling equipment penetration.

The detail soil profiles encountered in each borehole and the results of laboratory moisture content determinations are indicated on the attached borehole logs in Appendix A.

The following is a brief description of the subsurface conditions encountered during the current investigation.

Floor Tile over Concrete Floor Slab

The surficial cover at Boreholes BH101 and BH102 comprised ~25 mm floor tile over ~125 mm concrete slab. The top finished carpet was removed prior to advancing boreholes.

Fill

Fill materials were encountered underneath the concrete slab in both boreholes. The fill layer extended to depths approximately 0.4 and 2.0 m below the existing ground surface (~Elev. 104.1 and 103.7 m) in Boreholes 102 and 101 respectively. The upper portion of the fill in Borehole BH101 and all fill layer BH102 comprised black sand & gravel mixed with coal/cinders and occasional concrete fragments. The lower portion of the fill in Borehole 101 comprised brown clayey silt with trace sand layers/pockets, trace gravel, mixed with construction debris- red and yellow brick fragments/pieces.

Clayey Silt Till

A native clayey silt till deposit underlying the fill was encountered in both boreholes. The clayey silt till contains trace to some sand and trace gravel and was brown in colour. This deposit extended to depths of 1.2 and 2.6 m below the existing ground surface (~Elev. 103.3 and 103.1 m) in Boreholes 102 and 101 respectively.

The deposit existed in hard state based on the SPT N-values / pocket penetrometer readings. The recorded natural moisture contents ranging from about 16 to 14 percent of dry weight.

Sandy Silt

A sandy silt deposit underlying the clayey silt till deposit was encountered in both boreholes. Both boreholes were terminated in sandy silt at depths 1.8 and 2.8m below the existing ground surface (~Elev. 102.7 and 102.9 m) in Boreholes 102 and 101 respectively due to equipment refusal on very dense material.

The natural moisture contents for the samples from sandy silt deposit were recorded as ranging from about 6 to 8 percent of dry weight.

Groundwater Conditions

Groundwater conditions were assessed by taking readings in open holes during the course of the fieldwork. Both boreholes were dry upon completion.

3.1.1 Foundations Considerations

It is understood that the plan to provide foundation support to the proposed two-storey additions will be via enlargement of the existing wall and /or column footings. Based on the information obtained in the two interior boreholes it would be possible to enlarge the footings to support the additional loading from the proposed addition.

The recommended SLS geotechnical reaction and ULS factored geotechnical resistance derived from SPT N-values are summarized in following Table.

Table 2: Highest Founding Depths / Elevations and Allowable Bearing Pressures
for New Spread and Strip Footings

| Borehole No. | Highest Founding Depth / Elevation (m) | Bearing Pressure SLS / ULS (kPa) | Soil Type |
|--------------|--|----------------------------------|------------------------|
| 101 | 2.0 / 103.7 | 400/ 600 | Clayey silt till, hard |
| 102 | 0.4 / 104.1 | 400 / 600 | Clayey silt till, hard |

3.2 Interior Test pit- TP1

Test Pit TP1 was advanced from inside the partial basement level. The test pit was selected at a location to be able to expose the existing footing. The purpose of the test pit was to determine the type, depth and size of the footing. The concrete floor slab (~175 mm thick) at the surface was first removed from the test pit location to facilitate hand digging.

Based on observation from the test pit, the concrete floor slab was underlain by about 175 mm thick layer of black gravel, coal, cinder followed by brown clayey silt fill with occasional brick fragments. Upon further digging, the footing was exposed and following measurements were taken from the test pit.

- Top of the footing was measured ~0.61 m below top of the floor slab
- Bottom of the footing was measured ~0.96 m below top of the floor slab (thickness of the footing ~ 355 mm)
- Projection of the footing ~555 mm

The founding material was assessed to be dense sandy silt with trace of clay and occasional gravel. At the bottom of the test pit, some groundwater seepage was noted likely from the wet seams within the sandy silt deposits. The test pit was kept opened, not backfilled as instructed by the client for further observation by other parties.

The photographs showing the conditions in the test pits are enclosed in Appendix B.

3.3 Concrete Cores from existing Column

As per the scope of work, concrete cores were retrieved from two selected existing concrete columns designated as Column #1 (gridline 12/B) and Column #2 (gridline 12/C) to carry out compressive strength tests.

The concrete coring was carried out utilizing a handheld drill motor equipment- Weka DK 16 which is typically used for such jobs. For more info about the equipment, please refer to online link www.diamondproducts.com/weka-hd16-hand-drill-motor.

Three cores from each column were retrieved and brought back to EXP's laboratory for compressive strength test. The core sizes were selected based on the position of rebars as indicated by scanning results. The cores were retrieved without touching the rebar.

The compressive strength test results and photos showing the concrete core locations as well as rebar locations based on GPR scanning results, are presented in Appendix C. It should be noted that the compressive strength is reported as "corrected compressive strength" which indicates that a correction factor has been applied. The correction factor is used when the length of the core is not exactly 2X the diameter. If the length is less than 2X the diameter, the tested strength has to be reduced by the correction factor to produce the actual strength, which is reported the corrected compressive strength.

For repairing the holes after retrieval of cores, high strength concrete mix (bagged product) from Quickrete – Product No. 1101-40 was used. The core holes were cleaned prior to filling them with the specified concrete mix.

We trust the content of this letter is satisfactory for your purposes. If you have further questions, please do not hesitate to contact our office.

Yours truly,

EXP Services Inc.

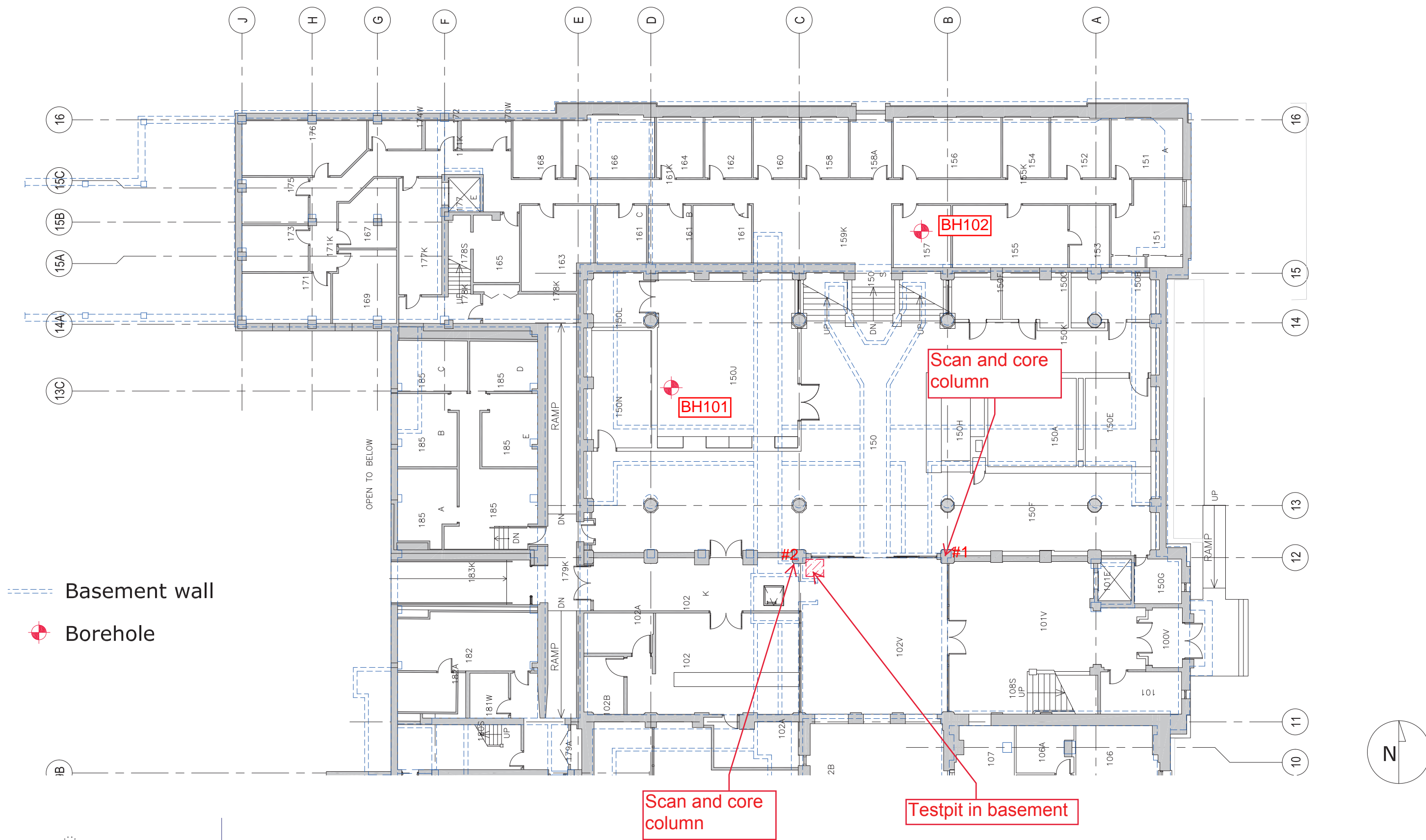


Aamna Arora, P. Eng.
Project Manager,
Geotechnical Division



Stephen S. M. Cheng, P. Eng.
Discipline Manager,
Geotechnical Division

Borehole / Test Pit/ Column Location Plan



Appendix A – Borehole Logs

Log of Borehole 101

Project No. BRM-00607558-A0

Drawing No. _____

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

Interior

Date Drilled: January 29, 2020

Auger Sample ☒

Combustible Vapour Reading ☐

SPT (N) Value ☒

Natural Moisture ☒

Drill Type: RAM Sounder (with SPT)

Dynamic Cone Test ☐

Plastic and Liquid Limit ☐

Datum: Geodetic

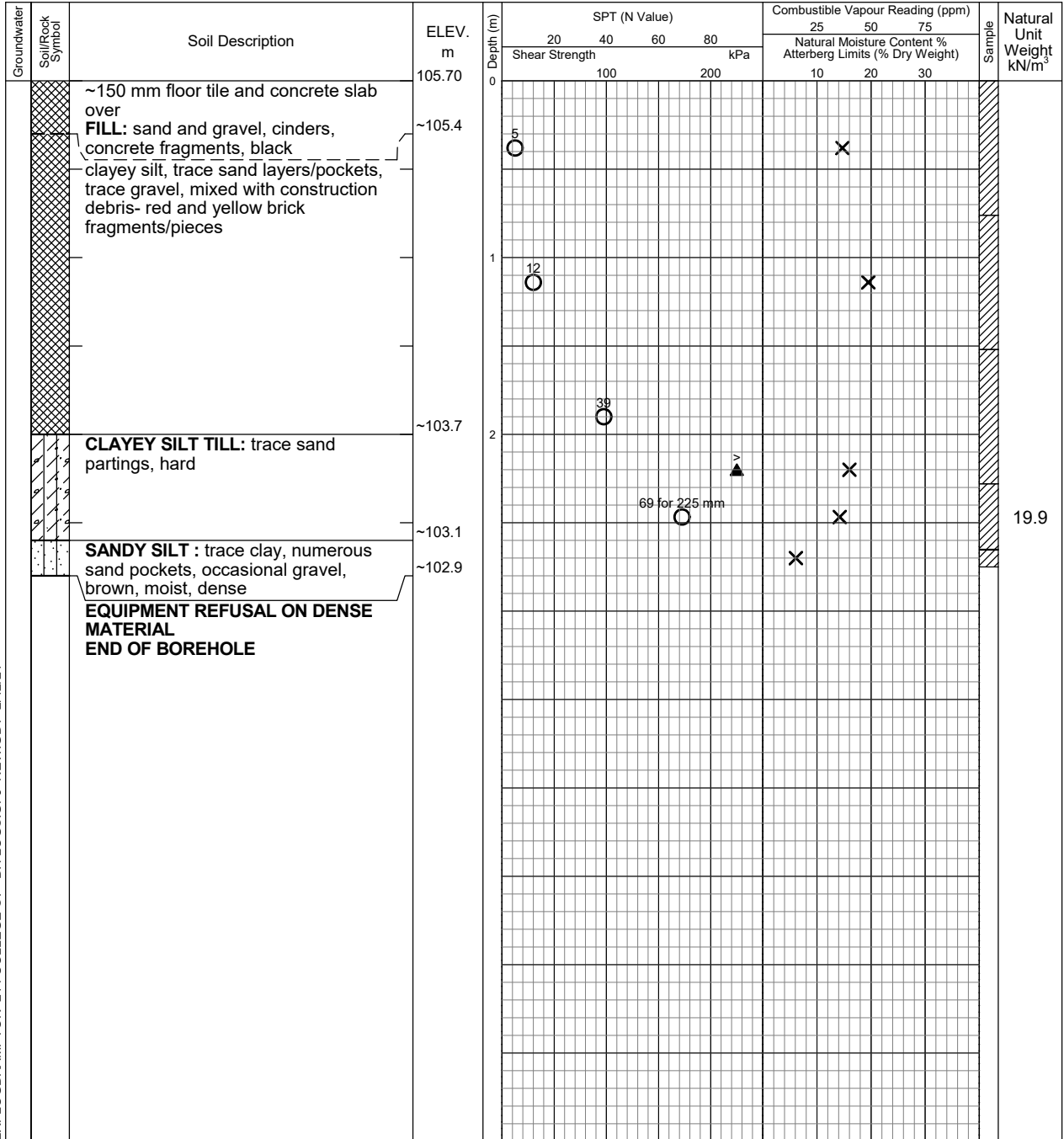
Shelby Tube ☐

Undrained Triaxial at ☐

Field Vane Test ☒

% Strain at Failure ☐

Penetrometer ☒



| Date | Water Level (m) | Hole Open to (m) |
|------|-----------------|------------------|
| | | |

Log of Borehole 102

Project No. BRM-00607558-A0

Drawing No. _____

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

Interior

Date Drilled: January 29, 2020

Auger Sample ☒

Combustible Vapour Reading ☐

SPT (N) Value ☐

Natural Moisture ☒

Drill Type: Poinjar (No SPT)

Dynamic Cone Test ☐

Plastic and Liquid Limit ☐

Datum: Geodetic

Shelby Tube ☐

Undrained Triaxial at ☐

Field Vane Test ☒

% Strain at Failure ☐

Penetrometer ☒

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) | | | | Combustible Vapour Reading (ppm) | | | Sample | Natural Unit Weight kN/m ³ |
|-------------|------------------|--|---------|-----------|--------------------|----|-----|----|---|----|----|--------|---------------------------------------|
| | | | | | 20 | 40 | 60 | 80 | 25 | 50 | 75 | | |
| | | | | | Shear Strength kPa | | | | Natural Moisture Content % Atterberg Limits (% Dry Weight) | | | | |
| | | | | | 100 | | 200 | | 10 | 20 | 30 | | |
| | | ~150 mm floor tile and concrete slab over FILL: sand and gravel, coal/cinder pieces, black | 104.48 | 0 | | | | | | | | | |
| | | CLAYEY SILT TILL: trace sand, trace gravel, brown, moist | ~104.1 | | | | | | | | | | |
| | | | | | | | | | | | | | 22.5 |
| | | | ~103.3 | 1 | | | | | | | | | |
| | | SANDY SILT : trace clay, occasional gravel, brown, moist, dense | | | | | | | | | | | 20.6 |
| | | | ~102.7 | | | | | | | | | | |
| | | EQUIPMENT REFUSAL ON VERY DENSE MATERIAL END OF BOREHOLE | | | | | | | | | | | |

EXPLOGBRAMPTON 214 COLLEGE ST - BH LOGS.GPJ NEW.GDT 2/12/21



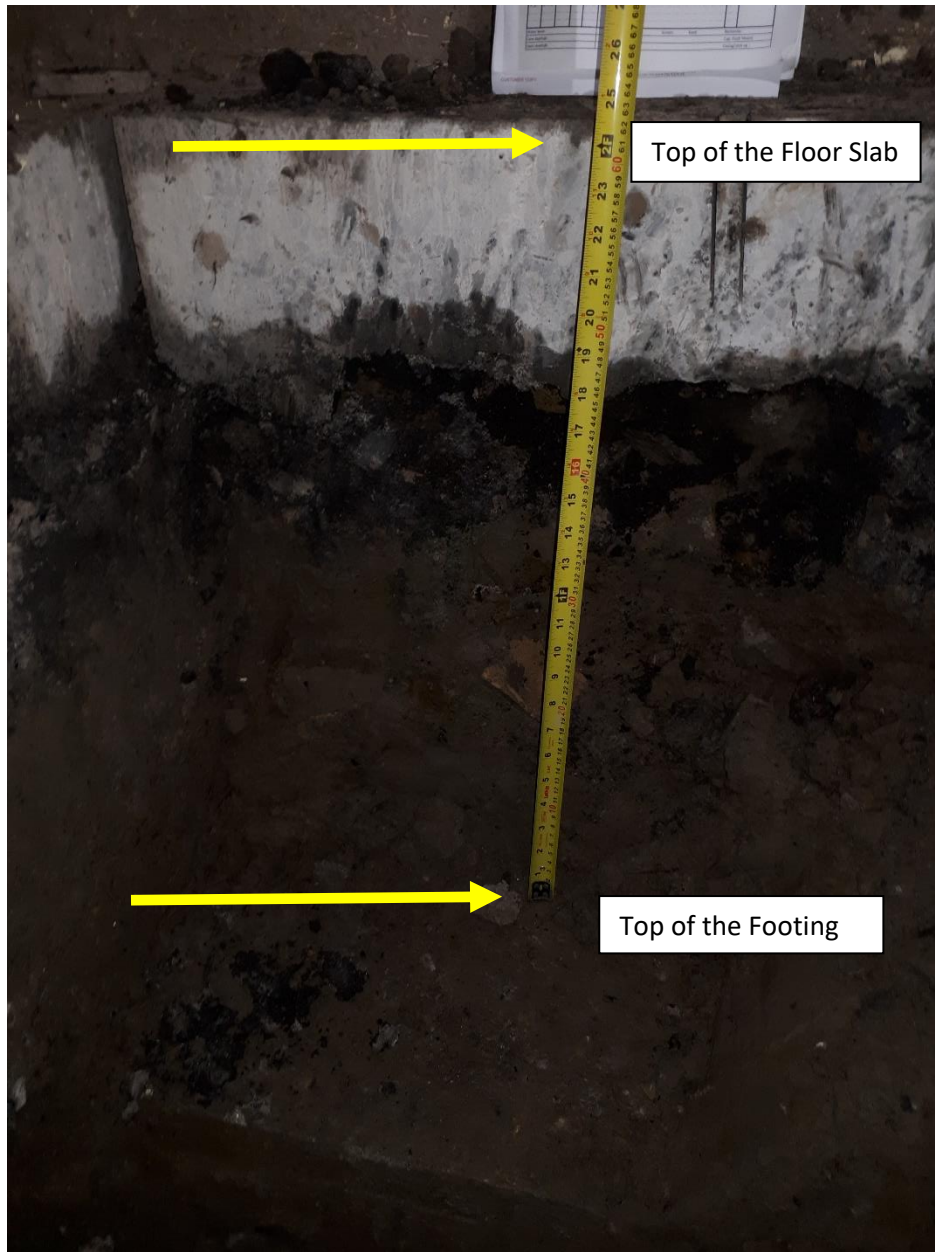
| Date | Water Level (m) | Hole Open to (m) |
|------|-----------------|------------------|
| | | |

Appendix B – Test Pit Photographs



Top of the Footing

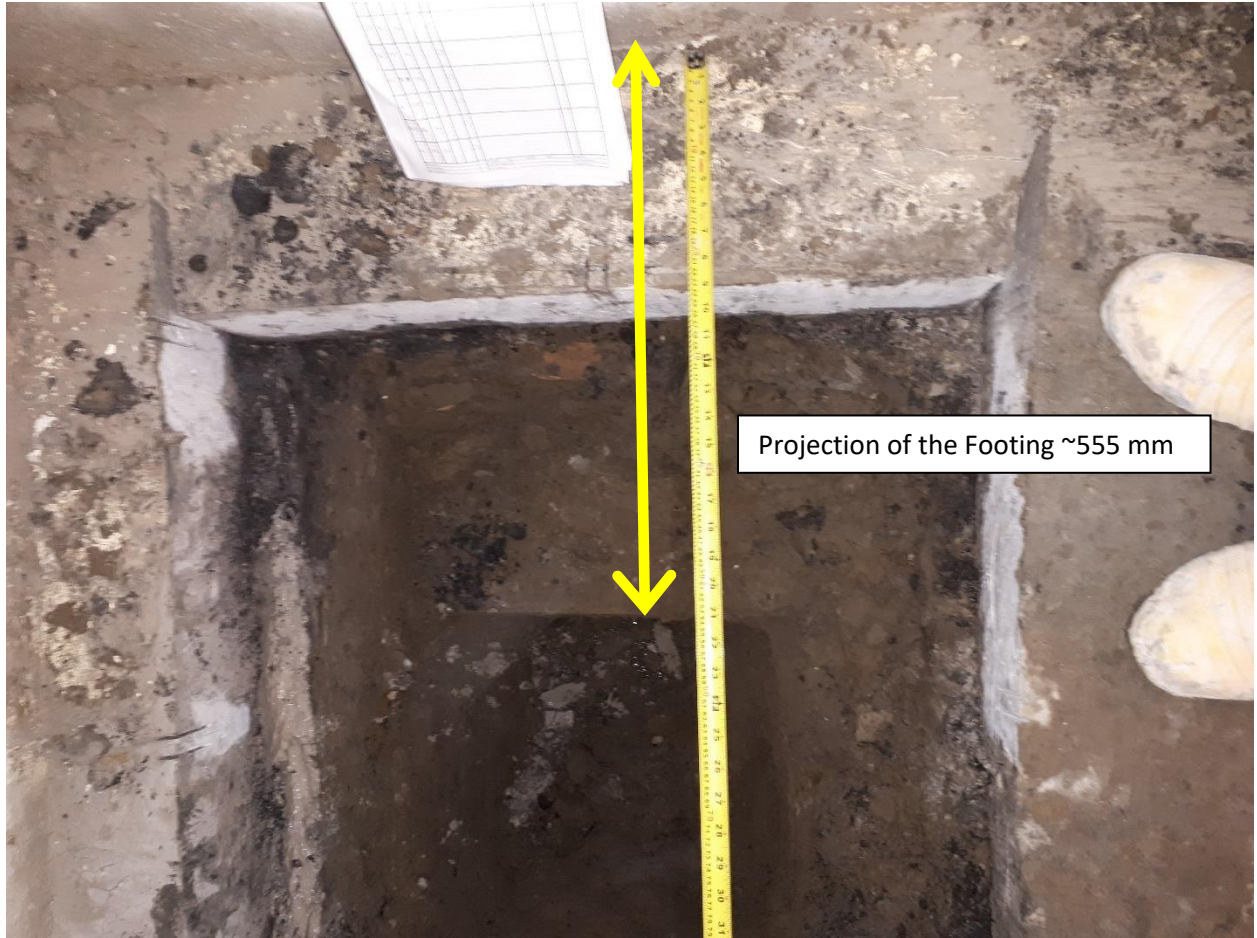
Bottom of the Footing



Top of the Floor Slab

Top of the Footing

Facing North



Plan view

Appendix C – Compressive Test Results

Photographs of Concrete Core Locations

Concrete Core Test

Project No.: BRM-00607558-A0 100

Project Name: N/A

| Core No. | 1A | 1B | 1C | 2A | 2B | 2C |
|---|------------------|--------|--------|-------|-------|-------|
| Location | Existing Cloumns | | | | | |
| Maximum Nominal Size Of Coarse Aggregate - (mm) | 19.0 | | | 19.0 | | |
| Date Cast | N/A | | | | | |
| Date Received | January 29, 2021 | | | | | |
| Date Cored | N/A | | | | | |
| Date Tested | February 1, 2021 | | | | | |
| Age at time of test (days) | N/A | | | | | |
| Length - (mm) | 138.0 | 134.0 | 132.0 | 98.0 | 94.0 | 90.0 |
| Average Diameter - (mm) | 69.0 | | | 49.0 | | |
| L/D Ratio | 2.00 | 1.94 | 1.91 | 2.00 | 1.92 | 1.84 |
| Correction Factor | 1.00 | 0.995 | 0.994 | 1.00 | 0.994 | 0.987 |
| Maximum Load (kN) | 130.99 | 174.88 | 155.15 | 91.44 | 63.44 | 81.06 |
| Corrected Compressive Strength - (MPa) | 35.0 | 46.5 | 41.2 | 48.5 | 33.4 | 42.4 |
| * Direction Of Loading | Perpendicular | | | | | |
| Moisture Condition At Time Of Test | Dry | | | | | |
| Specified Strength (MPa) | N/A | | | | | |
| Remarks | N/A | | | | | |

Tests in accordance with CSA A23.2-14C, unless otherwise indicated.

* NOTE: Relative to direction of compaction of concrete when placed

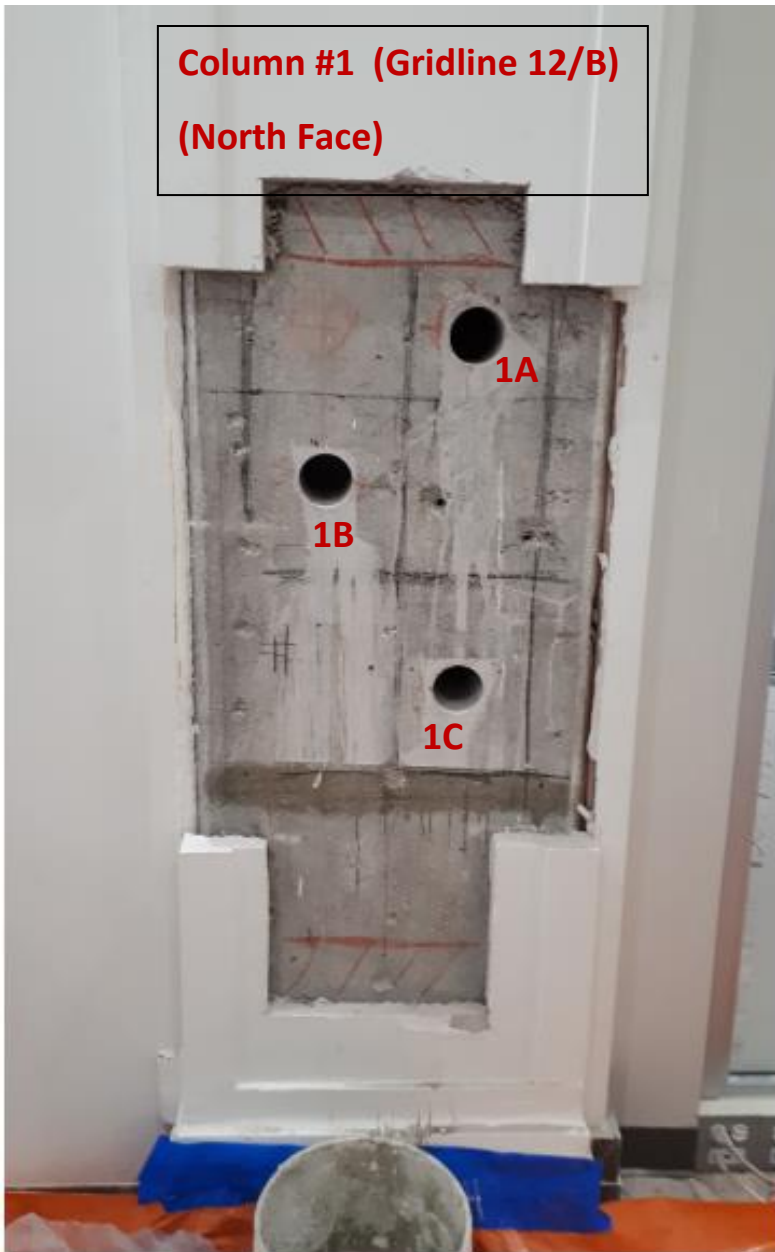


 Testing Laboratory Representative Signature
 Mark Kennedy, C.E.T.

January 27, 2021

 Date

Column #1 (Gridline 12/B)
(North Face)



Column # 2 (Gridline 12/C)
(South Face)



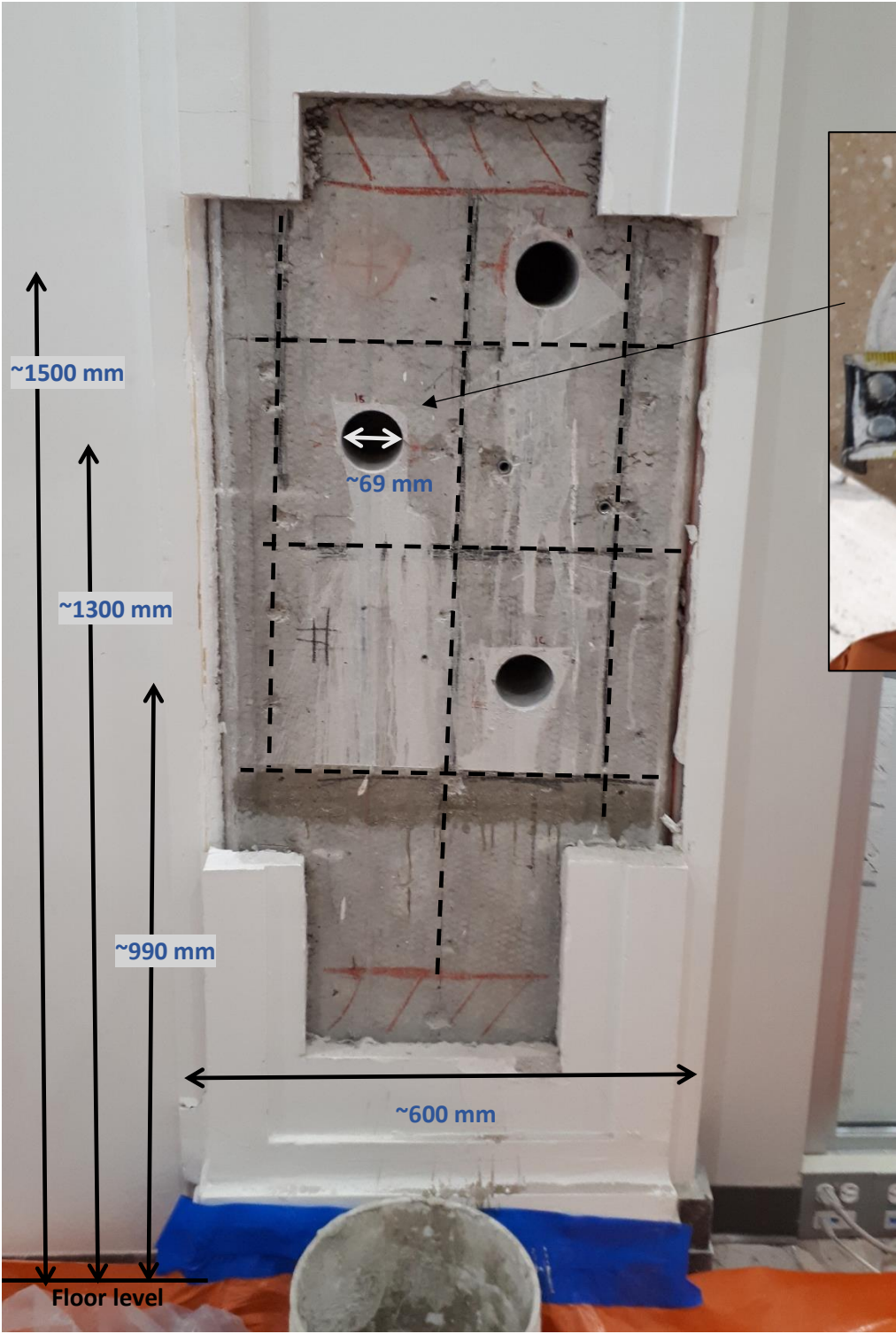
PHOTO 1- COLUMN #1 (GRIDLINE 12/B)



- - - -

Rebar Location as per GPR Scan

PHOTO 2 - COLUMN #1 (GRIDLINE 12/B)



----- Rebar Location as per GPR Scan

PHOTO 3 - COLUMN #2 (GRIDLINE 12/C)



- - - - -

Rebar Location as per GPR Scan

PHOTO 4 - COLUMN #2 (GRIDLINE 12/C)



----- Rebar Location as per GPR Scan



Koffler Student Services Centre, 214 College Street Toronto, Ontario

M5T 3A1

Foundation Drainage Report

Client:

University of Toronto

University Planning, Design & Construction

Operations and Real Estate Partnerships

255 McCaul STREET, 4th Floor

Toronto, Ontario M5T 1WZ1

Attention: Melissa Lao

Type of Document:

FINAL

Project Name:

Koffler Student Services Centre, 214 College Street, Toronto, Ontario

Project Number:

BRM-00607558-A0

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Date Submitted:

2021-08-16

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1 Introduction

1.1 Project Description

EXP Services Inc. (EXP) was retained by University of Toronto. to prepare a Foundation Drainage Report associated with the proposed development located at Koffler Student Services Centre, 214 College Street, Toronto, Ontario (hereinafter referred to as the 'Site'). The Site Location Plan is shown in Figure 1.

The Site with municipal address 214 College Street is located on the north side of College Street and west side of St George Street within the St. George Campus of University of Toronto.

The project site is developed with one 1- to 3-storey building with partial basement level which is known "Koffler Student Services Centre (Koffler Building)" with one (1) level of basement. It is understood that a two-storey addition (approximately 20m X 21m in size) has been proposed within northern portion of the Koffler Student Services Centre building on top of existing single storey portion of the building.

The purpose of the study is to address the City of Toronto (the 'City') comments on the site plan control application for Site. During previous correspondence, the City has requested a list of documents, including a hydrological review incorporating a foundation drainage assessment of the Site.

Currently the building complex consists of three (3) sump pumps to collect groundwater from the under-drain system and direct to three (3) separate discharge points (Appendix A).

These three sump pits are located as follows:

Sump 1: Room B8

Sump 2: Room B17

Sump 3: Room139

As per information provided by the University of Toronto, groundwater collected at sumps 1 and 2 is discharged to the sanitary and combined sewer system and groundwater collected at Sump 3 is discharged to the storm sewer system of the City of Toronto.

It is understood that no exterior modifications to existing built form, including the underground structure will be undertaken as part of the proposed development. The underground levels and foundation drainage system were not proposed to modify or alter (additional drains etc.) to cause any change to the existing foundation drainage volumes.

EXP conducted a Preliminary Geotechnical Investigation prior to this investigation. The pertinent information gathered from the noted investigations is utilized for this report.

This report presents the evaluation of the existing sub-drain discharge estimate based on existing foundation drainage analysis completed.

1.2 Project Objectives

The main objective of the hydrogeological review is to provide a foundation drainage assessment and groundwater quality for the existing building complex (3 sumps) to support discharge application to the City. The foundation drainage report includes a review of background hydrogeological information for the Site, as well as estimated foundation volumes.

1.3 Scope of Work

Since no modifications to the underground structures is planned, the hydrogeological assessment was simplified from the City of Toronto Terms and Reference for hydrogeological studies. As such, the scope of work included monitoring of existing sumps for a minimum of three (3) weeks, collecting groundwater samples for the City of Toronto Sewer By-Law parameters.

It was planned to collect three (3) groundwater samples since all three (3) sumps are directed to three (3) separate discharge points. However, due to inadequate quantity, a groundwater sample was not obtained from Sump 1 (Appendix B).

Electronic data loggers were installed in each of three (3) sumps to estimate the foundation drainage volumes from the Site.

This foundation drainage report includes a review of background hydrogeological review as well as estimated foundation discharge volumes.

A hydrological review summary form, as required by the City, is provided under separate cover.

The Foundation Drainage Report was prepared to address the City of Toronto comments on the site plan control application.

1.4 Review of Previous Reports

The following reports were reviewed as part of this Foundation Drainage Report:

- EXP Services Inc. (February 12, 2021), Interior Investigation, Koffler Student Services Centre – Proposed Renovation, 214 College Street, Toronto, ON, prepared for the University of Toronto.
- EXP Services Inc. (November 5, 2020), Koffler Student Services Centre – Proposed Renovation (P143-19-100), 214 College Street, Toronto, ON, prepared for the University of Toronto.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is within a physiographic region known as the Iroquois Plain. The physiographic landform is named Bevelled Till Plains. The South Slope lies to the north of the Iroquois Plain (Chapman & Putnam, 2007).

The Iroquois Plain was created along the shores of former Lake Iroquois, an ancient glacial lake. The noted Plain primarily consists of shallow water sandy deposits.

The topography of the Iroquois Plain is relatively flat with a gradual slope to the south, toward Lake Ontario.

2.1.2 Regional Geology and Hydrogeology

The surficial geology can be described as coarse textured (foreshore-basinal) glaciolacustrine deposits consisting of sand, gravel, minor silt and clay (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2.

Based on the available regional geology maps, the subsurface stratigraphy of the Site from top to bottom is summarized in Table 2-1 (TRCA, 2008 and Oak Ridge Moraine Groundwater Program, 2018). The overburden thickness is approximately 25 m.

Table 2-1: Summary of Subsurface Stratigraphy

| Stratigraphic Unit | General Description | Top Elevation of Stratigraphic Unit |
|---------------------------------|---|-------------------------------------|
| Sunnybrook Formation (Aquitard) | This lithologic unit was deposited near an ice sheet. It predominately consists of silt and clay. | 104 |
| Scarborough Formation (Aquifer) | This geology unit is interpreted as deposits of a fluvial-deltaic system fed by large braided melt-water rivers draining from an ice sheet. It consists of peat sand overlaying silt and clay deposits. | 101 |
| Georgian Bay Formation | Bedrock primarily consists of interbedded shale, limestone, dolostone and siltstone. It belongs to the Upper Ordovician, (Ministry of Northern Development and Mines, 2012). | 79 |

Regional groundwater across the area flows south, towards Lake Ontario (Oak Ridge Moraine Groundwater Program, 2018). Local deviation from the regional groundwater flow pattern may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

2.2 Site Setting

2.2.1 Site Topography

The Site is in an urban land use setting. The topography is considered relatively flat with a regional gradual southeasterly slope towards Lake Ontario.

The surface elevation of the Site ranges between approximately 104 and 105 meters above sea level (masl).

2.2.2 Local Surface Water Features

The Site is within the Lake Ontario watershed. No surface water features exist onsite. The nearest surface water feature is Lake Ontario, located approximately 2.4 kms south of the Site.

2.2.3 Local Geology and Hydrogeology

A summary of subsurface soil stratigraphy is provided in the following paragraphs. The soil descriptions are based on the geotechnical investigation report (EXP, February 2021) for the Site. They are summarized for the hydrogeological interpretations. As such, the information provided in this section shall not be used for construction design purposes.

The detailed soil profiles encountered in two (2) boreholes (BH1 and BH2) and the results of moisture content determinations are presented on the attached borehole logs (Appendix C). The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the Foundation Drainage Report and shall not be interpreted as exact planes of geological change.

The "Notes on Sample Description" preceding the borehole logs form an integral part of and should be read in conjunction with this report. The following is a brief description of the soil conditions encountered during the investigation.

Based on the results of the geotechnical investigation, the general subsurface soil stratigraphy consists of the following units from top to bottom:

Concrete Slab/ Asphaltic Concrete

The surficial cover at Boreholes BH1 and BH2 comprised of ~150 mm thick concrete slab. In Borehole BH3, asphaltic concrete ~65 mm in thickness was encountered at the surface.

Fill

Fill materials were encountered underneath the concrete slab/ asphaltic concrete in all three boreholes.

The upper portion of the fill in Boreholes BH 1 and BH2 was generally sand and gravel as granular base under the concrete slab. The lower portion of the fill in Boreholes BH 1 and BH2 was sandy silt to silty sand with minor organic inclusion and/or brick fragments. The fill directly below the asphaltic concrete in Borehole BH3 consists of clayey silt with some sand seams and minor brick inclusions. The fill materials were generally brown in colour. Some black staining was noted in the fill samples from BH2 and BH3.

The fill layer extended to depths ranged from approximately 0.6 to 1.5 m below the existing ground surface. The fill materials were in a loose to compact state of compaction based on SPT N-values ranging from 8 and 19 blows/0.3 m. The moisture contents within these fills were found to range from 10 to 20 percent of dry weight, indicating a moist condition.

Clayey Silt Till

A native clayey silt till deposit underlying the fill was encountered in all boreholes. The clayey silt till contains trace to some sand and trace gravel and was brown to grey in colour. The deposit existed in very stiff to hard state based on the SPT N-values obtained in this stratum which varied from 16 to 90 blows/0.3 m. The recorded natural moisture contents ranging from about 7 to 22 percent of dry weight.

This deposit extended to depths of 2.3 to 3.0 m below existing grade.

Sandy Silt

A sandy silt deposit underlying the clayey silt till deposit was encountered in all three boreholes. The brown to grey sandy silt existed in a very dense state with N-values ranging from 53 to 95 blows/0.3 m. The sand silt contains trace clayey pockets. This deposit was moist with some wet seams. A wet silty sand layer was noted at depth between 4.5 and 5.0 m below existing grade in Borehole BH1. The natural moisture contents for the samples from sandy silt deposit were recorded as ranging from about 11 to 16 percent of dry weight.

This deposit extended to depths of 3.7 to 5.7 m below existing grade. Boreholes BH3 was terminated in the sandy silt deposit.

Sandy Silt Till

A sandy silt till deposit was encountered underlying the sandy silt deposit in Boreholes BH1 and BH2. The sandy silt till deposit contains trace gravel and existed in dense to very dense state with N-values ranging from 37 to 61 blows/0.3 m. A silt layer with wet seams was noted in Borehole BH2 near the termination depth of the boreholes. The natural moisture contents were recorded as ranging from about 8 to 15 percent of dry weight.

The boreholes BH1 and BH2 were terminated in this deposit at a depth approximately 8.2 m below existing grade.

Borehole logs and location map are provided in Appendix C.

3 Methodology and Results

3.1 Water Level Monitoring

As part of the Geotechnical Investigation (EXP, February 2021) static water levels in the monitoring wells installed outside of the existing building were recorded in one (1) monitoring event on October 14, 2020. A summary of all static water level data as it relates to the elevation survey is given in Table 3-1 below.

Table 3-1: Summary of Groundwater Level Monitoring Results

| Borehole No. | Well Installation Date | Depth (mbgs) | Date of Groundwater Level Measurement | Depth to Groundwater Level Below Existing Grade /Geodetic water level (m/masl) |
|--------------|------------------------|--------------|---------------------------------------|--|
| BH 2 | October 9, 2020 | 7.7 | October 14, 2020 | 5.4 / 99.62 |
| BH 3 | October 9, 2020 | 3.1 | October 14, 2020 | Dry |

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

3.2 Water Quality Assessment

To assess the suitability for discharging pumped groundwater into the sewers owned by the City of Toronto during dewatering activities, two (2) groundwater sample were collected from Sumps 2 and 3 on May 25 and June 7, 2021, respectively. Collecting groundwater sample from Sump 1 was not possible due to inadequate quantity of water present in the sump during entire period of fieldwork from May 25 to June 25, 2021.

The sample was collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater sample was submitted to a CALA certified independent laboratory, Bureau Veritas Laboratory, in Mississauga, Ontario for analysis. Analytical results are provided in Appendix D.

Sump 2

When comparing the chemistry of the collected groundwater sample to the City of Toronto Sanitary and Combined Sewer Discharge Criteria (Table 1), there were no parameter exceedances to be reported.

When comparing the chemistry of the collected groundwater sample to the City of Toronto Storm Sewer Discharge Criteria (Table 1), following parameters reported an exceedance: Total Suspended Solids, Total Copper, Total Phosphorous and Total Zinc.

Sump 3

When comparing the chemistry of the collected groundwater sample to the City of Toronto Sanitary and Combined Sewer Discharge Criteria (Table 1), there were no parameter exceedances to be reported.

When comparing the chemistry of the collected groundwater sample to the City of Toronto Storm Sewer Discharge Criteria (Table 1), following parameters reported an exceedance: Total Suspended Solids, Mercury, Total Copper, Total Manganese and Total Zinc.

For groundwater samples collected as part of the current investigation there were no exceedances of the Sewer Use By-Law parameters of Tables 1 and 2 due to the reporting detection limit (RDL)

Table 3-2 summarizes exceedance(s) of the Sanitary (Table 1) and Storm (Table 2) Sewer Use By-Law parameters.

Table 3-2: Summary of Analytical Results

| Parameter | Units | City of Toronto Sanitary and Combined Sewer Discharge Limit (Table 1) | City of Toronto Storm Sewer Discharge Limit (Table 2) | Concentration Sump 2 25-May-2021 | Concentration Sump 3 07-June-2021 |
|------------------------|-------|---|--|--|---|
| Total Suspended Solids | mg/L | 350 | 15 | 18 | 18 |
| Mercury | mg/L | 0.01 | 0.0004 | ND | 0.0014 |
| Total Copper | ug/L | 2000 | 40 | 260 | 54 |
| Total Manganese (Mn) | µg/L | 5,000 | 50 | 49 | 170 |
| Total Phosphorous (P) | µg/L | 10,000 | 400 | 480 | 150 |
| Total Zinc | µg/L | 2,000 | 40 | 65 | 89 |

Bold – Exceeds City of Toronto Storm Sewer Discharge Limit (Table 2).

For the long-term dewatering discharge to the sanitary sewer system (post-development phase) and based on the water quality test results, the water is suitable to be discharged without a treatment system.

For the long-term dewatering discharge to the storm sewer system (post-development phase) and based on the water quality results, it is recommended to implement a suitable pre-treatment, as required. The treatment system has to be designed by a process / treatment engineer.

The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase, as required by the City.

An agreement to discharge into the sewers owned by the City of Toronto will be required prior to releasing dewatering effluent. The existing foundation system will remain and continue to discharge through the existing service connections.

3.3 Subdrain Discharge

An electronic data-loggers were installed in all three existing sump pits (1, 2 and 3) located in the basement level of the existing building (Appendix A) to monitor cycles of the pumped sump water for approximately Thirty (30) days from May 25 to June 25, 2021.

Electronic data loggers were installed in all three (3) sumps to monitor water levels continuously. Data loggers were programmed to measure water levels at 1-minute intervals.

The discharge rate of the pumped water was calculated using the total volume of water accumulated in the sump while the pump was automatically turned on and off. During the entire monitoring period (approximately 22 days continuously), no pumping was recorded in Sumps 1 and 3.

Table 2-1 below presents the calculated daily discharge volume based on water level data available during the monitoring of the pumped sump cycles for Sump 2. The results of the water level monitoring and water level fluctuations in the sumps (1, 2 and 3) for the entire monitoring period are provided in Appendix E.

Table 3.3: Average Daily Discharge Calculation (Sump 2)

| Item | Unit | Numerical Values |
|---|---------------------|--------------------------------------|
| Cumulative height of water when pump is OFF | m | 0.92 |
| Monitoring sump cycles period | days | 13.65 |
| Total time when pump is ON | min | 128 |
| Total time when pump is OFF | min | 325.44 |
| Percentage of time when pump is OFF | % | 99 |
| Average recovery rate of water in sump when pump is OFF | m/min | 0.000047 |
| Sump pit dimensions | m | Diameter - 0.5 Total Depth – 0.78 |
| Average recovery rate of water in sump when pump is ON (without recovery during pumping) | m ³ /day | 0.0270 |
| Average volume discharged into the sump pit when the pump is ON (without recovery during pumping) | m ³ /day | 0.0271 |
| Maximum daily discharge into the sump pit when the pump is ON during monitoring period (June 2, 2021) | m ³ /day | 0.1107 |

Based on the calculated discharge volumes provided in this report, the results of the preliminary estimate for the sub-drain discharge volumes are summarized in Table 3-3. Details of sump discharge rate assessment is provided in Appendix F.

Please note that seasonal and daily fluctuations are expected. These estimates may be affected by hydrogeological conditions beyond those preliminary assessed at this time, fluctuations in groundwater regimes, surrounding site alterations, and existing and future infrastructure developments.

Table 2-2 Summary of Long-Term Discharge Flow Rate

| Sump Number | Daily maximum discharge estimated during monitoring period (m ³ /day) | Long-Term Peak Flow Rate (m ³ /day) | Notes |
|-------------|--|--|---|
| Sump 1 | Negligible* | 5 | Estimate to account for some seasonal fluctuation – 5 m ³ /day above estimated maximum |
| Sump 2 | 0.1107 | 5 | |
| Sump 3 | Negligible* | 5 | |

*Not measurable

Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications. Due to estimated very low discharge rates, 5 m³/day of daily rate was added to the flow rate to accommodate the variability in seasonal groundwater fluctuations. This preliminary estimate of sub-drain discharge volumes is based on a limited monitoring period and the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this assessment may significantly influence the sub-drain discharge volumes. As a result, the exact volume discharged to be confirmed once the system is operational. It is recommended that a flow meter be installed at the sump to record daily discharge volumes to provide more representative estimates.

4 Conclusions and Recommendations

Based on the findings of the Foundation Drainage Report, the following conclusions and recommendations are provided:

- When comparing the chemistry of the collected groundwater sample from Sumps 2 and 3 to the City of Toronto Sanitary and Combined Sewer Discharge Criteria (Table 1), there were no parameter exceedances to be reported.
- When comparing the chemistry of the collected groundwater sample from Sump 2 to the City of Toronto Storm Sewer Discharge Criteria (Table 1), following parameters reported an exceedance: Total Suspended Solids, Total Copper, Total Phosphorous and Total Zinc.
- When comparing the chemistry of the collected groundwater sample from Sump 3 to the City of Toronto Storm Sewer Discharge Criteria (Table 1), following parameters reported an exceedance: Total Suspended Solids, Mercury, Total Copper, Total Manganese and Total Zinc.
- During the monitoring period from May 25 to June 25, 2021, there was not adequate quantity of water in Sump 1 to collect a groundwater sample.
- Based on monitoring results for the existing sub-drain system, the preliminary long-term flow rate of the foundation sub-drain is estimated to be approximately 5 m³/day each for all three (3) sumps (1, 2 and 3), including safety factor.
- The existing foundation drainage system will remain as part of the existing building and will continue to discharge foundation drainage through the existing service connection of the existing building.
- Regular maintenance/cleaning of the sub-drain system is recommended to ensure its proper operation.

The conclusions and recommendations provided above should be reviewed in conjunction with the entirety of the report. This report is solely intended for long-term dewatering assessments. Any changes to the design concept may result in a modification to the recommendations provided in this report.

5 Limitations

This report is based on a limited investigation designed to provide information to support an assessment of the current hydrogeological conditions within the study area. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. EXP must be contacted immediately, if any unforeseen Site conditions are experienced during construction activities. This will allow EXP to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost-effective manner.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

This report was prepared for the exclusive use of University of Toronto. This report may not be reproduced in whole or in part, without the prior written consent of EXP, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

EXP Services Inc.



Jay Samarakkody, P. Geo.
Senior Hydrogeologist
Environmental Services



Nataliya Tkach, P. Geo., P.Eng., PMP
Senior Hydrogeologist
Environmental Services

6 References

Cashman and Preene (2013) Groundwater Lowering in Construction, 2nd Edition.

Chapman, L.J. and Putnam, D.F. (2007). Physiography of Southern Ontario, 3rd Edition, Ontario Geological Survey.

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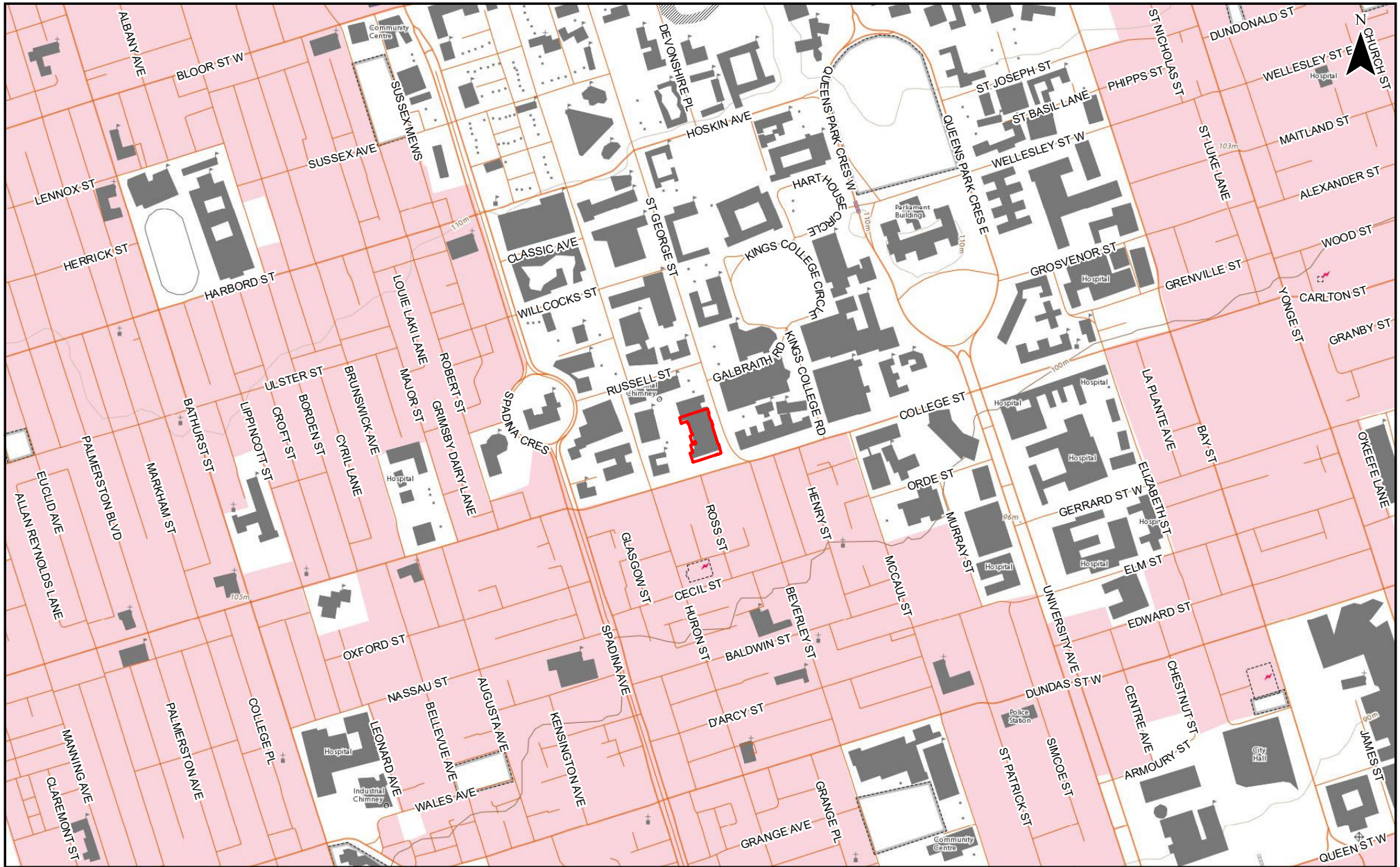
EXP Services Inc. (November 5, 2020), Interior Investigation, Koffler Student Services Centre – Proposed Renovation (P143-19-100), 214 College Street, Toronto, ON, prepared for the University of Toronto.

J.P. Powers, A.B. Corwin, P.C. Schmall and W.E. Kaeck (2007). Construction Dewatering and Groundwater Control, Third Edition.

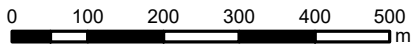
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Figures



SCALE:



LEGEND:

APPROXIMATE SITE BOUNDARY

SITE LOCATION PLAN

FIGURE:

1

FOUNDATION DRAINAGE REPORT
KOFFLER STUDENT SERVICES CENTRE
214 COLLEGE STREET
TORONTO, ONTARIO

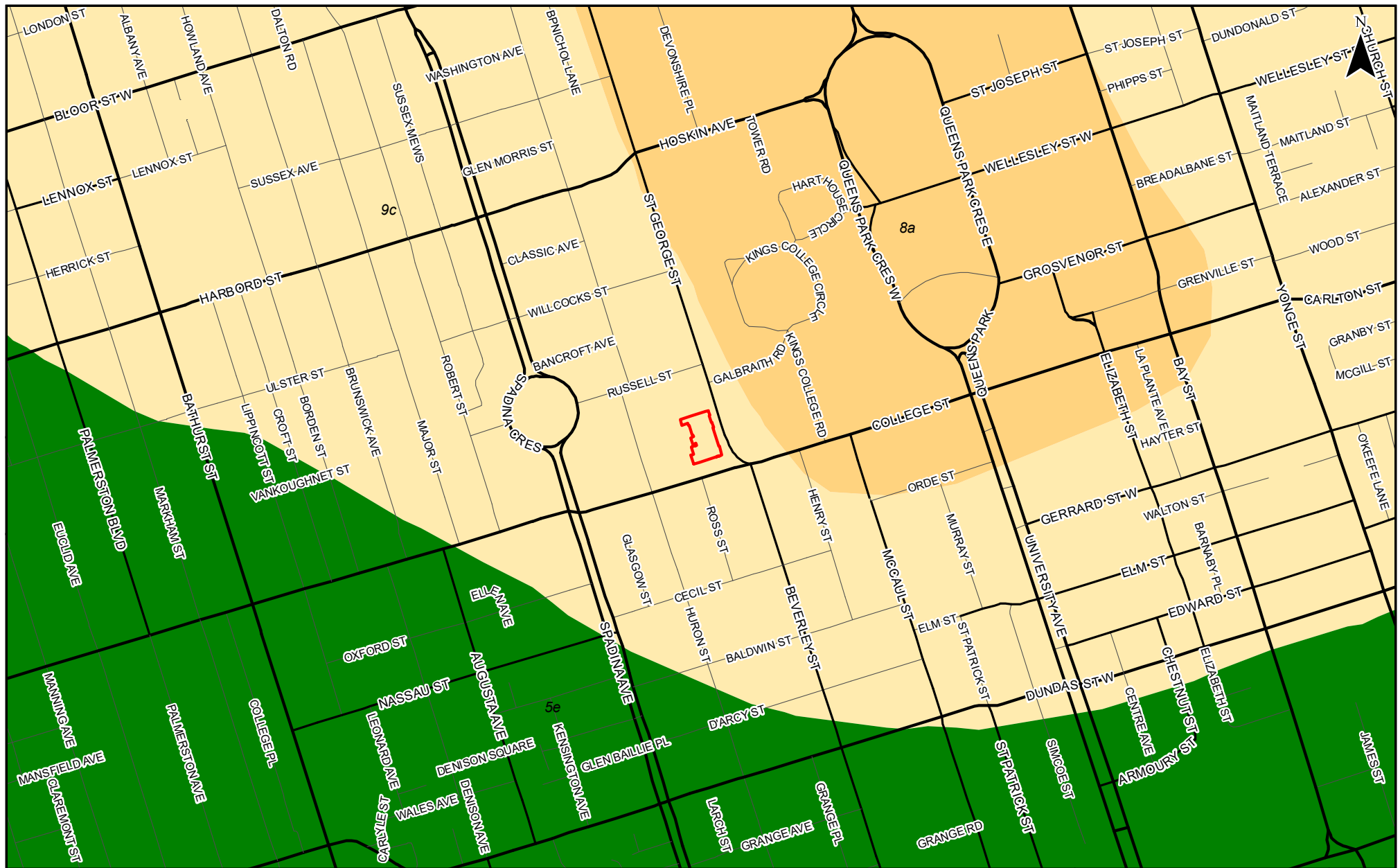
PROJECT NUMBER: BRM-00607558-A0

DATE: AUGUST 2021



DRAWN BY:
JA

CHECKED BY:
JS



SCALE:
0 120 240 360 480 600 m

SOURCE:
BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2010

LEGEND:

- APPROXIMATE SITE BOUNDARY
- 9C: COARSE-TEXTURED (FORESHORE-BASINAL) GLACIOLACUSTRINE DEPOSITS
- 8A: FINE-TEXTURED GLACIOLACUSTRINE DEPOSITS
- 5E: UNDIFFERENTIATED OLDER TILL AND STRATIFIED SEDIMENT

SURFICIAL GEOLOGY

FIGURE:
2

FOUNDATION DRAINAGE REPORT
KOFFLER STUDENT SERVICES CENTRE
214 COLLEGE STREET
TORONTO, ONTARIO

PROJECT NUMBER: BRM-00607558-A0

DATE: AUGUST 2021



DRAWN BY:
JA

CHECKED BY:
JS

Appendix A – Sump Pit Locations

Back STOREROOM
LEADING DOOR

Sump 3
STM

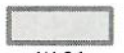
TCARD

Central Air Distribution of Air Handlers

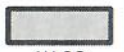
Building: 143
Koffler Student Services Centre

Floor: 1st

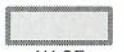
Legend:



AH 01
(Rm: 180)



AH 03
(Rm: UM-260)



AH 05
(Rm: UM-260)



AH 07
(Rm: UM-260)



No central ventilation provided




N

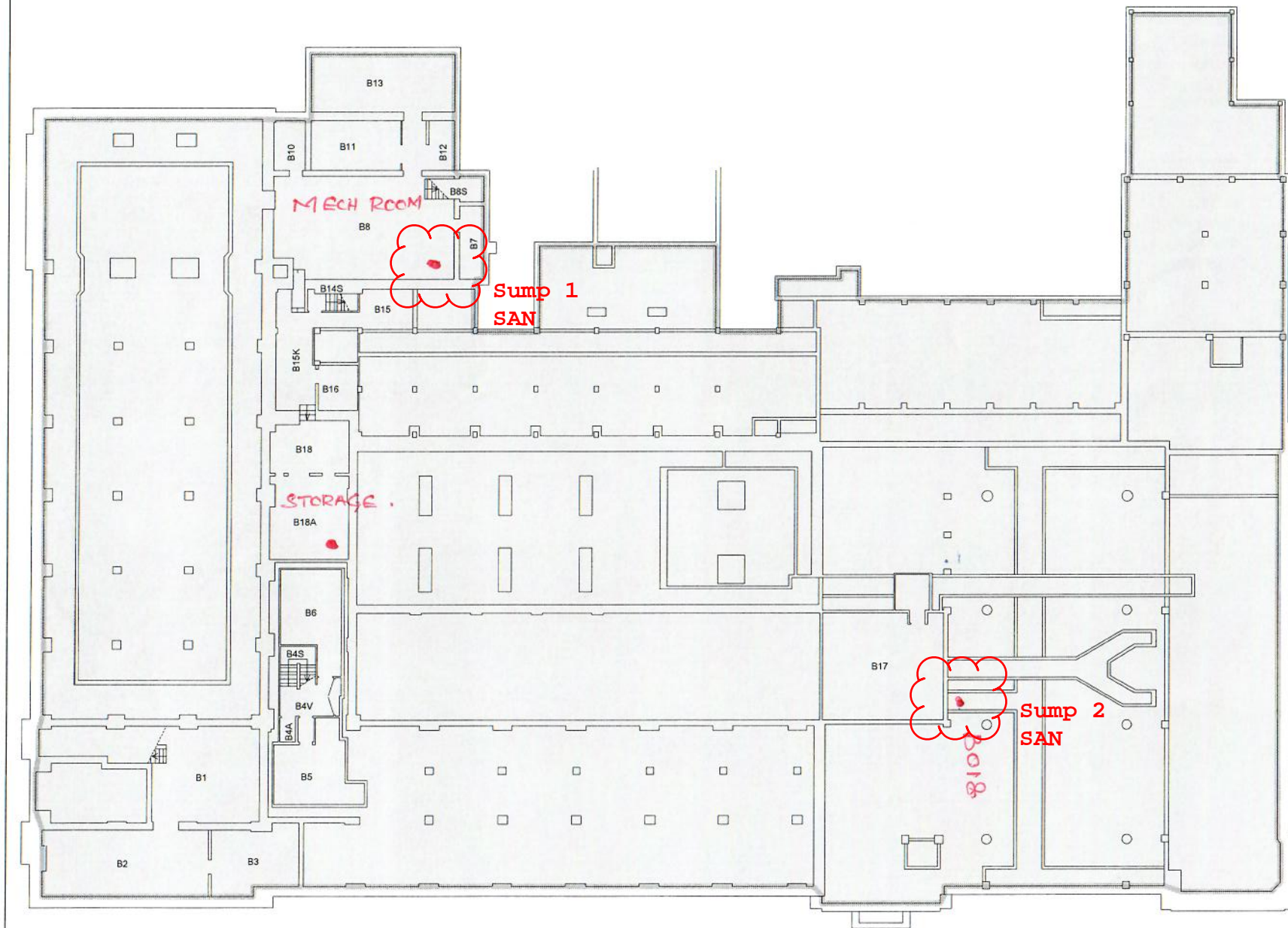
Central Air
Distribution
of Air
Handlers

Building:
143
Koffler Student
Services Centre

Floor:
Basement

Legend:

 No central
ventilation
provided



* B018 - ACCESS THROUGH THE HATCH
IN FRONT OF TEARD OFFICE.



Appendix B – Sump Pit Photographs

Sump 1



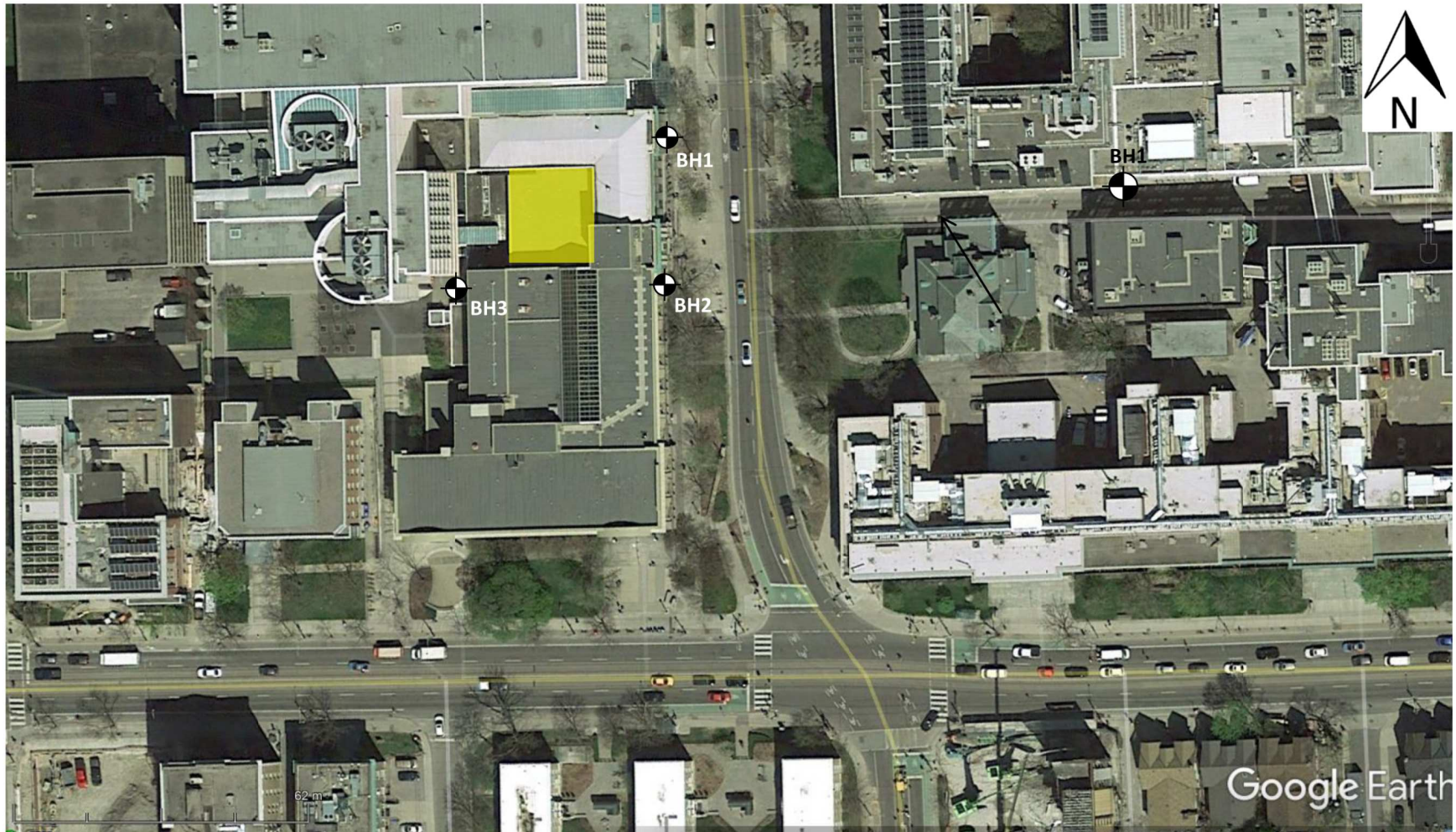
Sump 2



Sump 3



Appendix C – Borehole Logs and Location Plan



Borehole Location



Proposed 2- storey Addition



exp Services Inc.
1595 Clark Boulevard
Brampton, Ontario
L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

SCALE: As Shown

DATE:
November 2020

DWN.:AA

CHKD.:

BOREHOLE LOCATION PLAN
Proposed Koffler Building Renovations
214 College Street
Toronto, Ontario

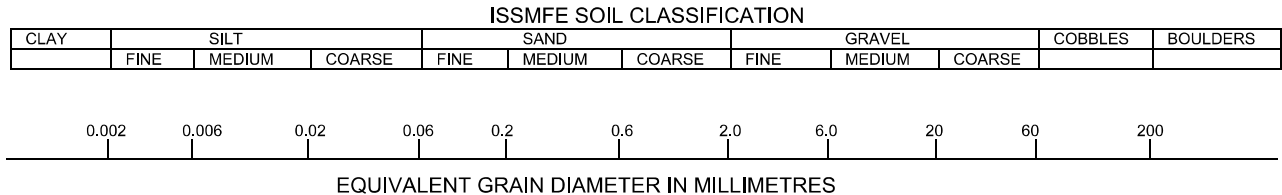
PROJECT NO.:
BRM-00607558-A0

DRAWING NO.: 1

Notes On Sample Descriptions

Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by exp Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.



| | | | | | |
|--|------|--------|------|--------|--------|
| CLAY (PLASTIC) TO SILT (NONPLASTIC) | FINE | MEDIUM | CRS. | FINE | COARSE |
| | SAND | | | GRAVEL | |

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.
3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH 1

Project No. BRM-00607558-A0

Drawing No. 2

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

Date Drilled: October 9, 2020

Drill Type: Solid Stem Auger Geoprobe 7822 Truck Mount

Datum: Geodetic

Auger Sample

SPT (N) Value

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

☐

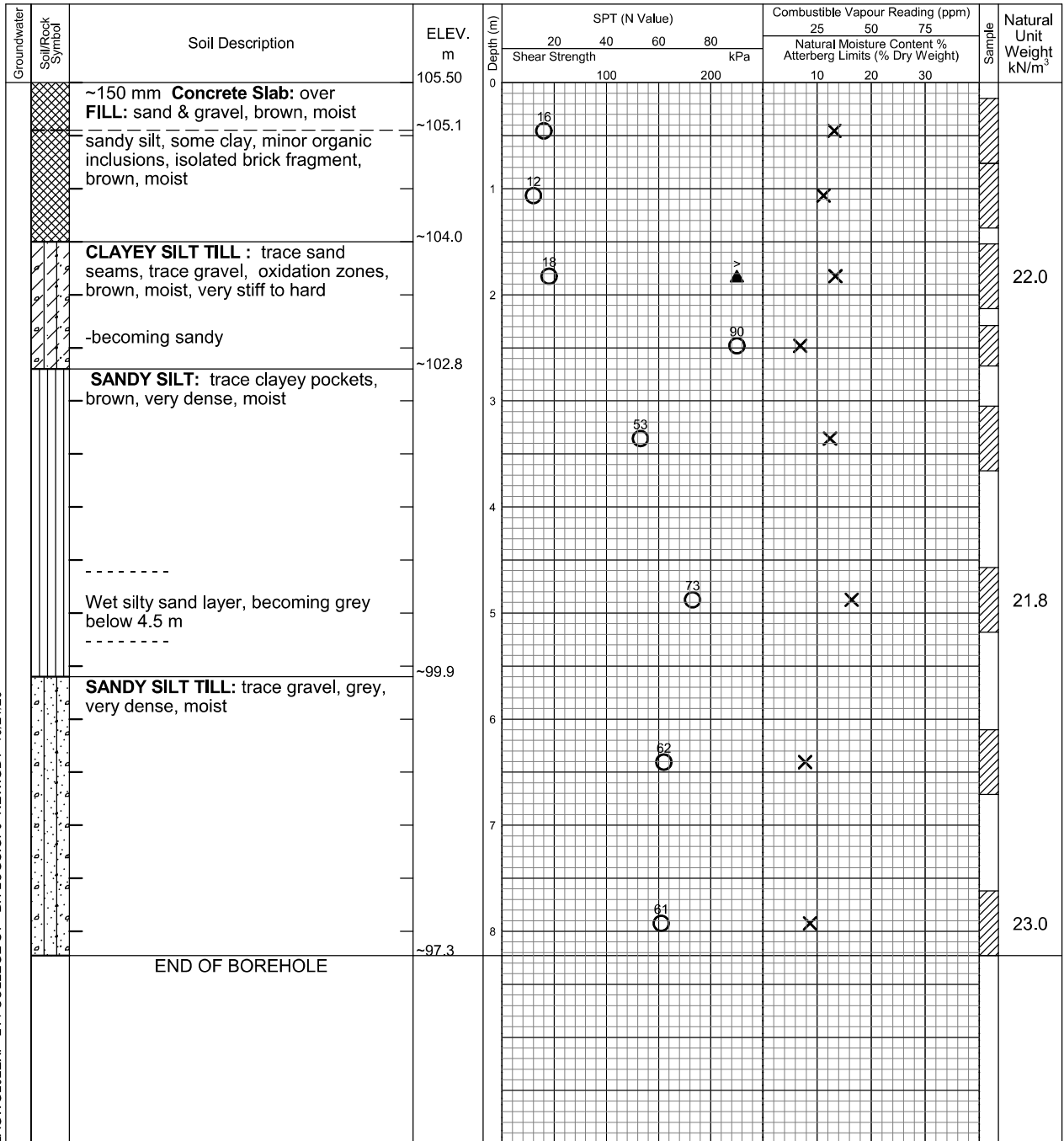
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LAGWGL02EXP 214 COLLEGE ST - BH LOGS.GPJ NEW.GDT 10/21/20



Notes:

- Borehole advanced to completion at ~8.2 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
- This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607558-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

Brampton

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---------------|-----------------|------------------|
| on completion | Dry | |

Log of Borehole BH 2

Project No. BRM-00607558-A0

Drawing No. 3

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

Date Drilled: October 9, 2020

Auger Sample

SPT (N) Value

Drill Type: Solid Stem Auger Geoprobe 7822 Truck Mount

Shelby Tube

Datum: Geodetic

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

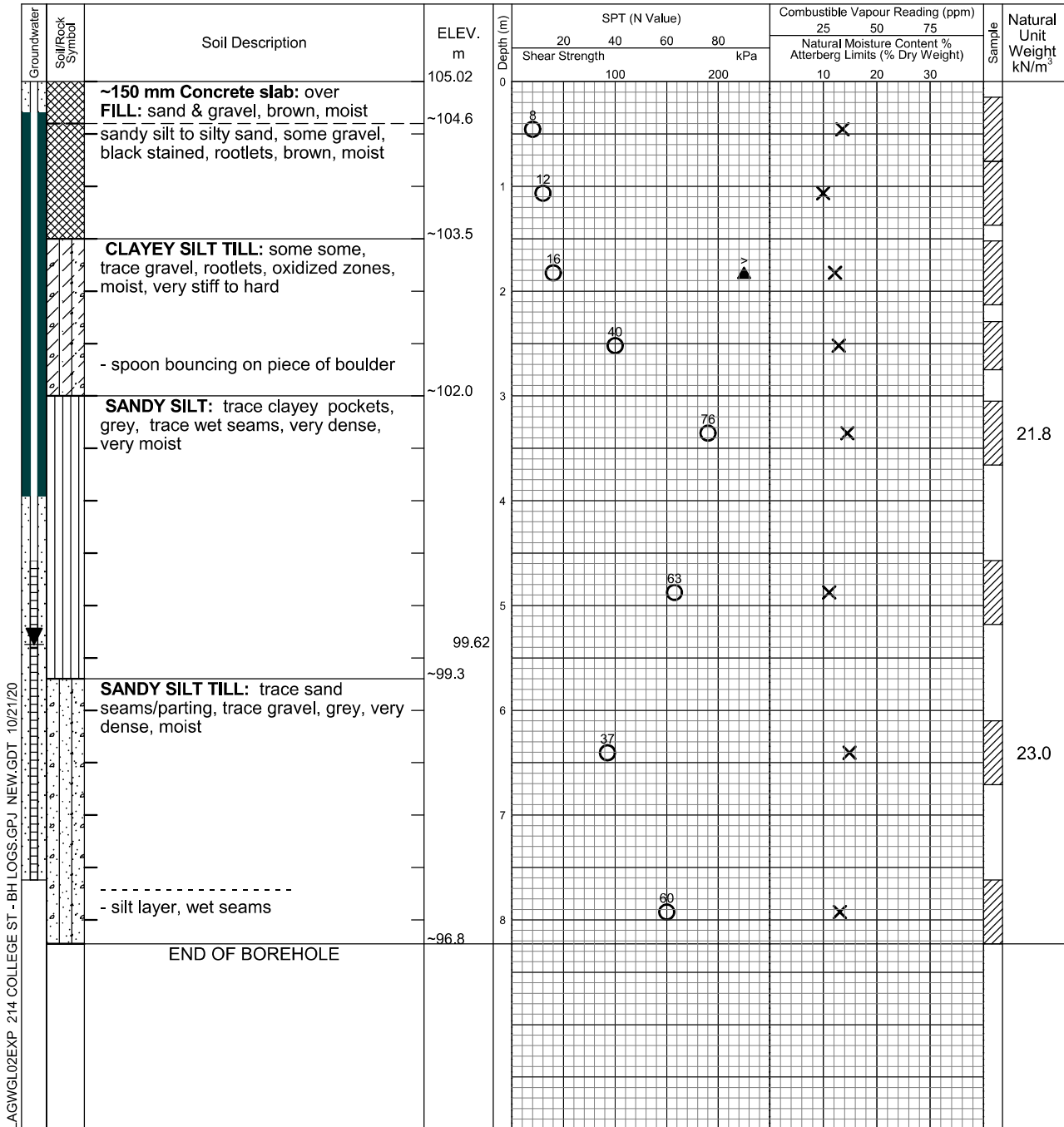
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Notes:

- Borehole advanced to completion at ~8.2 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
- This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607558-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

Brampton

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|-----------------------------------|-----------------|------------------|
| on completion October 14, 2020 | 6.2 5.4 | |

Log of Borehole BH 3

Project No. BRM-00607558-A0

Drawing No. 4

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 214 College Street, Toronto ON

Date Drilled: October 9, 2020

Drill Type: Solid Stem Auger Little Beaver

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

☐

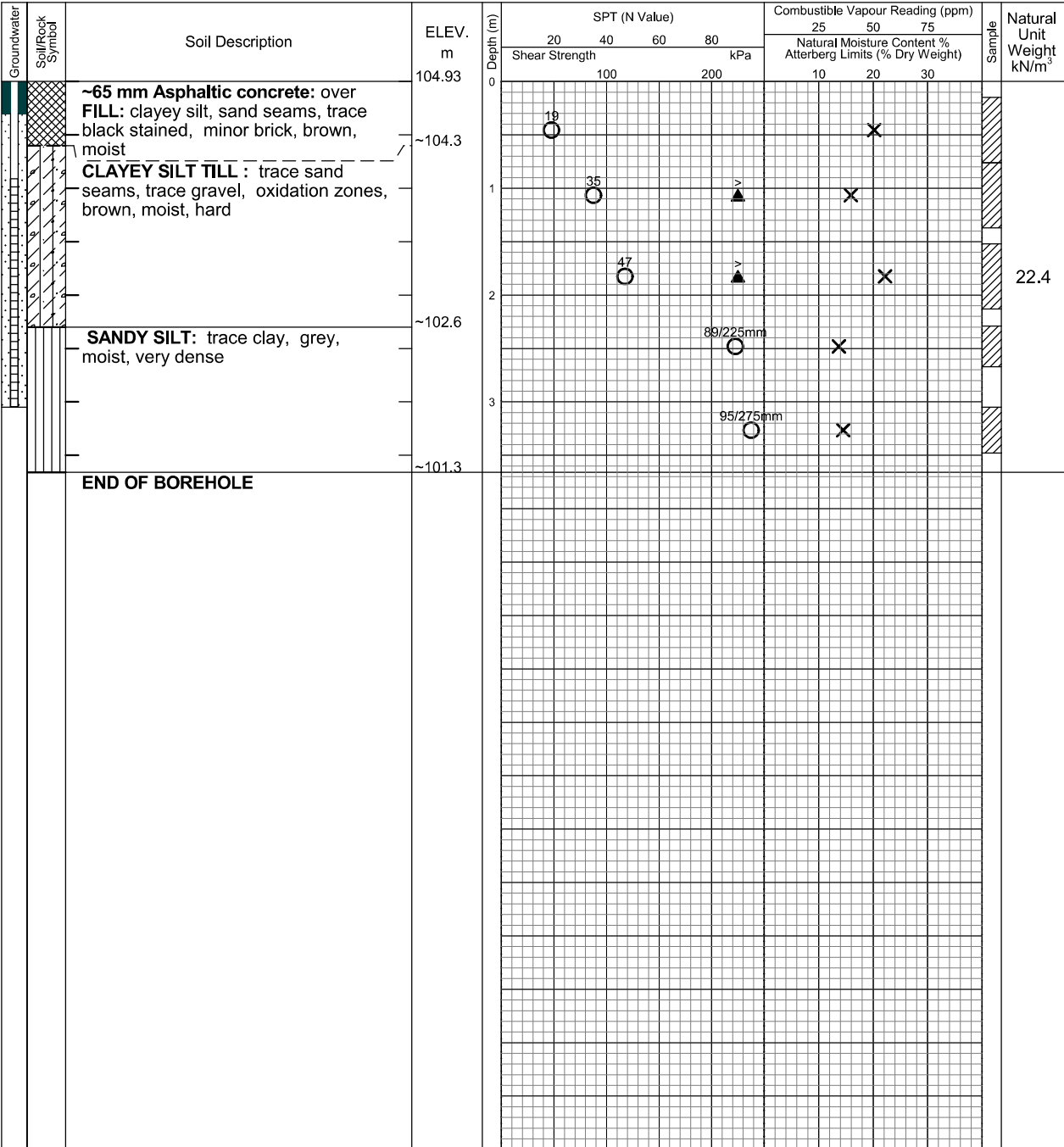
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Notes:

- Borehole advanced to completion at ~3.7 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
- This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607558-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

Elapsed Time

on completion
October 14, 2020

Water Level (m)

Dry
Dry

Hole Open to (m)

Brampton

LAGWGL02EXP 214 COLLEGE ST - BH LOGS.GPJ NEW.GDT 10/21/20

Appendix D – Laboratory's Certificates of Analysis



Your P.O. #: ENV-BRM
 Your Project #: BRM-00607558-A0
 Site Location: 214 COLLEGE ST
 Your C.O.C. #: 822431-07-01

Attention: Jay Samarakkody

exp Services Inc
 1595 Clark Blvd
 Brampton, ON
 CANADA L6T 4V1

Report Date: 2021/06/01
 Report #: R6657351
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1E0045

Received: 2021/05/25, 12:52

Sample Matrix: Water
 # Samples Received: 1

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|----------|-------------------|------------------|-------------------|----------------------|
| Sewer Use By-Law Semivolatile Organics | 1 | 2021/05/26 | 2021/05/27 | CAM SOP 00301 | EPA 8270 m |
| Biochemical Oxygen Demand (BOD) | 1 | 2021/05/26 | 2021/05/31 | CAM SOP-00427 | SM 23 5210B m |
| Chromium (VI) in Water | 1 | N/A | 2021/05/31 | CAM SOP-00436 | EPA 7199 m |
| Total Cyanide | 1 | 2021/05/26 | 2021/05/26 | CAM SOP-00457 | OMOE E3015 5 m |
| Fluoride | 1 | 2021/05/26 | 2021/05/27 | CAM SOP-00449 | SM 23 4500-F C m |
| Mercury in Water by CVAA | 1 | 2021/05/27 | 2021/05/28 | CAM SOP-00453 | EPA 7470A m |
| Total Metals Analysis by ICPMS | 1 | N/A | 2021/05/28 | CAM SOP-00447 | EPA 6020B m |
| E.coli, (CFU/100mL) | 1 | N/A | 2021/05/25 | CAM SOP-00552 | MOE LSB E3371 |
| Total Nonylphenol in Liquids by HPLC | 1 | 2021/05/27 | 2021/05/27 | CAM SOP-00313 | In-house Method |
| Nonylphenol Ethoxylates in Liquids: HPLC | 1 | 2021/05/27 | 2021/05/27 | CAM SOP-00313 | In-house Method |
| Animal and Vegetable Oil and Grease | 1 | N/A | 2021/05/29 | CAM SOP-00326 | EPA1664B m,SM5520B m |
| Total Oil and Grease | 1 | 2021/05/29 | 2021/05/29 | CAM SOP-00326 | EPA1664B m,SM5520B m |
| Polychlorinated Biphenyl in Water | 1 | 2021/05/27 | 2021/05/28 | CAM SOP-00309 | EPA 8082A m |
| pH | 1 | 2021/05/26 | 2021/05/27 | CAM SOP-00413 | SM 4500H+ B m |
| Phenols (4AAP) | 1 | N/A | 2021/05/26 | CAM SOP-00444 | OMOE E3179 m |
| Total Kjeldahl Nitrogen in Water | 1 | 2021/05/26 | 2021/05/27 | CAM SOP-00938 | OMOE E3516 m |
| Total PAHs (1) | 1 | N/A | 2021/05/28 | CAM SOP - 00301 | |
| Mineral/Synthetic O & G (TPH Heavy Oil) (2) | 1 | 2021/05/29 | 2021/05/29 | CAM SOP-00326 | EPA1664B m,SM5520F m |
| Total Suspended Solids | 1 | 2021/05/26 | 2021/05/27 | CAM SOP-00428 | SM 23 2540D m |
| Volatile Organic Compounds in Water | 1 | N/A | 2021/05/27 | CAM SOP-00228 | EPA 8260C m |

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or



Your P.O. #: ENV-BRM
Your Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your C.O.C. #: 822431-07-01

Attention: Jay Samarakkody

exp Services Inc
1595 Clark Blvd
Brampton, ON
CANADA L6T 4V1

Report Date: 2021/06/01
Report #: R6657351
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1E0045

Received: 2021/05/25, 12:52

implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Total PAHs include only those PAHs specified in the sewer use by-law.

(2) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU
VERITASBV Labs Job #: C1E0045
Report Date: 2021/06/01exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TORONTO SANITARY&STORM SEWER (100-2016)

| | | | | | | | | | |
|---------------|-------|----------|------------|---------------------|-----|----------|---------------------|-----|----------|
| BV Labs ID | | | | PQN191 | | | PQN191 | | |
| Sampling Date | | | | 2021/05/25 11:00 | | | 2021/05/25 11:00 | | |
| COC Number | | | | 822431-07-01 | | | 822431-07-01 | | |
| | UNITS | Criteria | Criteria-2 | SUMP 2 | RDL | QC Batch | SUMP 2 Lab-Dup | RDL | QC Batch |

Calculated Parameters

| | | | | | | | | | |
|---------------------------------------|------|-----|---|----|------|---------|--|--|--|
| Total Animal/Vegetable Oil and Grease | mg/L | 150 | - | ND | 0.50 | 7369346 | | | |
|---------------------------------------|------|-----|---|----|------|---------|--|--|--|

Inorganics

| | | | | | | | | | |
|-------------------------------|------|----------|---------|------|--------|---------|------|----|---------|
| Total BOD | mg/L | 300 | 15 | 3 | 2 | 7370974 | | | |
| Fluoride (F-) | mg/L | 10 | - | 0.62 | 0.10 | 7372628 | | | |
| Total Kjeldahl Nitrogen (TKN) | mg/L | 100 | - | 2.4 | 0.10 | 7372081 | | | |
| pH | pH | 6.0:11.5 | 6.0:9.5 | 8.05 | | 7372637 | 8.10 | | 7372637 |
| Phenols-4AAP | mg/L | 1.0 | 0.008 | ND | 0.0010 | 7371475 | | | |
| Total Suspended Solids | mg/L | 350 | 15 | 18 | 10 | 7372416 | 15 | 10 | 7372416 |
| Total Cyanide (CN) | mg/L | 2 | 0.02 | ND | 0.0050 | 7371317 | | | |

Petroleum Hydrocarbons

| | | | | | | | | | |
|--------------------------------------|------|----|---|----|------|---------|--|--|--|
| Total Oil & Grease | mg/L | - | - | ND | 0.50 | 7378565 | | | |
| Total Oil & Grease Mineral/Synthetic | mg/L | 15 | - | ND | 0.50 | 7378566 | | | |

Miscellaneous Parameters

| | | | | | | | | | |
|--------------------------------|------|------|-------|----|-------|---------|--|--|--|
| Nonylphenol Ethoxylate (Total) | mg/L | 0.2 | 0.01 | ND | 0.005 | 7373301 | | | |
| Nonylphenol (Total) | mg/L | 0.02 | 0.001 | ND | 0.001 | 7373289 | | | |

Metals

| | | | | | | | | | |
|---------------------|------|-------|--------|------|---------|---------|--|--|--|
| Chromium (VI) | ug/L | 2000 | 40 | ND | 0.50 | 7374364 | | | |
| Mercury (Hg) | mg/L | 0.01 | 0.0004 | ND | 0.00010 | 7373612 | | | |
| Total Aluminum (Al) | ug/L | 50000 | - | 300 | 4.9 | 7376072 | | | |
| Total Antimony (Sb) | ug/L | 5000 | - | ND | 0.50 | 7376072 | | | |
| Total Arsenic (As) | ug/L | 1000 | 20 | ND | 1.0 | 7376072 | | | |
| Total Cadmium (Cd) | ug/L | 700 | 8 | 0.49 | 0.090 | 7376072 | | | |
| Total Chromium (Cr) | ug/L | 4000 | 80 | ND | 5.0 | 7376072 | | | |
| Total Cobalt (Co) | ug/L | 5000 | - | ND | 0.50 | 7376072 | | | |
| Total Copper (Cu) | ug/L | 2000 | 40 | 260 | 0.90 | 7376072 | | | |

No Fill

No Exceedance

Grey

Exceeds 1 criteria policy/level

Black

Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

Criteria: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681.

Criteria-2: Toronto Storm Sewer Discharge Use By-Law

ND = Not detected

BUREAU
VERITASBV Labs Job #: C1E0045
Report Date: 2021/06/01exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TORONTO SANITARY&STORM SEWER (100-2016)

| BV Labs ID | | | | PQN191 | | | PQN191 | | |
|---|---------------------------------|----------|------------|---------------------|-------|----------|---------------------|-----|----------|
| Sampling Date | | | | 2021/05/25 11:00 | | | 2021/05/25 11:00 | | |
| COC Number | | | | 822431-07-01 | | | 822431-07-01 | | |
| | UNITS | Criteria | Criteria-2 | SUMP 2 | RDL | QC Batch | SUMP 2 Lab-Dup | RDL | QC Batch |
| Total Iron (Fe) | ug/L | - | - | 2100 | 100 | 7376072 | | | |
| Total Lead (Pb) | ug/L | 1000 | 120 | 17 | 0.50 | 7376072 | | | |
| Total Manganese (Mn) | ug/L | 5000 | 50 | 49 | 2.0 | 7376072 | | | |
| Total Molybdenum (Mo) | ug/L | 5000 | - | 1.7 | 0.50 | 7376072 | | | |
| Total Nickel (Ni) | ug/L | 2000 | 80 | 4.1 | 1.0 | 7376072 | | | |
| Total Phosphorus (P) | ug/L | 10000 | 400 | 480 | 100 | 7376072 | | | |
| Total Selenium (Se) | ug/L | 1000 | 20 | ND | 2.0 | 7376072 | | | |
| Total Silver (Ag) | ug/L | 5000 | 120 | ND | 0.090 | 7376072 | | | |
| Total Tin (Sn) | ug/L | 5000 | - | 4.0 | 1.0 | 7376072 | | | |
| Total Titanium (Ti) | ug/L | 5000 | - | 11 | 5.0 | 7376072 | | | |
| Total Zinc (Zn) | ug/L | 2000 | 40 | 65 | 5.0 | 7376072 | | | |
| Semivolatile Organics | | | | | | | | | |
| Di-N-butyl phthalate | ug/L | 80 | 15 | ND | 2 | 7372354 | | | |
| Bis(2-ethylhexyl)phthalate | ug/L | 12 | 8.8 | ND | 2 | 7372354 | | | |
| 3,3'-Dichlorobenzidine | ug/L | 2 | 0.8 | ND | 0.8 | 7372354 | | | |
| Pentachlorophenol | ug/L | 5 | 2 | ND | 1 | 7372354 | | | |
| Phenanthrene | ug/L | - | - | 0.4 | 0.2 | 7372354 | | | |
| Anthracene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Fluoranthene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Pyrene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Benzo(a)anthracene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Chrysene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Benzo(b/j)fluoranthene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Benzo(k)fluoranthene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Benzo(a)pyrene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Indeno(1,2,3-cd)pyrene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| No Fill | No Exceedance | | | | | | | | |
| Grey | Exceeds 1 criteria policy/level | | | | | | | | |
| Black | Exceeds both criteria/levels | | | | | | | | |
| RDL = Reportable Detection Limit | | | | | | | | | |
| QC Batch = Quality Control Batch | | | | | | | | | |
| Lab-Dup = Laboratory Initiated Duplicate | | | | | | | | | |
| Criteria: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681. | | | | | | | | | |
| Criteria-2: Toronto Storm Sewer Discharge Use By-Law | | | | | | | | | |
| ND = Not detected | | | | | | | | | |

BUREAU
VERITAS

BV Labs Job #: C1E0045

Report Date: 2021/06/01

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

TORONTO SANITARY&STORM SEWER (100-2016)

| BV Labs ID | | | | PQN191 | | | PQN191 | | |
|-------------------------------------|-------|----------|------------|---------------------|------|----------|---------------------|-----|----------|
| Sampling Date | | | | 2021/05/25 11:00 | | | 2021/05/25 11:00 | | |
| COC Number | | | | 822431-07-01 | | | 822431-07-01 | | |
| | UNITS | Criteria | Criteria-2 | SUMP 2 | RDL | QC Batch | SUMP 2 Lab-Dup | RDL | QC Batch |
| Dibenzo(a,h)anthracene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Benzo(g,h,i)perylene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Dibenzo(a,i)pyrene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Benzo(e)pyrene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Perylene | ug/L | - | - | ND | 0.2 | 7372354 | | | |
| Dibenzo(a,j) acridine | ug/L | - | - | ND | 0.4 | 7372354 | | | |
| 7H-Dibenzo(c,g) Carbazole | ug/L | - | - | ND | 0.4 | 7372354 | | | |
| 1,6-Dinitropyrene | ug/L | - | - | ND | 0.4 | 7372354 | | | |
| 1,3-Dinitropyrene | ug/L | - | - | ND | 0.4 | 7372354 | | | |
| 1,8-Dinitropyrene | ug/L | - | - | ND | 0.4 | 7372354 | | | |
| Calculated Parameters | | | | | | | | | |
| Total PAHs (18 PAHs) | ug/L | 5 | 2 | ND | 1 | 7369347 | | | |
| Volatile Organics | | | | | | | | | |
| Benzene | ug/L | 10 | 2 | ND | 0.40 | 7371353 | | | |
| Chloroform | ug/L | 40 | 2 | 1.8 | 0.40 | 7371353 | | | |
| 1,2-Dichlorobenzene | ug/L | 50 | 5.6 | ND | 0.80 | 7371353 | | | |
| 1,4-Dichlorobenzene | ug/L | 80 | 6.8 | ND | 0.80 | 7371353 | | | |
| cis-1,2-Dichloroethylene | ug/L | 4000 | 5.6 | ND | 1.0 | 7371353 | | | |
| trans-1,3-Dichloropropene | ug/L | 140 | 5.6 | ND | 0.80 | 7371353 | | | |
| Ethylbenzene | ug/L | 160 | 2 | ND | 0.40 | 7371353 | | | |
| Methylene Chloride(Dichloromethane) | ug/L | 2000 | 5.2 | ND | 4.0 | 7371353 | | | |
| 1,1,2,2-Tetrachloroethane | ug/L | 1400 | 17 | ND | 0.80 | 7371353 | | | |
| Tetrachloroethylene | ug/L | 1000 | 4.4 | ND | 0.40 | 7371353 | | | |
| Toluene | ug/L | 16 | 2 | ND | 0.40 | 7371353 | | | |
| Trichloroethylene | ug/L | 400 | 7.6 | ND | 0.40 | 7371353 | | | |
| p+m-Xylene | ug/L | - | - | ND | 0.40 | 7371353 | | | |

No Fill

No Exceedance

Grey

Exceeds 1 criteria policy/level

Black

Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

Criteria: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681.

Criteria-2: Toronto Storm Sewer Discharge Use By-Law

ND = Not detected

BUREAU
VERITASBV Labs Job #: C1E0045
Report Date: 2021/06/01exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS**TORONTO SANITARY&STORM SEWER (100-2016)**

| BV Labs ID | | | | PQN191 | | | PQN191 | | |
|---|---------------------------------|----------|------------|---------------------|------|----------|---------------------|-----|----------|
| Sampling Date | | | | 2021/05/25 11:00 | | | 2021/05/25 11:00 | | |
| COC Number | | | | 822431-07-01 | | | 822431-07-01 | | |
| | UNITS | Criteria | Criteria-2 | SUMP 2 | RDL | QC Batch | SUMP 2 Lab-Dup | RDL | QC Batch |
| o-Xylene | ug/L | - | - | ND | 0.40 | 7371353 | | | |
| Total Xylenes | ug/L | 1400 | 4.4 | ND | 0.40 | 7371353 | | | |
| PCBs | | | | | | | | | |
| Total PCB | ug/L | 1 | 0.4 | ND | 0.05 | 7373956 | | | |
| Microbiological | | | | | | | | | |
| Escherichia coli | CFU/100mL | - | 200 | <10 | 10 | 7369928 | | | |
| Surrogate Recovery (%) | | | | | | | | | |
| 2,4,6-Tribromophenol | % | - | - | 70 | | 7372354 | | | |
| 2-Fluorobiphenyl | % | - | - | 70 | | 7372354 | | | |
| D14-Terphenyl (FS) | % | - | - | 89 | | 7372354 | | | |
| D5-Nitrobenzene | % | - | - | 98 | | 7372354 | | | |
| D8-Acenaphthylene | % | - | - | 86 | | 7372354 | | | |
| Decachlorobiphenyl | % | - | - | 61 | | 7373956 | | | |
| 4-Bromofluorobenzene | % | - | - | 93 | | 7371353 | | | |
| D4-1,2-Dichloroethane | % | - | - | 117 | | 7371353 | | | |
| D8-Toluene | % | - | - | 92 | | 7371353 | | | |
| No Fill | No Exceedance | | | | | | | | |
| Grey | Exceeds 1 criteria policy/level | | | | | | | | |
| Black | Exceeds both criteria/levels | | | | | | | | |
| RDL = Reportable Detection Limit | | | | | | | | | |
| QC Batch = Quality Control Batch | | | | | | | | | |
| Lab-Dup = Laboratory Initiated Duplicate | | | | | | | | | |
| Criteria: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681. | | | | | | | | | |
| Criteria-2: Toronto Storm Sewer Discharge Use By-Law | | | | | | | | | |
| ND = Not detected | | | | | | | | | |



BUREAU
VERITAS

BV Labs Job #: C1E0045
Report Date: 2021/06/01

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TEST SUMMARY

BV Labs ID: PQN191
Sample ID: SUMP 2
Matrix: Water

Collected: 2021/05/25
Shipped:
Received: 2021/05/25

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|--|-----------------|---------|------------|---------------|---------------------|
| Sewer Use By-Law Semivolatile Organics | GC/MS | 7372354 | 2021/05/26 | 2021/05/27 | Kathy Horvat |
| Biochemical Oxygen Demand (BOD) | DO | 7370974 | 2021/05/26 | 2021/05/31 | Nusrat Naz |
| Chromium (VI) in Water | IC | 7374364 | N/A | 2021/05/31 | Lang Le |
| Total Cyanide | SKAL/CN | 7371317 | 2021/05/26 | 2021/05/26 | Louise Harding |
| Fluoride | ISE | 7372628 | 2021/05/26 | 2021/05/27 | Surinder Rai |
| Mercury in Water by CVAA | CV/AA | 7373612 | 2021/05/27 | 2021/05/28 | Medhat Nasr |
| Total Metals Analysis by ICPMS | ICP/MS | 7376072 | N/A | 2021/05/28 | Arefa Dabhad |
| E.coli, (CFU/100mL) | PL | 7369928 | N/A | 2021/05/25 | Tasbir Singh |
| Total Nonylphenol in Liquids by HPLC | LC/FLU | 7373289 | 2021/05/27 | 2021/05/27 | Dennis Boodram |
| Nonylphenol Ethoxylates in Liquids: HPLC | LC/FLU | 7373301 | 2021/05/27 | 2021/05/27 | Dennis Boodram |
| Animal and Vegetable Oil and Grease | BAL | 7369346 | N/A | 2021/05/29 | Automated Statchk |
| Total Oil and Grease | BAL | 7378565 | 2021/05/29 | 2021/05/29 | Saumya Modh |
| Polychlorinated Biphenyl in Water | GC/ECD | 7373956 | 2021/05/27 | 2021/05/28 | Svitlana Shaula |
| pH | AT | 7372637 | 2021/05/26 | 2021/05/27 | Surinder Rai |
| Phenols (4AAP) | TECH/PHEN | 7371475 | N/A | 2021/05/26 | Deonarine Ramnarine |
| Total Kjeldahl Nitrogen in Water | SKAL | 7372081 | 2021/05/26 | 2021/05/27 | Massarat Jan |
| Total PAHs | CALC | 7369347 | N/A | 2021/05/28 | Automated Statchk |
| Mineral/Synthetic O & G (TPH Heavy Oil) | BAL | 7378566 | 2021/05/29 | 2021/05/29 | Saumya Modh |
| Total Suspended Solids | BAL | 7372416 | 2021/05/26 | 2021/05/27 | Shivani Desai |
| Volatile Organic Compounds in Water | GC/MS | 7371353 | N/A | 2021/05/27 | Ancheol Jeong |

BV Labs ID: PQN191 Dup
Sample ID: SUMP 2
Matrix: Water

Collected: 2021/05/25
Shipped:
Received: 2021/05/25

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|------------------------|-----------------|---------|------------|---------------|---------------|
| pH | AT | 7372637 | 2021/05/26 | 2021/05/27 | Surinder Rai |
| Total Suspended Solids | BAL | 7372416 | 2021/05/26 | 2021/05/27 | Shivani Desai |



BUREAU
VERITAS

BV Labs Job #: C1E0045
Report Date: 2021/06/01

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

| | |
|-----------|--------|
| Package 1 | 17.0°C |
|-----------|--------|

Sample PQN191 [SUMP 2] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

BUREAU
VERITAS

BV Labs Job #: C1E0045

Report Date: 2021/06/01

QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|-------------------------------------|------------|--------------|-----------|--------------|-----------|-------------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7371353 | 4-Bromofluorobenzene | 2021/05/27 | 102 | 70 - 130 | 102 | 70 - 130 | 96 | % | | | | |
| 7371353 | D4-1,2-Dichloroethane | 2021/05/27 | 108 | 70 - 130 | 107 | 70 - 130 | 115 | % | | | | |
| 7371353 | D8-Toluene | 2021/05/27 | 104 | 70 - 130 | 103 | 70 - 130 | 92 | % | | | | |
| 7372354 | 2,4,6-Tribromophenol | 2021/05/27 | 129 | 10 - 130 | 76 | 10 - 130 | 46 | % | | | | |
| 7372354 | 2-Fluorobiphenyl | 2021/05/27 | 74 | 30 - 130 | 69 | 30 - 130 | 72 | % | | | | |
| 7372354 | D14-Terphenyl (FS) | 2021/05/27 | 102 | 30 - 130 | 89 | 30 - 130 | 87 | % | | | | |
| 7372354 | D5-Nitrobenzene | 2021/05/27 | 97 | 30 - 130 | 90 | 30 - 130 | 100 | % | | | | |
| 7372354 | D8-Acenaphthylene | 2021/05/27 | 84 | 30 - 130 | 83 | 30 - 130 | 86 | % | | | | |
| 7373956 | Decachlorobiphenyl | 2021/05/28 | 96 | 60 - 130 | 96 | 60 - 130 | 94 | % | | | | |
| 7370974 | Total BOD | 2021/05/31 | | | | | ND,RDL=2 | mg/L | 14 | 30 | 91 | 80 - 120 |
| 7371317 | Total Cyanide (CN) | 2021/05/26 | 97 | 80 - 120 | 98 | 80 - 120 | ND, RDL=0.0050 | mg/L | NC | 20 | | |
| 7371353 | 1,1,2,2-Tetrachloroethane | 2021/05/27 | 107 | 70 - 130 | 106 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |
| 7371353 | 1,2-Dichlorobenzene | 2021/05/27 | 98 | 70 - 130 | 98 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |
| 7371353 | 1,4-Dichlorobenzene | 2021/05/27 | 112 | 70 - 130 | 112 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |
| 7371353 | Benzene | 2021/05/27 | 97 | 70 - 130 | 97 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | Chloroform | 2021/05/27 | 106 | 70 - 130 | 104 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | cis-1,2-Dichloroethylene | 2021/05/27 | 103 | 70 - 130 | 102 | 70 - 130 | ND, RDL=0.50 | ug/L | NC | 30 | | |
| 7371353 | Ethylbenzene | 2021/05/27 | 90 | 70 - 130 | 90 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | Methylene Chloride(Dichloromethane) | 2021/05/27 | 115 | 70 - 130 | 113 | 70 - 130 | ND, RDL=2.0 | ug/L | NC | 30 | | |
| 7371353 | o-Xylene | 2021/05/27 | 88 | 70 - 130 | 92 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | p+m-Xylene | 2021/05/27 | 94 | 70 - 130 | 95 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | Tetrachloroethylene | 2021/05/27 | 96 | 70 - 130 | 94 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | Toluene | 2021/05/27 | 98 | 70 - 130 | 96 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | Total Xylenes | 2021/05/27 | | | | | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371353 | trans-1,3-Dichloropropene | 2021/05/27 | 116 | 70 - 130 | 111 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |
| 7371353 | Trichloroethylene | 2021/05/27 | 106 | 70 - 130 | 105 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7371475 | Phenols-4AAP | 2021/05/26 | 101 | 80 - 120 | 100 | 80 - 120 | ND, RDL=0.0010 | mg/L | NC | 20 | | |
| 7372081 | Total Kjeldahl Nitrogen (TKN) | 2021/05/27 | 98 | 80 - 120 | 97 | 80 - 120 | ND, RDL=0.10 | mg/L | NC | 20 | 96 | 80 - 120 |



BUREAU
VERITAS

BV Labs Job #: C1E0045

Report Date: 2021/06/01

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|----------------------------|------------|--------------|-----------|--------------|-----------|------------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7372354 | 1,3-Dinitropyrene | 2021/05/27 | 1.3 (1) | 30 - 130 | 97 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7372354 | 1,6-Dinitropyrene | 2021/05/27 | 1.4 (1) | 30 - 130 | 94 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7372354 | 1,8-Dinitropyrene | 2021/05/27 | 0.00 (1) | 30 - 130 | 107 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7372354 | 3,3'-Dichlorobenzidine | 2021/05/27 | 56 | 30 - 130 | 101 | 30 - 130 | ND, RDL=0.8 | ug/L | NC | 40 | | |
| 7372354 | 7H-Dibenzo(c,g) Carbazole | 2021/05/27 | 50 | 30 - 130 | 96 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7372354 | Anthracene | 2021/05/27 | 100 | 30 - 130 | 91 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Benzo(a)anthracene | 2021/05/27 | 116 | 30 - 130 | 100 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Benzo(a)pyrene | 2021/05/27 | 87 | 30 - 130 | 86 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Benzo(b,j)fluoranthene | 2021/05/27 | 103 | 30 - 130 | 101 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Benzo(e)pyrene | 2021/05/27 | 100 | 30 - 130 | 104 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Benzo(g,h,i)perylene | 2021/05/27 | 72 | 30 - 130 | 106 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Benzo(k)fluoranthene | 2021/05/27 | 107 | 30 - 130 | 99 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Bis(2-ethylhexyl)phthalate | 2021/05/27 | 98 | 30 - 130 | 101 | 30 - 130 | ND,RDL=2 | ug/L | NC | 40 | | |
| 7372354 | Chrysene | 2021/05/27 | 110 | 30 - 130 | 99 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Dibenzo(a,h)anthracene | 2021/05/27 | 77 | 30 - 130 | 108 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Dibenzo(a,i)pyrene | 2021/05/27 | 33 | 30 - 130 | 91 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Dibenzo(a,j) acridine | 2021/05/27 | 81 | 30 - 130 | 100 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7372354 | Di-N-butyl phthalate | 2021/05/27 | 108 | 30 - 130 | 104 | 30 - 130 | ND,RDL=2 | ug/L | 0.48 | 40 | | |
| 7372354 | Fluoranthene | 2021/05/27 | 119 | 30 - 130 | 104 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Indeno(1,2,3-cd)pyrene | 2021/05/27 | 74 | 30 - 130 | 109 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Pentachlorophenol | 2021/05/27 | 91 | 30 - 130 | 69 | 30 - 130 | ND,RDL=1 | ug/L | NC | 40 | | |
| 7372354 | Perylene | 2021/05/27 | 124 | 30 - 130 | 103 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Phenanthrene | 2021/05/27 | 105 | 30 - 130 | 94 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372354 | Pyrene | 2021/05/27 | 119 | 30 - 130 | 105 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7372416 | Total Suspended Solids | 2021/05/27 | | | | | ND, RDL=10 | mg/L | 18 | 25 | 95 | 85 - 115 |
| 7372628 | Fluoride (F-) | 2021/05/27 | 102 | 80 - 120 | 101 | 80 - 120 | ND, RDL=0.10 | mg/L | 14 | 20 | | |
| 7372637 | pH | 2021/05/27 | | | 102 | 98 - 103 | | | 0.63 | N/A | | |
| 7373289 | Nonylphenol (Total) | 2021/05/27 | 112 | 50 - 130 | 111 | 50 - 130 | ND, RDL=0.001 | mg/L | NC | 40 | | |

BUREAU
VERITAS

BV Labs Job #: C1E0045

Report Date: 2021/06/01

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|--------------------------------|------------|--------------|-----------|--------------|-----------|--------------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7373301 | Nonylphenol Ethoxylate (Total) | 2021/05/27 | 73 | 50 - 130 | 94 | 50 - 130 | ND, RDL=0.005 | mg/L | NC | 40 | | |
| 7373612 | Mercury (Hg) | 2021/05/28 | 94 | 75 - 125 | 95 | 80 - 120 | ND, RDL=0.00010 | mg/L | NC | 20 | | |
| 7373956 | Total PCB | 2021/05/28 | 103 | 60 - 130 | 94 | 60 - 130 | ND, RDL=0.05 | ug/L | NC | 40 | | |
| 7374364 | Chromium (VI) | 2021/05/31 | 102 | 80 - 120 | 98 | 80 - 120 | ND, RDL=0.50 | ug/L | NC | 20 | | |
| 7376072 | Total Aluminum (Al) | 2021/05/28 | NC | 80 - 120 | 99 | 80 - 120 | ND, RDL=4.9 | ug/L | 4.3 | 20 | | |
| 7376072 | Total Antimony (Sb) | 2021/05/28 | 103 | 80 - 120 | 98 | 80 - 120 | ND, RDL=0.50 | ug/L | | | | |
| 7376072 | Total Arsenic (As) | 2021/05/28 | 100 | 80 - 120 | 99 | 80 - 120 | ND, RDL=1.0 | ug/L | | | | |
| 7376072 | Total Cadmium (Cd) | 2021/05/28 | 100 | 80 - 120 | 98 | 80 - 120 | ND, RDL=0.090 | ug/L | 14 | 20 | | |
| 7376072 | Total Chromium (Cr) | 2021/05/28 | 99 | 80 - 120 | 97 | 80 - 120 | ND, RDL=5.0 | ug/L | NC | 20 | | |
| 7376072 | Total Cobalt (Co) | 2021/05/28 | 96 | 80 - 120 | 96 | 80 - 120 | ND, RDL=0.50 | ug/L | | | | |
| 7376072 | Total Copper (Cu) | 2021/05/28 | 97 | 80 - 120 | 94 | 80 - 120 | ND, RDL=0.90 | ug/L | 5.2 | 20 | | |
| 7376072 | Total Iron (Fe) | 2021/05/28 | 96 | 80 - 120 | 98 | 80 - 120 | ND, RDL=100 | ug/L | 0.69 | 20 | | |
| 7376072 | Total Lead (Pb) | 2021/05/28 | 97 | 80 - 120 | 98 | 80 - 120 | ND, RDL=0.50 | ug/L | 2.9 | 20 | | |
| 7376072 | Total Manganese (Mn) | 2021/05/28 | 99 | 80 - 120 | 97 | 80 - 120 | ND, RDL=2.0 | ug/L | | | | |
| 7376072 | Total Molybdenum (Mo) | 2021/05/28 | 101 | 80 - 120 | 97 | 80 - 120 | ND, RDL=0.50 | ug/L | | | | |
| 7376072 | Total Nickel (Ni) | 2021/05/28 | 98 | 80 - 120 | 100 | 80 - 120 | ND, RDL=1.0 | ug/L | 4.7 | 20 | | |
| 7376072 | Total Phosphorus (P) | 2021/05/28 | NC | 80 - 120 | 97 | 80 - 120 | ND, RDL=100 | ug/L | | | | |
| 7376072 | Total Selenium (Se) | 2021/05/28 | 101 | 80 - 120 | 103 | 80 - 120 | ND, RDL=2.0 | ug/L | | | | |
| 7376072 | Total Silver (Ag) | 2021/05/28 | 96 | 80 - 120 | 98 | 80 - 120 | ND, RDL=0.090 | ug/L | | | | |
| 7376072 | Total Tin (Sn) | 2021/05/28 | 86 | 80 - 120 | 98 | 80 - 120 | ND, RDL=1.0 | ug/L | | | | |
| 7376072 | Total Titanium (Ti) | 2021/05/28 | 86 | 80 - 120 | 95 | 80 - 120 | ND, RDL=5.0 | ug/L | | | | |
| 7376072 | Total Zinc (Zn) | 2021/05/28 | 99 | 80 - 120 | 101 | 80 - 120 | ND, RDL=5.0 | ug/L | 0.50 | 20 | | |
| 7378565 | Total Oil & Grease | 2021/05/29 | | | 97 | 85 - 115 | ND, RDL=0.50 | mg/L | 1.3 | 25 | | |



BUREAU
VERITAS

BV Labs Job #: C1E0045

Report Date: 2021/06/01

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|--------------------------------------|------------|--------------|-----------|--------------|-----------|--------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7378566 | Total Oil & Grease Mineral/Synthetic | 2021/05/29 | | | 92 | 85 - 115 | ND, RDL=0.50 | mg/L | 2.7 | 25 | | |

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.




BUREAU
VERITAS

BV Labs Job #: C1E0045
Report Date: 2021/06/01

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ewa Pranjic


Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Tasbir Singh

Tasbir Singh, Analyst 2

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Page 14 of 15



BUREAU
VERITAS

BV Labs Job #: C1E0045
Report Date: 2021/06/01

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

Exceedance Summary Table – Toronto Sanitary Sewer
Result Exceedances

| Sample ID | BV Labs ID | Parameter | Criteria | Result | DL | UNITS |
|---|------------|-----------|----------|--------|----|-------|
| No Exceedances | | | | | | |
| The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines. | | | | | | |

Exceedance Summary Table – Toronto Storm Sewer
Result Exceedances

| Sample ID | BV Labs ID | Parameter | Criteria | Result | DL | UNITS |
|---|------------|------------------------|----------|--------|------|-------|
| SUMP 2 | PQN191-08 | Total Copper (Cu) | 40 | 260 | 0.90 | ug/L |
| SUMP 2 | PQN191-08 | Total Phosphorus (P) | 400 | 480 | 100 | ug/L |
| SUMP 2 | PQN191-06 | Total Suspended Solids | 15 | 18 | 10 | mg/L |
| SUMP 2 | PQN191-08 | Total Zinc (Zn) | 40 | 65 | 5.0 | ug/L |
| The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines. | | | | | | |



Your P.O. #: ENV-BRM
 Your Project #: BRM-00607558-A0
 Site Location: 214 COLLEGE ST
 Your C.O.C. #: 761730-71-01

Attention: Francois Chartier

exp Services Inc
 1595 Clark Blvd
 Brampton, ON
 CANADA L6T 4V1

Report Date: 2021/06/14
 Report #: R6675443
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1F4810

Received: 2021/06/07, 16:58

Sample Matrix: Water
 # Samples Received: 1

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|----------|-------------------|------------------|-------------------|----------------------|
| Sewer Use By-Law Semivolatile Organics | 1 | 2021/06/08 | 2021/06/10 | CAM SOP 00301 | EPA 8270 m |
| Biochemical Oxygen Demand (BOD) | 1 | 2021/06/08 | 2021/06/13 | CAM SOP-00427 | SM 23 5210B m |
| Chromium (VI) in Water | 1 | N/A | 2021/06/10 | CAM SOP-00436 | EPA 7199 m |
| Total Cyanide | 1 | 2021/06/09 | 2021/06/09 | CAM SOP-00457 | OMOE E3015 5 m |
| Fluoride | 1 | 2021/06/08 | 2021/06/09 | CAM SOP-00449 | SM 23 4500-F C m |
| Mercury in Water by CVAA | 1 | 2021/06/11 | 2021/06/11 | CAM SOP-00453 | EPA 7470A m |
| Total Metals Analysis by ICPMS | 1 | N/A | 2021/06/10 | CAM SOP-00447 | EPA 6020B m |
| E.coli, (CFU/100mL) | 1 | N/A | 2021/06/07 | CAM SOP-00552 | MOE LSB E3371 |
| Total Nonylphenol in Liquids by HPLC | 1 | 2021/06/08 | 2021/06/08 | CAM SOP-00313 | In-house Method |
| Nonylphenol Ethoxylates in Liquids: HPLC | 1 | 2021/06/08 | 2021/06/08 | CAM SOP-00313 | In-house Method |
| Animal and Vegetable Oil and Grease | 1 | N/A | 2021/06/13 | CAM SOP-00326 | EPA1664B m,SM5520B m |
| Total Oil and Grease | 1 | 2021/06/12 | 2021/06/13 | CAM SOP-00326 | EPA1664B m,SM5520B m |
| Polychlorinated Biphenyl in Water | 1 | 2021/06/09 | 2021/06/09 | CAM SOP-00309 | EPA 8082A m |
| pH | 1 | 2021/06/08 | 2021/06/09 | CAM SOP-00413 | SM 4500H+ B m |
| Phenols (4AAP) | 1 | N/A | 2021/06/09 | CAM SOP-00444 | OMOE E3179 m |
| Total Kjeldahl Nitrogen in Water | 1 | 2021/06/08 | 2021/06/09 | CAM SOP-00938 | OMOE E3516 m |
| Total PAHs (1) | 1 | N/A | 2021/06/10 | CAM SOP - 00301 | |
| Mineral/Synthetic O & G (TPH Heavy Oil) (2) | 1 | 2021/06/12 | 2021/06/13 | CAM SOP-00326 | EPA1664B m,SM5520F m |
| Total Suspended Solids | 1 | 2021/06/08 | 2021/06/09 | CAM SOP-00428 | SM 23 2540D m |
| Volatile Organic Compounds in Water | 1 | N/A | 2021/06/11 | CAM SOP-00228 | EPA 8260C m |

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or



Your P.O. #: ENV-BRM
Your Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your C.O.C. #: 761730-71-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
CANADA L6T 4V1

Report Date: 2021/06/14
Report #: R6675443
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1F4810

Received: 2021/06/07, 16:58

implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Total PAHs include only those PAHs specified in the sewer use by-law.

(2) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU
VERITASBV Labs Job #: C1F4810
Report Date: 2021/06/14exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TORONTO SANITARY&STORM SEWER (100-2016)

| BV Labs ID | | | | PTP755 | | | PTP755 | | |
|---------------|-------|----------|------------|---------------------|-----|----------|---------------------|-----|----------|
| Sampling Date | | | | 2021/06/07 14:30 | | | 2021/06/07 14:30 | | |
| COC Number | | | | 761730-71-01 | | | 761730-71-01 | | |
| | UNITS | Criteria | Criteria-2 | SUMP 3 | RDL | QC Batch | SUMP 3 Lab-Dup | RDL | QC Batch |

| | | | | | | | | | |
|---------------------------------------|------|---------|----------|--------|---------|---------|----|-------|---------|
| Calculated Parameters | | | | | | | | | |
| Total Animal/Vegetable Oil and Grease | mg/L | - | 150 | ND | 0.50 | 7393285 | | | |
| Inorganics | | | | | | | | | |
| Total BOD | mg/L | 15 | 300 | 3 | 2 | 7394826 | | | |
| Fluoride (F-) | mg/L | - | 10 | ND | 0.10 | 7396606 | | | |
| Total Kjeldahl Nitrogen (TKN) | mg/L | - | 100 | 4.1 | 0.10 | 7396013 | | | |
| pH | pH | 6.0:9.5 | 6.0:11.5 | 7.93 | | 7396625 | | | |
| Phenols-4AAP | mg/L | 0.008 | 1.0 | ND | 0.0010 | 7397267 | | | |
| Total Suspended Solids | mg/L | 15 | 350 | 18 | 10 | 7396288 | | | |
| Total Cyanide (CN) | mg/L | 0.02 | 2 | 0.0065 | 0.0050 | 7398649 | | | |
| Petroleum Hydrocarbons | | | | | | | | | |
| Total Oil & Grease | mg/L | - | - | ND | 0.50 | 7405214 | | | |
| Total Oil & Grease Mineral/Synthetic | mg/L | - | 15 | ND | 0.50 | 7405216 | | | |
| Miscellaneous Parameters | | | | | | | | | |
| Nonylphenol Ethoxylate (Total) | mg/L | 0.01 | 0.2 | ND | 0.005 | 7394581 | ND | 0.005 | 7394581 |
| Nonylphenol (Total) | mg/L | 0.001 | 0.02 | ND | 0.001 | 7394576 | ND | 0.001 | 7394576 |
| Metals | | | | | | | | | |
| Chromium (VI) | ug/L | 40 | 2000 | 1.5 | 0.50 | 7398320 | | | |
| Mercury (Hg) | mg/L | 0.0004 | 0.01 | 0.0014 | 0.00010 | 7402655 | | | |
| Total Aluminum (Al) | ug/L | - | 50000 | 320 | 4.9 | 7399755 | | | |
| Total Antimony (Sb) | ug/L | - | 5000 | 0.75 | 0.50 | 7399755 | | | |
| Total Arsenic (As) | ug/L | 20 | 1000 | ND | 1.0 | 7399755 | | | |
| Total Cadmium (Cd) | ug/L | 8 | 700 | ND | 0.090 | 7399755 | | | |
| Total Chromium (Cr) | ug/L | 80 | 4000 | ND | 5.0 | 7399755 | | | |
| Total Cobalt (Co) | ug/L | - | 5000 | ND | 0.50 | 7399755 | | | |
| Total Copper (Cu) | ug/L | 40 | 2000 | 54 | 0.90 | 7399755 | | | |

| | |
|---------|---------------------------------|
| No Fill | No Exceedance |
| Grey | Exceeds 1 criteria policy/level |
| Black | Exceeds both criteria/levels |

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

Criteria: Toronto Storm Sewer Discharge Use By-Law

Criteria-2: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681.

ND = Not detected

BUREAU
VERITASBV Labs Job #: C1F4810
Report Date: 2021/06/14exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TORONTO SANITARY&STORM SEWER (100-2016)

| BV Labs ID | | | | PTP755 | | | PTP755 | | | | | | | | | | | |
|---|---------------|----------|------------|---------------------|-------|----------|---------------------|-----|----------|---------------------------------|--|--|--|--|--|--|--|--|
| Sampling Date | | | | 2021/06/07 14:30 | | | 2021/06/07 14:30 | | | | | | | | | | | |
| COC Number | | | | 761730-71-01 | | | 761730-71-01 | | | | | | | | | | | |
| | UNITS | Criteria | Criteria-2 | SUMP 3 | RDL | QC Batch | SUMP 3 Lab-Dup | RDL | QC Batch | | | | | | | | | |
| Total Iron (Fe) | ug/L | - | - | 1600 | 100 | 7399755 | | | | | | | | | | | | |
| Total Lead (Pb) | ug/L | 120 | 1000 | 7.5 | 0.50 | 7399755 | | | | | | | | | | | | |
| Total Manganese (Mn) | ug/L | 50 | 5000 | 170 | 2.0 | 7399755 | | | | | | | | | | | | |
| Total Molybdenum (Mo) | ug/L | - | 5000 | 14 | 0.50 | 7399755 | | | | | | | | | | | | |
| Total Nickel (Ni) | ug/L | 80 | 2000 | 2.9 | 1.0 | 7399755 | | | | | | | | | | | | |
| Total Phosphorus (P) | ug/L | 400 | 10000 | 150 | 100 | 7399755 | | | | | | | | | | | | |
| Total Selenium (Se) | ug/L | 20 | 1000 | ND | 2.0 | 7399755 | | | | | | | | | | | | |
| Total Silver (Ag) | ug/L | 120 | 5000 | ND | 0.090 | 7399755 | | | | | | | | | | | | |
| Total Tin (Sn) | ug/L | - | 5000 | 1.8 | 1.0 | 7399755 | | | | | | | | | | | | |
| Total Titanium (Ti) | ug/L | - | 5000 | 16 | 5.0 | 7399755 | | | | | | | | | | | | |
| Total Zinc (Zn) | ug/L | 40 | 2000 | 89 | 5.0 | 7399755 | | | | | | | | | | | | |
| Semivolatile Organics | | | | | | | | | | | | | | | | | | |
| Di-N-butyl phthalate | ug/L | 15 | 80 | ND | 2 | 7396600 | ND | 2 | 7396600 | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | ug/L | 8.8 | 12 | 3 | 2 | 7396600 | 3 | 2 | 7396600 | | | | | | | | | |
| 3,3'-Dichlorobenzidine | ug/L | 0.8 | 2 | ND | 0.8 | 7396600 | ND | 0.8 | 7396600 | | | | | | | | | |
| Pentachlorophenol | ug/L | 2 | 5 | ND | 1 | 7396600 | ND | 1 | 7396600 | | | | | | | | | |
| Phenanthrene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Anthracene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Fluoranthene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Pyrene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Benzo(a)anthracene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Chrysene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Benzo(b/j)fluoranthene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Benzo(k)fluoranthene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Benzo(a)pyrene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| Indeno(1,2,3-cd)pyrene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 | | | | | | | | | |
| No Fill | No Exceedance | | | | | | | | | | | | | | | | | |
| Grey | | | | | | | | | | Exceeds 1 criteria policy/level | | | | | | | | |
| Black | | | | | | | | | | | | | | | | | | |
| RDL = Reportable Detection Limit | | | | | | | | | | | | | | | | | | |
| QC Batch = Quality Control Batch | | | | | | | | | | | | | | | | | | |
| Lab-Dup = Laboratory Initiated Duplicate | | | | | | | | | | | | | | | | | | |
| Criteria: Toronto Storm Sewer Discharge Use By-Law | | | | | | | | | | | | | | | | | | |
| Criteria-2: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681. | | | | | | | | | | | | | | | | | | |
| ND = Not detected | | | | | | | | | | | | | | | | | | |

BUREAU
VERITASBV Labs Job #: C1F4810
Report Date: 2021/06/14exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TORONTO SANITARY&STORM SEWER (100-2016)

| BV Labs ID | | | | PTP755 | | | PTP755 | | |
|---|---------------------------------|----------|------------|---------------------|------|----------|---------------------|-----|----------|
| Sampling Date | | | | 2021/06/07 14:30 | | | 2021/06/07 14:30 | | |
| COC Number | | | | 761730-71-01 | | | 761730-71-01 | | |
| | UNITS | Criteria | Criteria-2 | SUMP 3 | RDL | QC Batch | SUMP 3 Lab-Dup | RDL | QC Batch |
| Dibenzo(a,h)anthracene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 |
| Benzo(g,h,i)perylene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 |
| Dibenzo(a,i)pyrene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 |
| Benzo(e)pyrene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 |
| Perylene | ug/L | - | - | ND | 0.2 | 7396600 | ND | 0.2 | 7396600 |
| Dibenzo(a,j) acridine | ug/L | - | - | ND | 0.4 | 7396600 | ND | 0.4 | 7396600 |
| 7H-Dibenzo(c,g) Carbazole | ug/L | - | - | ND | 0.4 | 7396600 | ND | 0.4 | 7396600 |
| 1,6-Dinitropyrene | ug/L | - | - | ND | 0.4 | 7396600 | ND | 0.4 | 7396600 |
| 1,3-Dinitropyrene | ug/L | - | - | ND | 0.4 | 7396600 | ND | 0.4 | 7396600 |
| 1,8-Dinitropyrene | ug/L | - | - | ND | 0.4 | 7396600 | ND | 0.4 | 7396600 |
| Calculated Parameters | | | | | | | | | |
| Total PAHs (18 PAHs) | ug/L | 2 | 5 | ND | 1 | 7394077 | | | |
| Volatile Organics | | | | | | | | | |
| Benzene | ug/L | 2 | 10 | ND | 0.40 | 7396302 | | | |
| Chloroform | ug/L | 2 | 40 | ND | 0.40 | 7396302 | | | |
| 1,2-Dichlorobenzene | ug/L | 5.6 | 50 | ND | 0.80 | 7396302 | | | |
| 1,4-Dichlorobenzene | ug/L | 6.8 | 80 | ND | 0.80 | 7396302 | | | |
| cis-1,2-Dichloroethylene | ug/L | 5.6 | 4000 | ND | 1.0 | 7396302 | | | |
| trans-1,3-Dichloropropene | ug/L | 5.6 | 140 | ND | 0.80 | 7396302 | | | |
| Ethylbenzene | ug/L | 2 | 160 | ND | 0.40 | 7396302 | | | |
| Methylene Chloride(Dichloromethane) | ug/L | 5.2 | 2000 | ND | 4.0 | 7396302 | | | |
| 1,1,2,2-Tetrachloroethane | ug/L | 17 | 1400 | ND | 0.80 | 7396302 | | | |
| Tetrachloroethylene | ug/L | 4.4 | 1000 | ND | 0.40 | 7396302 | | | |
| Toluene | ug/L | 2 | 16 | ND | 0.40 | 7396302 | | | |
| Trichloroethylene | ug/L | 7.6 | 400 | ND | 0.40 | 7396302 | | | |
| p+m-Xylene | ug/L | - | - | ND | 0.40 | 7396302 | | | |
| No Fill | No Exceedance | | | | | | | | |
| Grey | Exceeds 1 criteria policy/level | | | | | | | | |
| Black | Exceeds both criteria/levels | | | | | | | | |
| RDL = Reportable Detection Limit | | | | | | | | | |
| QC Batch = Quality Control Batch | | | | | | | | | |
| Lab-Dup = Laboratory Initiated Duplicate | | | | | | | | | |
| Criteria: Toronto Storm Sewer Discharge Use By-Law | | | | | | | | | |
| Criteria-2: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681. | | | | | | | | | |
| ND = Not detected | | | | | | | | | |



BUREAU
VERITAS

BV Labs Job #: C1F4810
Report Date: 2021/06/14

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TORONTO SANITARY&STORM SEWER (100-2016)

| BV Labs ID | | | | PTP755 | | | PTP755 | | |
|---|---------------------------------|----------|------------|---------------------|------|----------|---------------------|-----|----------|
| Sampling Date | | | | 2021/06/07 14:30 | | | 2021/06/07 14:30 | | |
| COC Number | | | | 761730-71-01 | | | 761730-71-01 | | |
| | UNITS | Criteria | Criteria-2 | SUMP 3 | RDL | QC Batch | SUMP 3 Lab-Dup | RDL | QC Batch |
| o-Xylene | ug/L | - | - | ND | 0.40 | 7396302 | | | |
| Total Xylenes | ug/L | 4.4 | 1400 | ND | 0.40 | 7396302 | | | |
| PCBs | | | | | | | | | |
| Total PCB | ug/L | 0.4 | 1 | ND | 0.05 | 7397188 | | | |
| Microbiological | | | | | | | | | |
| Escherichia coli | CFU/100mL | 200 | - | <10 | 10 | 7394234 | | | |
| Surrogate Recovery (%) | | | | | | | | | |
| 2,4,6-Tribromophenol | % | - | - | 73 | | 7396600 | 70 | | 7396600 |
| 2-Fluorobiphenyl | % | - | - | 38 | | 7396600 | 38 | | 7396600 |
| D14-Terphenyl (FS) | % | - | - | 78 | | 7396600 | 78 | | 7396600 |
| D5-Nitrobenzene | % | - | - | 38 | | 7396600 | 38 | | 7396600 |
| D8-Acenaphthylene | % | - | - | 53 | | 7396600 | 54 | | 7396600 |
| Decachlorobiphenyl | % | - | - | 96 | | 7397188 | | | |
| 4-Bromofluorobenzene | % | - | - | 94 | | 7396302 | | | |
| D4-1,2-Dichloroethane | % | - | - | 108 | | 7396302 | | | |
| D8-Toluene | % | - | - | 96 | | 7396302 | | | |
| No Fill | No Exceedance | | | | | | | | |
| Grey | Exceeds 1 criteria policy/level | | | | | | | | |
| Black | Exceeds both criteria/levels | | | | | | | | |
| RDL = Reportable Detection Limit | | | | | | | | | |
| QC Batch = Quality Control Batch | | | | | | | | | |
| Lab-Dup = Laboratory Initiated Duplicate | | | | | | | | | |
| Criteria: Toronto Storm Sewer Discharge Use By-Law | | | | | | | | | |
| Criteria-2: Toronto Sanitary and Combined Sewers Discharge Guidelines. Referenced to the Chapter 681. | | | | | | | | | |
| ND = Not detected | | | | | | | | | |



BUREAU
VERITAS

BV Labs Job #: C1F4810
Report Date: 2021/06/14

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

TEST SUMMARY

BV Labs ID: PTP755
Sample ID: SUMP 3
Matrix: Water

Collected: 2021/06/07
Shipped:
Received: 2021/06/07

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|--|-----------------|---------|------------|---------------|---------------------|
| Sewer Use By-Law Semivolatile Organics | GC/MS | 7396600 | 2021/06/08 | 2021/06/10 | Kathy Horvat |
| Biochemical Oxygen Demand (BOD) | DO | 7394826 | 2021/06/08 | 2021/06/13 | Frank Zhang |
| Chromium (VI) in Water | IC | 7398320 | N/A | 2021/06/10 | Lang Le |
| Total Cyanide | SKAL/CN | 7398649 | 2021/06/09 | 2021/06/09 | Aditiben Patel |
| Fluoride | ISE | 7396606 | 2021/06/08 | 2021/06/09 | Surinder Rai |
| Mercury in Water by CVAA | CV/AA | 7402655 | 2021/06/11 | 2021/06/11 | Gagandeep Rai |
| Total Metals Analysis by ICPMS | ICP/MS | 7399755 | N/A | 2021/06/10 | Prempal Bhatti |
| E.coli, (CFU/100mL) | PL | 7394234 | N/A | 2021/06/07 | Farhana Rahman |
| Total Nonylphenol in Liquids by HPLC | LC/FLU | 7394576 | 2021/06/08 | 2021/06/08 | Dennis Boodram |
| Nonylphenol Ethoxylates in Liquids: HPLC | LC/FLU | 7394581 | 2021/06/08 | 2021/06/08 | Dennis Boodram |
| Animal and Vegetable Oil and Grease | BAL | 7393285 | N/A | 2021/06/13 | Automated Statchk |
| Total Oil and Grease | BAL | 7405214 | 2021/06/12 | 2021/06/13 | Mitul Patel |
| Polychlorinated Biphenyl in Water | GC/ECD | 7397188 | 2021/06/09 | 2021/06/09 | Svitlana Shaula |
| pH | AT | 7396625 | 2021/06/08 | 2021/06/09 | Surinder Rai |
| Phenols (4AAP) | TECH/PHEN | 7397267 | N/A | 2021/06/09 | Deonarine Ramnarine |
| Total Kjeldahl Nitrogen in Water | SKAL | 7396013 | 2021/06/08 | 2021/06/09 | Massarat Jan |
| Total PAHs | CALC | 7394077 | N/A | 2021/06/10 | Automated Statchk |
| Mineral/Synthetic O & G (TPH Heavy Oil) | BAL | 7405216 | 2021/06/12 | 2021/06/13 | Mitul Patel |
| Total Suspended Solids | BAL | 7396288 | 2021/06/08 | 2021/06/09 | Sandeep Kaur |
| Volatile Organic Compounds in Water | GC/MS | 7396302 | N/A | 2021/06/11 | Rebecca McClean |

BV Labs ID: PTP755 Dup
Sample ID: SUMP 3
Matrix: Water

Collected: 2021/06/07
Shipped:
Received: 2021/06/07

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|--|-----------------|---------|------------|---------------|----------------|
| Sewer Use By-Law Semivolatile Organics | GC/MS | 7396600 | 2021/06/08 | 2021/06/10 | Kathy Horvat |
| Total Nonylphenol in Liquids by HPLC | LC/FLU | 7394576 | 2021/06/08 | 2021/06/08 | Dennis Boodram |
| Nonylphenol Ethoxylates in Liquids: HPLC | LC/FLU | 7394581 | 2021/06/08 | 2021/06/08 | Dennis Boodram |



BUREAU
VERITAS

BV Labs Job #: C1F4810
Report Date: 2021/06/14

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

| | |
|-----------|--------|
| Package 1 | 16.0°C |
|-----------|--------|

Sample PTP755 [SUMP 3] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

BUREAU
VERITAS

BV Labs Job #: C1F4810

Report Date: 2021/06/14

QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|-------------------------------------|------------|--------------|-----------|--------------|-----------|------------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7396302 | 4-Bromofluorobenzene | 2021/06/10 | 101 | 70 - 130 | 101 | 70 - 130 | 98 | % | | | | |
| 7396302 | D4-1,2-Dichloroethane | 2021/06/10 | 105 | 70 - 130 | 101 | 70 - 130 | 104 | % | | | | |
| 7396302 | D8-Toluene | 2021/06/10 | 101 | 70 - 130 | 103 | 70 - 130 | 98 | % | | | | |
| 7396600 | 2,4,6-Tribromophenol | 2021/06/10 | 73 | 10 - 130 | 79 | 10 - 130 | 74 | % | | | | |
| 7396600 | 2-Fluorobiphenyl | 2021/06/10 | 61 | 30 - 130 | 67 | 30 - 130 | 72 | % | | | | |
| 7396600 | D14-Terphenyl (FS) | 2021/06/10 | 85 | 30 - 130 | 86 | 30 - 130 | 85 | % | | | | |
| 7396600 | D5-Nitrobenzene | 2021/06/10 | 90 | 30 - 130 | 97 | 30 - 130 | 91 | % | | | | |
| 7396600 | D8-Acenaphthylene | 2021/06/10 | 81 | 30 - 130 | 81 | 30 - 130 | 83 | % | | | | |
| 7397188 | Decachlorobiphenyl | 2021/06/09 | 102 | 60 - 130 | 82 | 60 - 130 | 107 | % | | | | |
| 7394576 | Nonylphenol (Total) | 2021/06/08 | 121 | 50 - 130 | 110 | 50 - 130 | ND, RDL=0.001 | mg/L | NC | 40 | | |
| 7394581 | Nonylphenol Ethoxylate (Total) | 2021/06/08 | 105 | 50 - 130 | 113 | 50 - 130 | ND, RDL=0.005 | mg/L | NC | 40 | | |
| 7394826 | Total BOD | 2021/06/13 | | | | | ND,RDL=2 | mg/L | NC | 30 | 100 | 80 - 120 |
| 7396013 | Total Kjeldahl Nitrogen (TKN) | 2021/06/09 | 98 | 80 - 120 | 104 | 80 - 120 | ND, RDL=0.10 | mg/L | 12 | 20 | 101 | 80 - 120 |
| 7396288 | Total Suspended Solids | 2021/06/09 | | | | | ND, RDL=10 | mg/L | NC | 25 | 99 | 85 - 115 |
| 7396302 | 1,1,2,2-Tetrachloroethane | 2021/06/11 | 114 | 70 - 130 | 106 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |
| 7396302 | 1,2-Dichlorobenzene | 2021/06/11 | 104 | 70 - 130 | 101 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |
| 7396302 | 1,4-Dichlorobenzene | 2021/06/11 | 116 | 70 - 130 | 113 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |
| 7396302 | Benzene | 2021/06/11 | 94 | 70 - 130 | 92 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | Chloroform | 2021/06/11 | 107 | 70 - 130 | 104 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | cis-1,2-Dichloroethylene | 2021/06/11 | 108 | 70 - 130 | 105 | 70 - 130 | ND, RDL=0.50 | ug/L | NC | 30 | | |
| 7396302 | Ethylbenzene | 2021/06/11 | 92 | 70 - 130 | 91 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | Methylene Chloride(Dichloromethane) | 2021/06/11 | 117 | 70 - 130 | 113 | 70 - 130 | ND, RDL=2.0 | ug/L | NC | 30 | | |
| 7396302 | o-Xylene | 2021/06/11 | 90 | 70 - 130 | 91 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | p+m-Xylene | 2021/06/11 | 94 | 70 - 130 | 93 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | Tetrachloroethylene | 2021/06/11 | 100 | 70 - 130 | 99 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | Toluene | 2021/06/11 | 98 | 70 - 130 | 96 | 70 - 130 | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | Total Xylenes | 2021/06/11 | | | | | ND, RDL=0.20 | ug/L | NC | 30 | | |
| 7396302 | trans-1,3-Dichloropropene | 2021/06/11 | 109 | 70 - 130 | 94 | 70 - 130 | ND, RDL=0.40 | ug/L | NC | 30 | | |

BUREAU
VERITAS

BV Labs Job #: C1F4810

Report Date: 2021/06/14

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|----------------------------|------------|--------------|-----------|--------------|-----------|-------------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7396302 | Trichloroethylene | 2021/06/11 | 112 | 70 - 130 | 110 | 70 - 130 | ND, RDL=0.20 | ug/L | 0.31 | 30 | | |
| 7396600 | 1,3-Dinitropyrene | 2021/06/10 | 64 | 30 - 130 | 99 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7396600 | 1,6-Dinitropyrene | 2021/06/10 | 48 | 30 - 130 | 107 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7396600 | 1,8-Dinitropyrene | 2021/06/10 | 36 | 30 - 130 | 81 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7396600 | 3,3'-Dichlorobenzidine | 2021/06/10 | 50 | 30 - 130 | 106 | 30 - 130 | ND, RDL=0.8 | ug/L | NC | 40 | | |
| 7396600 | 7H-Dibenzo(c,g) Carbazole | 2021/06/10 | 101 | 30 - 130 | 95 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7396600 | Anthracene | 2021/06/10 | 84 | 30 - 130 | 86 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Benzo(a)anthracene | 2021/06/10 | 92 | 30 - 130 | 94 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Benzo(a)pyrene | 2021/06/10 | 76 | 30 - 130 | 84 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Benzo(b,j)fluoranthene | 2021/06/10 | 90 | 30 - 130 | 93 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Benzo(e)pyrene | 2021/06/10 | 92 | 30 - 130 | 100 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Benzo(g,h,i)perylene | 2021/06/10 | 83 | 30 - 130 | 103 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Benzo(k)fluoranthene | 2021/06/10 | 91 | 30 - 130 | 103 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Bis(2-ethylhexyl)phthalate | 2021/06/10 | 103 | 30 - 130 | 102 | 30 - 130 | ND,RDL=2 | ug/L | 0.093 | 40 | | |
| 7396600 | Chrysene | 2021/06/10 | 95 | 30 - 130 | 98 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Dibenzo(a,h)anthracene | 2021/06/10 | 87 | 30 - 130 | 103 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Dibenzo(a,i)pyrene | 2021/06/10 | 44 | 30 - 130 | 107 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Dibenzo(a,j) acridine | 2021/06/10 | 85 | 30 - 130 | 103 | 30 - 130 | ND, RDL=0.4 | ug/L | NC | 40 | | |
| 7396600 | Di-N-butyl phthalate | 2021/06/10 | 62 | 30 - 130 | 102 | 30 - 130 | ND,RDL=2 | ug/L | NC | 40 | | |
| 7396600 | Fluoranthene | 2021/06/10 | 95 | 30 - 130 | 97 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Indeno(1,2,3-cd)pyrene | 2021/06/10 | 89 | 30 - 130 | 106 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Pentachlorophenol | 2021/06/10 | 42 | 30 - 130 | 67 | 30 - 130 | ND,RDL=1 | ug/L | NC | 40 | | |
| 7396600 | Perylene | 2021/06/10 | 96 | 30 - 130 | 96 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Phenanthrene | 2021/06/10 | 87 | 30 - 130 | 89 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396600 | Pyrene | 2021/06/10 | 96 | 30 - 130 | 97 | 30 - 130 | ND, RDL=0.2 | ug/L | NC | 40 | | |
| 7396606 | Fluoride (F-) | 2021/06/09 | 99 | 80 - 120 | 95 | 80 - 120 | ND, RDL=0.10 | mg/L | NC | 20 | | |
| 7396625 | pH | 2021/06/09 | | | 102 | 98 - 103 | | | 0.34 | N/A | | |
| 7397188 | Total PCB | 2021/06/09 | 101 | 60 - 130 | 84 | 60 - 130 | ND, RDL=0.05 | ug/L | NC | 40 | | |
| 7397267 | Phenols-4AAP | 2021/06/09 | 101 | 80 - 120 | 99 | 80 - 120 | ND, RDL=0.0010 | mg/L | NC | 20 | | |



BUREAU
VERITAS

BV Labs Job #: C1F4810

Report Date: 2021/06/14

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|-----------------------|------------|--------------|-----------|--------------|-----------|--------------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7398320 | Chromium (VI) | 2021/06/10 | 97 | 80 - 120 | 103 | 80 - 120 | ND, RDL=0.50 | ug/L | NC | 20 | | |
| 7398649 | Total Cyanide (CN) | 2021/06/09 | 94 | 80 - 120 | 100 | 80 - 120 | ND, RDL=0.0050 | mg/L | NC | 20 | | |
| 7399755 | Total Aluminum (Al) | 2021/06/10 | 96 | 80 - 120 | 91 | 80 - 120 | ND, RDL=4.9 | ug/L | 3.6 | 20 | | |
| 7399755 | Total Antimony (Sb) | 2021/06/10 | 104 | 80 - 120 | 97 | 80 - 120 | ND, RDL=0.50 | ug/L | | | | |
| 7399755 | Total Arsenic (As) | 2021/06/10 | 100 | 80 - 120 | 95 | 80 - 120 | ND, RDL=1.0 | ug/L | | | | |
| 7399755 | Total Cadmium (Cd) | 2021/06/10 | 99 | 80 - 120 | 95 | 80 - 120 | ND, RDL=0.090 | ug/L | NC | 20 | | |
| 7399755 | Total Chromium (Cr) | 2021/06/10 | 96 | 80 - 120 | 91 | 80 - 120 | ND, RDL=5.0 | ug/L | NC | 20 | | |
| 7399755 | Total Cobalt (Co) | 2021/06/10 | 99 | 80 - 120 | 96 | 80 - 120 | ND, RDL=0.50 | ug/L | NC | 20 | | |
| 7399755 | Total Copper (Cu) | 2021/06/10 | 101 | 80 - 120 | 98 | 80 - 120 | ND, RDL=0.90 | ug/L | 1.5 | 20 | | |
| 7399755 | Total Iron (Fe) | 2021/06/10 | 96 | 80 - 120 | 92 | 80 - 120 | ND, RDL=100 | ug/L | NC | 20 | | |
| 7399755 | Total Lead (Pb) | 2021/06/10 | 96 | 80 - 120 | 93 | 80 - 120 | ND, RDL=0.50 | ug/L | NC | 20 | | |
| 7399755 | Total Manganese (Mn) | 2021/06/10 | 97 | 80 - 120 | 92 | 80 - 120 | ND, RDL=2.0 | ug/L | 0.50 | 20 | | |
| 7399755 | Total Molybdenum (Mo) | 2021/06/10 | 104 | 80 - 120 | 94 | 80 - 120 | ND, RDL=0.50 | ug/L | 1.1 | 20 | | |
| 7399755 | Total Nickel (Ni) | 2021/06/10 | 96 | 80 - 120 | 94 | 80 - 120 | ND, RDL=1.0 | ug/L | NC | 20 | | |
| 7399755 | Total Phosphorus (P) | 2021/06/10 | 103 | 80 - 120 | 102 | 80 - 120 | ND, RDL=100 | ug/L | | | | |
| 7399755 | Total Selenium (Se) | 2021/06/10 | 101 | 80 - 120 | 99 | 80 - 120 | ND, RDL=2.0 | ug/L | | | | |
| 7399755 | Total Silver (Ag) | 2021/06/10 | 98 | 80 - 120 | 93 | 80 - 120 | ND, RDL=0.090 | ug/L | NC | 20 | | |
| 7399755 | Total Tin (Sn) | 2021/06/10 | 100 | 80 - 120 | 93 | 80 - 120 | ND, RDL=1.0 | ug/L | | | | |
| 7399755 | Total Titanium (Ti) | 2021/06/10 | 95 | 80 - 120 | 92 | 80 - 120 | ND, RDL=5.0 | ug/L | | | | |
| 7399755 | Total Zinc (Zn) | 2021/06/10 | 100 | 80 - 120 | 98 | 80 - 120 | ND, RDL=5.0 | ug/L | | | | |
| 7402655 | Mercury (Hg) | 2021/06/11 | 98 | 75 - 125 | 98 | 80 - 120 | ND, RDL=0.00010 | mg/L | NC | 20 | | |
| 7405214 | Total Oil & Grease | 2021/06/13 | | | 99 | 85 - 115 | ND, RDL=0.50 | mg/L | 2.8 | 25 | | |



BUREAU
VERITAS

BV Labs Job #: C1F4810

Report Date: 2021/06/14

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

| QC Batch | Parameter | Date | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | | QC Standard | |
|----------|--------------------------------------|------------|--------------|-----------|--------------|-----------|--------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 7405216 | Total Oil & Grease Mineral/Synthetic | 2021/06/13 | | | 97 | 85 - 115 | ND, RDL=0.50 | mg/L | 6.4 | 25 | | |

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times$ RDL).



BUREAU
VERITAS

BV Labs Job #: C1F4810
Report Date: 2021/06/14

exp Services Inc
Client Project #: BRM-00607558-A0
Site Location: 214 COLLEGE ST
Your P.O. #: ENV-BRM
Sampler Initials: CS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist

Farhana Rahman, Senior Analyst

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Bureau Veritas Laboratories
6740 Campbell Road, Mississauga, Ontario Canada L5N 2L8 Tel (905) 817-5700 Toll-free 800-563-6266 Fax (905) 817-5777 www.bvlabs.com

CHAIN OF CUSTODY RECORD

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BUREAU
VERITAS

BV Labs Job #: C1F4810

Report Date: 2021/06/14

exp Services Inc

Client Project #: BRM-00607558-A0

Site Location: 214 COLLEGE ST

Your P.O. #: ENV-BRM

Sampler Initials: CS

Exceedance Summary Table – Toronto Storm Sewer

Result Exceedances

| Sample ID | BV Labs ID | Parameter | Criteria | Result | DL | UNITS |
|-----------|------------|------------------------|----------|--------|---------|-------|
| SUMP 3 | PTP755-09 | Total Copper (Cu) | 40 | 54 | 0.90 | ug/L |
| SUMP 3 | PTP755-09 | Total Manganese (Mn) | 50 | 170 | 2.0 | ug/L |
| SUMP 3 | PTP755-12 | Mercury (Hg) | 0.0004 | 0.0014 | 0.00010 | mg/L |
| SUMP 3 | PTP755-05 | Total Suspended Solids | 15 | 18 | 10 | mg/L |
| SUMP 3 | PTP755-09 | Total Zinc (Zn) | 40 | 89 | 5.0 | ug/L |

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedance Summary Table – Toronto Sanitary Sewer

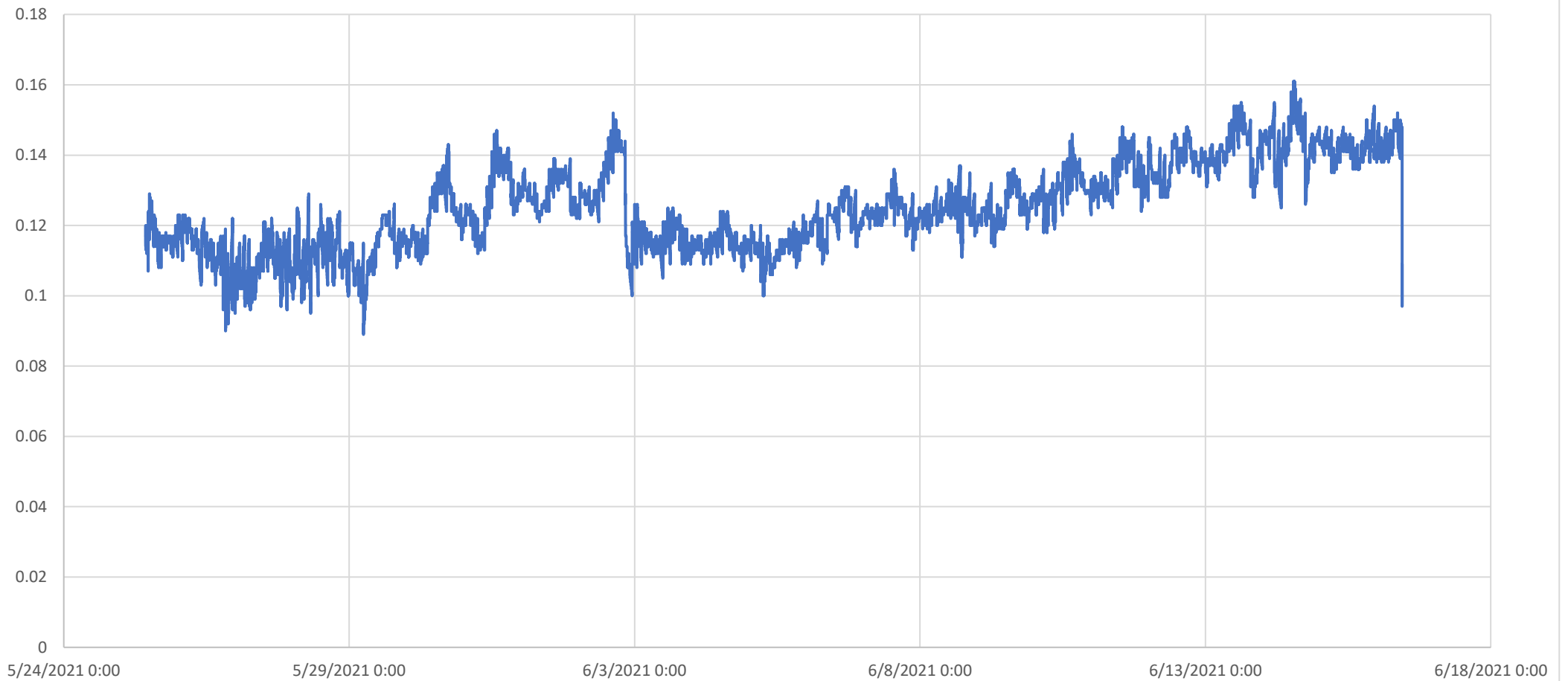
Result Exceedances

| Sample ID | BV Labs ID | Parameter | Criteria | Result | DL | UNITS |
|----------------|------------|-----------|----------|--------|----|-------|
| No Exceedances | | | | | | |

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Appendix E – Continuous Water Level Monitoring Results

214 College - Sump 1 Water levles
May 25, 2021 to June 16, 2021



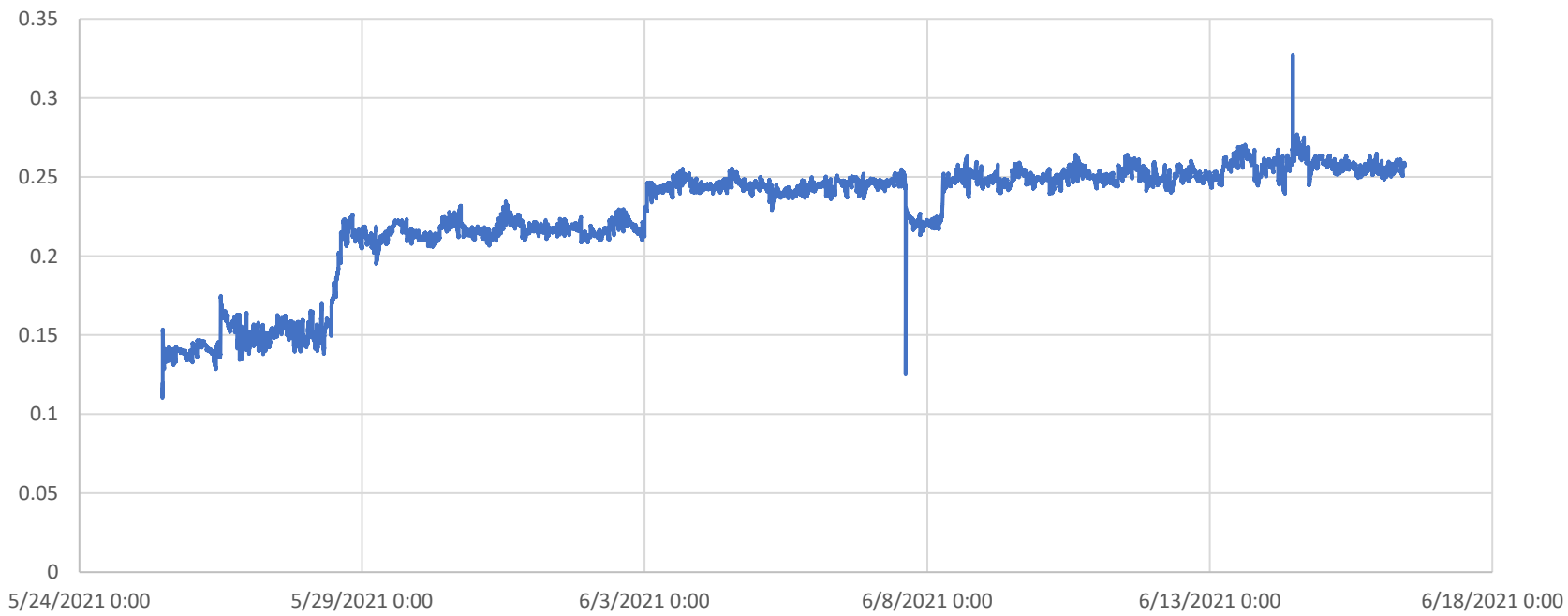
214 College - Sump 2 Water Levels

May 25, 2021 to June 16, 2021



Sump 2 located at Koffler Student Services

214 College - Sump 3 Water Levels
May 25, 2021 to June 16, 2021



Appendix F – Sump Discharge Rate Assessment

Appndix F - Sump Discharge Rate Estimate (Sump 2)

214 College St, Toronto

BRM-00607558-A0

Discharge Cycles

| Sump Details | | |
|--------------|-------|----------------|
| Diameter | 0.50 | m |
| Radius | 0.25 | m |
| Area | 0.196 | m ² |
| Depth | 0.78 | m |

| Pump Cycle | Date/Time | Water Levels (m) | | | Time Pump is off (days) | Time Pump is off (min) | Total WL Increase when pump is Off (m) | Total Discharge into Sump when pump is OFF (m3) | Volume pumped* (m3) | Time Pump on (h:mm) | Time Pump on (min) | Discharge* (m ³ /min) |
|------------|------------------------------------|------------------|-------------|---------------|-------------------------|------------------------|--|---|---------------------|---------------------|--------------------|----------------------------------|
| | | Pump ON | Pump OFF | WL Difference | | | | | | | | |
| 1 | 6/2/2021 20:11 6/2/2021 20:42 | 0.7268 - | - 0.1643 | 0.5625 | | | | | 0.11 | 0:31 | 31 | 0.004 |
| 2 | 6/7/2021 17:12 6/7/2021 17:18 | 0.4824 - | - 0.1608 | 0.3216 | 4.85 | 6990 | 0.3181 | 0.062 | 0.06 | 0:06 | 6 | 0.011 |
| 3 | 6/10/2021 16:08 6/10/2021 16:22 | 0.5088 - | - 0.1768 | 0.332 | 2.95 | 4250 | 0.348 | 0.068 | 0.07 | 0:14 | 14 | 0.005 |
| 4 | 6/14/2021 13:41 6/14/2021 13:43 | 0.5155 - | - 0.1635 | 0.352 | 3.89 | 5599 | 0.2517 | 0.049 | 0.07 | 0:02 | 2 | 0.035 |
| 5 | 6/16/2021 10:26 6/16/2021 11:41 | 0.4152 - | - 0.1083 | 0.3069 | 1.86 | 2683 | | | 0.06 | 1:15 | 75 | 0.001 |
| Total | | 1.31 | | | 13.56 | 19522 | 0.92 | 0.18 | 0.37 | 2:08 | 128.00 | |

| Pumping | Duration | Volume Pumped when pump is on* (m3) | Time in Days | Pumping Rate* m ³ /day | Total Pumping Rate** m ³ /day |
|---------|-----------------------------------|-------------------------------------|--------------|-----------------------------------|--|
| Average | 6/2/2021 20:11 6/16/2021 11:41 | 0.37 | 13.65 | 0.0270 | 0.0271 |
| Maximum | 6/2/2021 20:11 6/2/2021 20:42 | 0.11 | 1.00 | 0.1104 | 0.1107 |

| | | |
|---|----------|--------|
| Average pumping rate of discharge into the sump-when pump off | 0.000009 | m3/min |
| | 0.013 | m3/day |

Notes:

*excluding volume discharged into the sump when pump is on

**including discharge into sump during pumping (pump is on)

214 College - Sump 2 Water Levels

May 25, 2021 to June 16, 2021



Sump 2 located at Koffler Student Services



FORMERLY FGMDA

HERITAGE IMPACT ASSESSMENT

Koffler Health and Wellness Centre Renovation and Addition

KOFFLER STUDENT SERVICES CENTRE

UNIVERSITY OF TORONTO
214 COLLEGE STREET, TORONTO
PROJECT NO. EVOQ: 9385-20-00

ISSUE DATE: NOVEMBER 15, 2024

ISSUED FOR BUILDING PERMIT



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1.0 Introduction

1.1 Scope of Report

This Heritage Impact Assessment has been prepared by EVOQ Architecture Inc. for the University of Toronto as part of a proposed renovation and expansion of Koffler Health and Wellness Centre within the Koffler Student Services Centre Building. This building is located at 214 College Street, and is home to essential student services for the university, such as the Campus Bookstore, academic and career departments, the Health and Wellness Centre, housing support services and the Family Care Office. The property is included on the City of Toronto Heritage Register and is designated Part IV under the Ontario Heritage Act. By-Law 509-75 was passed by City Council on November 26, 1975.

The proposed interventions to the Koffler Student Centre Building, hereby referred to as the Proposal, include the renovation of selected interior spaces and the addition of two storeys to the existing structure at the rear, structural upgrades as required, and a new accessible entrance along St. George Street.

The purpose of this Heritage Impact Assessment (HIA) is to evaluate the impact the Proposal will have on the existing cultural heritage resources of the Subject Property and to recommend an overall approach to the conservation of these resources.

The following Proposal documents were reviewed as part of the HIA:

- Health and Wellness Centre Koffler Centre Renovation, Project No. 23-011 (P143-19-100), Issued for Client Review, dated October 4, 2024, by ENFORM Architects.
- University of Toronto Health & Wellness Centre at Koffler Renovation, Project No. EN023-00965, Issued for Progress Issuance, dated October 4, 2024, by ENTUITIVE.
- Health and Wellness Centre Renovation at Koffler, Project No. 21590.003, Mechanical, Issued for 50% Review, dated October 4, 2024, by Smith + Andersen.
- Health and Wellness Centre Renovation at Koffler, Project No. 21590.003, Electrical, progress set, received October 18, 2024, by Smith + Andersen.
- Health and Wellness Centre at Koffler Renovation, Project No. P143-19-100, Landscape, Issued for Building Permit, dated February 16, 2024, by Henry Kortekaas & Associates Inc.

1.2 Statement of Professional Qualifications

EVOQ is an award-winning architecture firm recognized for quality interventions and site sensitive design solutions. Our name, EVOQ, is also our conviction that architecture should be an expression of meaning.

As contextual architects, we are always looking at the broader picture, respecting the history, culture and location of each project to inform our design process. Our purpose is to create a link between past, present and future with creativity and nuance. The firm, formerly known as FGMDA, was first established in 1996, following the merger of two offices founded in 1983. In 2016, we incorporated and changed our name to EVOQ Architecture. For over 30 years, EVOQ has been at the forefront of heritage conservation in Canada. EVOQ has consistently provided leadership in the stewardship of heritage architecture. In re-imagining the evolution of places and spaces and refining their forms, EVOQ is always mindful of their essential inherent quality and seeks solutions that are respectful of the place and the environment.

Report personnel involved:

Dima Cook OAA, OAAQ, AAA, AIBC, AANB, CAHP, MRAIC, LEED AP

Dima has extensive experience in heritage conservation, construction and project management. She is recognized for managing large, complex projects from early design to contract administration. As Principal with EVOQ, Dima was responsible for opening and directing the firm's Toronto office in 2012.

She served as the co-chair of the APT Sustainable Preservation Sub-committee on Climate Change from 2011 to 2016 and was appointed to the City of Toronto Design Review Panel as Heritage Representative in 2014. Dima was elected to the CAHP Board of Directors from 2018 to 2022 and continues to chair the Advocacy Committee focused on issues of Climate Change and Sustainability. She is a sought-after guest speaker and is frequently invited to participate in peer review committees.

Michael MacNeill OAA

Michael is an architect with experience in renovations, additions, and reuse on a wide range of projects, from smaller residential and commercial work to larger institutional buildings. He is technical adept, with particular expertise in detailing and building envelope design. He has recently expanded his experience working on mandates within the heritage context; his recent work includes heritage reporting and heritage approvals at municipal and federal levels.

1.3 Executive Summary

The Health and Wellness Centre (HWC) at University of Toronto provides critical services for the university community. They offer a range of health services for physical health, mental health, and wellness programs.

HWC's mission is

to promote and support student well-being through inclusive, evidence-based, and collaborative programming and healthcare

HWC's vision is

That all students feel part of a connected campus community that nurtures and empowers their individual well-being and ability to thrive.

The proposed development is seeking to renew and expand the HWC within the historic Koffler building. The proposed scope consists of interior clinic and office renovations on the ground, second and third floors, a new elevator connecting the three floors, and an upgraded stair and ramp at the secondary St. George Street entrance. This work will allow the provision of health services in one consolidated location. .

The purpose of this HIA is to review the renovations' impacts to this designated Part IV building.

This HIA assessment finds that the proposed development conserves the integrity of the cultural heritage resource and its heritage attributes. There are minimal heritage impact; the interior renovations occur within non-heritage spaces. The two exterior additions, of the upgraded front entrance ramp and stair and the elevator, does not impact the legibility of the heritage character of the Koffler Centre. They are discrete and visually mitigated by being compatible with and distinguishable from the heritage fabric.

The proposed development will have an overall positive impact. It allows for a portion of the building's interior to be renewed and its accessibility upgraded in a manner that conserves the buildings heritage form and character. It allows the expanded HWC to meet its mission to serve the physical and mental health needs of the University of Toronto community.

1.4 Property Owner

The Governing Council of The University of Toronto
27 King's College Circle
Simcoe Hall, Room 106
Toronto, ON M5S 1A1

1.5 Owner's Representative or Agent

Melissa Lao P. Eng
Project Manager, Project Management
University Planning, Design & Construction
Operations & Real Estate Partnerships
University of Toronto
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2.0 Applicable Guidelines and Key Heritage Policies

This section outlines the relevant policies and guidelines used to inform the evaluation of the Proposal and the preparation of the HIA.

HIA Terms of Reference

This Heritage Impact Assessment Report adheres to the Terms of References for HIAs, as defined by the City of Toronto.

Parks Canada Standards and Guidelines for the Conservation of Historic Places in Canada

The Standards and Guidelines for the Conservation of Historic Places in Canada forms the basis of the approach to heritage conservation that was used to produce this HIA. The process defined by the document of understanding, planning, and intervening was closely adhered to when assessing the impact of the Proposal on the cultural heritage value of the Subject Property and its heritage attributes (character-defining elements). The primary treatment for the Proposal, as defined in the Standards and Guidelines, is rehabilitation. The following standards apply for the rehabilitation of a heritage property:

- 1. Conserve the heritage value of an historic place. Do not remove, replace or substantially alter its intact or repairable character-defining elements. Do not move a part of an historic place if its current location is a character-defining element.*
- 2. Conserve changes to an historic place that, over time, have become character-defining elements in their own right.*
- 3. Conserve heritage value by adopting an approach calling for minimal intervention.*
- 4. Recognize each historic place as a physical record of its time, place and use. Do not create a false sense of historical development by adding elements from other historic places or properties, or by combining features of the same property that never coexisted.*
- 5. Find a use for an historic place that requires minimal or no change to its character-defining elements.*
- 6. Protect and, if necessary, stabilize an historic place until any subsequent intervention is undertaken. Protect and preserve archaeological resources, take mitigation measures to limit damage and loss of information.*
- 7. Evaluate the existing condition of character-defining elements to determine the appropriate intervention needed. Use the gentlest means possible for any intervention. Respect heritage value when undertaking an intervention.*

8. Maintain character-defining elements on an ongoing basis. Repair character-defining elements by reinforcing their materials using recognized conservation methods. Replace in kind any extensively deteriorated or missing parts of character-defining elements, where there are surviving prototypes.

9. Make any intervention needed to preserve character-defining elements physically and visually compatible with the historic place and identifiable on close inspection. Document any intervention for future reference.

10. Repair rather than replace character-defining elements. Where character-defining elements are too severely deteriorated to repair, and where sufficient physical evidence exists, replace them with new elements that match the forms, materials and detailing of sound versions of the same elements. Where there is insufficient physical evidence, make the form, material and detailing of the new elements compatible with the character of the historic place.

11. Conserve the heritage value and character-defining elements when creating any new additions to an historic place or any related new construction. Make the new work physically and visually compatible with, subordinate to and distinguishable from the historic place.

12. Create new additions or related new construction so that the essential form and integrity of an historic place will not be impaired if the new work is removed in the future.

Provincial Policy Statement (2020)

Section 2.6 of the Provincial Policy Statement (PPS) regarding Cultural Heritage and Archaeology provides guidance for the assessment of the impact of the Proposal on the existing cultural heritage resources. The following policies in the PPS are particularly relevant:

2.6.1: Significant built heritage resources and significant cultural heritage landscapes shall be conserved.

2.6.3: Planning authorities shall not permit development and site alteration on adjacent lands to protected heritage property except where the proposed development and site alteration has been evaluated and it has been demonstrated that the heritage attributes of the protected heritage property will be conserved.

Ontario Heritage Act

Section 33 of the Ontario Heritage Act further dictates the approach and process to assess the impact of alterations to a heritage building, particularly as described in Subsection (1):

33 (1): No owner of property designated under section 29 shall alter the property or permit the alteration of the property if the alteration is likely to affect the property's heritage attributes, as set out in the description of the property's heritage attributes in the by-law that was required to be registered under clause 29 (12) (b) or subsection 29 (19), as the case may be, unless the owner applies to the council of the municipality in which the property is situate and receives consent in writing to the alteration. 2019, c 9, Sched. 11, s. 11

The preparation of the HIA was also guided by Regulation 09/06 of the Ontario Heritage Act, which lays out evaluation criteria to be used in order to determine whether a property merits designation under Part IV of the Act. In the case of the Subject Property and Proposal, which is designated under Part IV, these evaluation criteria were used to help guide and ensure the identification and preservation of the existing cultural heritage value and heritage attributes.

City of Toronto Official Plan

The HIA was prepared in accordance with the City of Toronto's Official Plan, specifically with regards to the policies laid out in Section 3.1.6 Heritage Conservation:

Policies:

3.1.6.5: Proposed alterations, development, and/or public works on or adjacent to a property on the Heritage Register will ensure that the integrity of the heritage property's cultural heritage value and attributes will be retained, prior to work commencing on the property and to the satisfaction of the City. Where a Heritage Impact Assessment is required in Schedule 3 of the Official Plan, it will describe and assess the potential impacts and mitigation strategies for the proposed alteration, development or public work.

Heritage Impact Assessments:

3.1.6.22: Heritage Impact Assessment will address all applicable heritage conservation policies of the Official Plan and the assessment will demonstrate conservation options and mitigation measures consistent with those policies. A Heritage Impact Assessment shall be considered when determining how a heritage property is to be conserved.

3.1.6.23: Heritage Impact Assessment will evaluate the impact of a proposed alteration to a property on the Heritage Register, and/or to properties adjacent to a property on the Heritage Register, to the satisfaction of the City.

3.1.6.24: Heritage Impact Assessment will be required for the proposed demolition of a property on the Heritage Register. Where demolition of a property adjacent to a property on the Heritage Register is proposed, the City may require a study on the implications of the demolition on the structural integrity of the property on the Heritage Register.

3.1.6.25: In addition to a Heritage Impact Assessment, the City may request a Heritage Property Conservation Plan to address in detail the conservation treatments for the subject heritage property. The City may also request a Heritage Interpretation Plan to promote a heritage property or area, to the public.

Development of Properties on the Heritage Register

3.1.6.26: New construction on, or adjacent to, a property on the Heritage Register will be designed to conserve the cultural heritage values, attributes and character of that property and to mitigate visual and physical impact on it.

3.1.6.27: Where it is supported by the cultural heritage values and attributes of a property on the Heritage Register, the conservation of whole or substantial portions of buildings, structures and landscapes on those properties is desirable and encouraged. The retention of facades alone is discouraged.

University of Toronto Secondary Plan

The Subject Property falls within the City of Toronto's University of Toronto St. George Secondary Plan which provides Objectives for the future planning and development of the campus. The Secondary Plan for the campus has been in effect as of July 28, 2023.

The Subject Property is not situated within an area of Site and Area Specific Policies. Within the larger campus, the front lawns along College Street are considered existing key open spaces and the intersection of College Street at St George Street is considered a gateway into the campus, with St. George Street as a view corridor.

The following relevant policies and principles apply:

Objectives

3.1 The Secondary Plan area will evolve and grown in a manner that:

c) conserves and complements cultural heritage resources and strengthens the unique landscape qualities of the Area;

Public Realm

4.1 The public realm network, including those elements shown on Maps 20-2A to 20-2E, will be achieved over time through development, capital investment and maintenance projects, and will evolve in a manner that:

b) integrates sensitively with its surrounding context, into cultural heritage resources, existing elements of the public realm and neighbourhoods outside of the Secondary Plan Area;

Institutional Major Open Spaces

4.6 Institutional Major Open Spaces shown on Map 20-2C will be protected, enhanced, and maintained for passive and active recreation and athletics, pedestrian movement, informal gathering and ceremonial functions, in a manner that is responsive to their context and meets the needs of users, including:

b) leveraging the value of cultural heritage resources to inform and enhance a sense of place;
5.1 Not all parts of the Secondary Plan Area will experience the same level of intensification and change. The location, scale and intensity of development will be determined through

d) local character, immediate surrounding context and individual site characteristics, including cultural heritage resources;

Built Form Considerations

5.3 To reinforce the Area's diverse physical character, conserve and enhance its cultural heritage resources, contribute to an architecturally varied and interesting built environment, enhance and expand the public realm with comfortable pedestrian-level conditions, and provide for consideration of institutional uses and programming, development will:

a) be sensitive to and compatible with the public realm, built form, cultural heritage resources and neighbourhood context;

c) be set back a minimum of 6.0 metres from the curb to the building face along streets, except where in situ conservation of cultural heritage resources prevents sidewalk widening, to accommodate existing and anticipated high pedestrian volumes and provide enhanced streetscaping;

Heritage

5.5 Ongoing growth and development of the Secondary Plan Area will respect the significance and history of the Area, and will reinforce and enhance its sense of place and distinct Character Areas.

5.6 Design responses, including setbacks, stepbacks and stepping down of building heights additional to the built form and urban design standards identified in this Plan and Council- adopted Urban Design Guidelines may be required to conserve the scale and character of a property included on the City's Heritage Register.

The building straddles two character areas, the College Street Character Area and the St. George Street Character Area. As the proposal primarily intervenes along St. George Street, the following principles and policies are relevant:

5.12 Development within the St. George Street Character Area will:

a) maintain and enhance the streetscape and setback areas along St. George Street;

b) generally consist of low-scale institutional buildings and mid-scale institutional buildings. New taller institutional elements are not permitted in the Character Area, other than at the southwest corner of Harbord Street and St. George Street, where a taller institutional element may be considered, provided that it is located, designed and massed to enhance Roberts Library's monumental built form, cultural heritage value and open spaces; north of Harbord Street and Hoskin Avenue:

i. complement and reinforce the historic development pattern of large mansion lots on St. George Street, and their characteristic larger houseform buildings and deep lawns and gardens, through adaptive reuse and the sensitive siting, rhythm and scale of infill development; and

ii. be designed and massed to provide built form transition in scale from mid-scale institutional building components to the adjacent Neighbourhoods designated portion of the Huron-Sussex Character Area; and

c) south of Harbord Street and Hoskin Avenue, respect and reinforce St. George Street as the transition between the higher scale of the West Campus Character Area and the lower scale of the Central Campus Character Area, with generous building setbacks, low-scale base buildings and deep stepbacks to mid-scale building components.

3.0 Introduction to the Development Site

3.1 Description of the Subject Property

The Koffler Student Services Centre is located at the northwest corner of St. George Street and College Street, and is known municipally as 214 College Street. It is designated Part IV under the Ontario Heritage Act.

The building is three stories tall with a mezzanine floor and a basement level, with its principal façade along College Street. The building itself is set back along College Street, with a treed and landscaped front lawn. Along St. George Street, there are planters and a generous sidewalk.

The original building was constructed in 1909, in the Beaux-Arts style, as the central reference library for the City of Toronto. This library contained the main reference library (the upper floors) with a double height reading room, and upper exhibition space along its east wing, a ground floor circulating library with its own entrance, and a rear five-level stack space for book storage.

In 1930, an addition to the north of the building was constructed, including new reading rooms and stacks, a library for youth, a theatre and exhibition space, and expansion to book storage and cataloguing space. In 1959, there was a rear infill. In 1984, there was a significant renovation transforming the central library into the new student centre for the University of Toronto; this included the enclosure of the courtyard as well as reconfiguration of the levels in the stacks spaces and the exhibition spaces. This renovation in general retained the original 1909 and 1930 facades. In 2002, its northern façade was enclosed by the construction of the adjacent Bahen Centre for Information Technology.

The principal façade is along College Street, symmetrical with its end entrances marked by paired composite brick pilasters supporting a dentiled round-arched pediment. The east entrance to the central reference library is defined by a large set of stairs; the more modest west entrance leads directly to the ground floor circulating library. Both the principal and secondary (along St. George Street) elevations are punctuated by ground floor paired rectangular windows in stone cladding with double-height round-arched windows on its buff brick field cladding in the upper floors. Its bays are defined by brick pilasters supporting a brick entablature and parapet above. Stone ornamentation includes exaggerated keystones and decorative cartouche. Slight differentiations are observed between the 1910 and 1930 sections, with bush-hammered sandstone in the 1909 building and limestone in 1930. The secondary St. George entrance is also more restrained in its detailing. It should be noted that the existing ramp and stairs are not original to the building.

Refer to Appendix A for scaled location plans, as per HIA Terms of Reference.

The interior of the building still retains some of the ordered, symmetrical and axial Beaux-Arts style, with its clear hierarchies. A grand ceremonial staircase leads into the main entrance hall, reading room and mezzanine of the original 1910 building. The reading room in the St. George addition also retain some of this detailing. These spaces are highly decorative, with pilasters, columns and coffered ceilings. This area of the building has undergone some interior renovations.

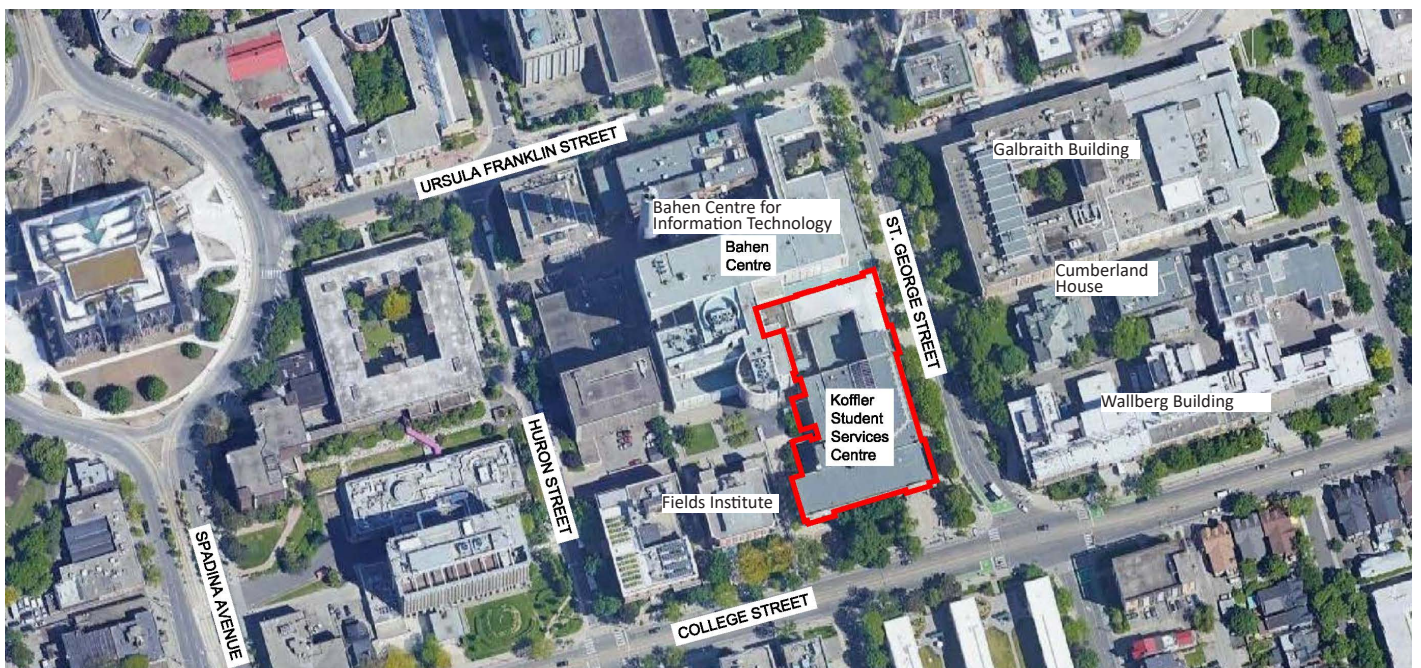


Figure 1: Aerial Site Map, property outlined in red (2020, Google Earth)



Figure 2: South Elevation, along College Street (November 2024, EVOQ)



Figure 3: South Elevation, Front Entrance (November 2024, EVOQ)



Figure 4: South Front Lawns (November 2024, EVOQ)



Figure 5: Walkway along the east elevation, looking northwards (November 2024, EVOQ)



Figure 6: East elevation, secondary St. George entrance (November 2024, EVOQ)



Figure 7: East Elevation along St. George Street, looking northwards (November 2024, EVOQ)



Figure 8: East Elevation along St. George Street, looking southwards (November 2024, EVOQ)



Figure 9: North Elevation (November 2024, EVOQ)



Figure 10: West Elevation of the original 1909 wing and 1959 infill (November 2024, EVOQ)



Figure 11: West Elevation of the 1959 infill (2020, EVOQ)



Figure 12: West Elevation of 1930s wing and the 1959 infill (November 2024, EVOQ)

3.2 Description of the Surrounding Context

The Subject Property is located in the southwest precinct of the University of Toronto's St. George Campus. Its siting at the northwest corner of College Street and St. George Street marks the boundary of the St. George campus as well as a gateway entrance. The southern terminus of St. George Street is signified by the Wilson Gate, two decorative conical steel posts installed into low concrete walls, on either side of St. George Street; the name 'University of Toronto' is carved into concrete wall just in front of the Koffler building along with the university shield. St. George Street was revitalized in the mid-1990's, and now forms a pedestrian route linking the west campus precinct and the historical central campus to the northeast. As one of the buildings along the north side of College Street forming the border of the university precinct, the Koffler Student Services Centre is surrounded by campus buildings to the east, north and west. Generally, the surrounding campus buildings are low-to-mid rise complexes.

Directly west of the Koffler building is the Fields Institute for Research in Mathematical Sciences, constructed in 1995. It is also set back and aligned with the Koffler building. To its east is the Student Commons, a five-storey brick building constructed in 1909, with a shallower setback; its side façade is visible from the front lawns of the Koffler building. To the northwest of the Koffler building is 215 Huron Street, constructed in 1959; it currently houses administration offices for various university divisions. Directly north of the building is the Bahen Centre for Information Technology, constructed in 2002. It is an L-shaped building that encloses the north façade of the Koffler's 1930 north wing addition within a tall east-west atrium.

Note: Although the heritage register notes the designated Part IV Boys and Girls Home, By-Law 509-75 north of the Koffler Centre, it has since been demolished. A further listed victorian house, the E.M. Chadwick House at 44 George Street, remains extant and has been incorporated into the Bahen Centre for Information Technology. This house is not visible from the Subject Property.)



Figure 13: Aerial Context Map (2018, Google Earth). *Indicates nearby listed heritage properties.

On the east side of St. George are additional campus buildings. The Wallberg Building is sited at the northeast corner of College and St. George Streets. Constructed in 1949, it stretches the entire block to Kings College Rd. The original three-storey brick building received a fourth-storey penthouse in 2012. To the north of the Wallberg Building is Cumberland House, significantly set back from St. George Street, reflecting the estates of the mid-1800s. This Italianate villa, constructed in 1860 and designed by Frederic Cumberland, is used as space for the International Student Centre. This house is listed on the City of Toronto heritage register. To its north is the 4-storey Galbraith building, constructed in 1960 and is currently used as engineering administrative offices.

To the south of the Koffler building, along the south side of College street, are generally a mix of institutional and residential buildings. They are non-campus buildings, with the exception of the Gage Building, to its southwest, currently home to the school of public health and is listed on the City of Toronto heritage register. To the west of Gage Building, is a listed 5-storey institutional building. Directly south of Koffler are three listed heritage low-rise apartment blocks. To Koffler's southeast, on the corner of College and Beverley Streets is a new high-rise condo tower. The neighbourhood further south of College is a mainly residential character area comprised of three-storey Victorian houses.



Figure 14: Aerial View of the Koffler Building looking northeastwards from College Street (1977, courtesy of Toronto Public Library, TPL-A-A309))



Figure 15: Bahen Centre entrance to the north of Koffler Student Services Centre (November 2024, EVOQ)



Figure 16: South Elevation of the Bahen Centre at the rear; Koffler Student Services Centre to the right (November 2024, EVOQ)



Figure 17: Rear connection between Koffler Student Services Centre and the Bahen Centre (2020, EVOQ)



Figure 21: South elevation, looking westwards to the Fields Institute and Student Commons; Koffler building to the right (November 2024, EVOQ)



Figure 22: South elevation, looking eastwards to the Wallberg Building; Koffler building to the left (November 2024, EVOQ)



Figure 18: View at College and St George Streets, looking northwards. The Koffler building is to the left (November 2024, EVOQ)



Figure 20: View looking westwards at College and St. George Streets, Koffler building to the right (November 2024, EVOQ)



Figure 19: View along College Street, looking eastwards; Koffler front lawns to the left (November 2024, EVOQ)

3.3 Description of Adjacent Heritage Properties

There are a number of adjacent heritage properties to Hart House, as observed earlier in the Chapter. The following provides a more detailed description. The City of Toronto Official Plan notes the following definition of ‘adjacent’:

Adjacent: means those lands adjoining a property on the Heritage Register or lands that are directly across from and near to a property on the Heritage Register and separated by land used as a private or public road, highway, street, lane, trail, right-of-way, walkway, green space, park and/or easement, or an intersection of any of these; whose location has the potential to have an impact on the property on the heritage register; or as otherwise defined in the Heritage Conservation District Plan adopted by by-law.

Cumberland House

Description of the property: Cumberland House is located at 33 George Street. Originally constructed by Frederick Cumberland as his own residence in 1860, it was named Pendarves and stood within spacious grounds, with its primary entrance facing eastwards. In 1883 after Cumberland’s death, it was renovated by William Storm for another client, at which point the entrance was moved to the west elevation. Acquired by the University of Toronto in 1923, it now serves as office and meeting space for the International Student Centre.

Heritage Status: Listed on the municipal heritage register, June 20, 1973

Reasons for listing: An Ontario Heritage Trust notes, in a provincial plaque in the Legislative Building at Queen’s Park, Toronto, commemorating Pendarves- Cumberland House:

Renowned Toronto architectural firm Cumberland & Storm designed this building as the family home of senior partner Frederic W. Cumberland. Completed in 1860 and named Pendarves, the original Italianate villa-style structure stood on spacious grounds with its main entrance facing east towards the new University of Toronto campus. In 1883, it was substantially redesigned by William Storm. After the 1912 closure of Government House on Simcoe Street, Toronto, the Ontario Government leased Pendarves as the temporary official residence and receiving rooms for the Lieutenant Governor. It was first occupied by Sir John Gibson until 1914 and then by Sir John Hendrie until the 1915 completion of Chorley Park, Toronto, the last and most opulent vice-regal residence. Acquired by the University of Toronto in 1923 and eventually renamed Cumberland House, this is a rare surviving example of Cumberland’s residential work, and is significant for its use as the residence for the Lieutenant Governor of Ontario.



Figure 23: Cumberland House (November 2024, EVOQ)



Figure 24: Cumberland House (1912, courtesy of TPL, Toronto Star, TSPA 0112981F)



Figure 25: Cumberland House (c1970, courtesy of TPL, 974-22)

Gage House

Description of the property: This building, constructed in 1914 and designed by architect Charles S. Cobb, was originally built for the National Sanatorium Association in honour of Sir William J Gage. Gage was known for his work in diagnosing and treating tuberculosis. This Georgian-Revival building, retains much of its detailing. The building now houses the Gage Research Institute, part of the Dalla Lana School of Public Health at the University of Toronto campus.

Heritage Status: Listed on the municipal heritage register, 2018

Reasons for listing: recognized for its design value, and its contextual value (refer to College Street Planning Study, 2017)



Figure 26: Gage House (November 2024, EVOQ)

211-219 College Street Apartments

Description of the property: This property consists of a series of three rectangular apartment blocks set within a spacious landscape, in a garden-court setting. Constructed in 1927, each of the three-storey brick buildings has retained its emphasized cornice detailing and decorative entrances.

Heritage Status: Listed on the municipal heritage register, 2018

Reasons for listing: recognized for its design value, and its contextual value (refer to College Street Planning Study, 2017)



Figure 27: 211-219 College Street Apartments (November 2024, EVOQ)

4.0 Heritage Conservation Plan Summary

The City of Toronto HIA Terms of Reference requires that a Cultural Heritage Evaluation Report (CHER) be prepared, as the Koffler building is a property designated under Part IV of the Ontario Heritage Act prior to 2006.

As part of the Health and Wellness Centre - Koffler Centre Renovation, a comprehensive Heritage Conservation Plan was prepared. This Heritage Conservation Plan encompasses the requirements of the CHER. This report is appended as Appendix B. The following summarizes the particular chapters within the Heritage Conservation Plan relevant to this HIA:

Heritage Conservation Plan- Chapter 2

This chapter includes an outline of the broad, historical context surrounding the design and construction of the building. It provides a comprehensive understanding of the evolution of the site, building, and context. Research supporting this text is drawn from both primary historical, archival sources and secondary sources.

Heritage Conservation Plan- Chapters 3 & 4

These chapters discuss the significant heritage values and related heritage attributes. It includes a thorough assessment of heritage value through illustrations and mapping. It also synthesizes the assessment by illustrating the heritage attributes and mapping areas retaining heritage value, prioritizing their conservation in interventions. It also includes the Statement of Significance (SOS). The SOS is also located in Chapter 5.0 of this HIA Report.

Heritage Conservation Plan- Chapter 5

This section provides a general building condition assessment of the building, both exterior and interior, of the heritage areas of the building. This HIA, in Chapter 6.0 will build upon the condition assessment and discuss project-specific conditions that are impacted by the proposed interventions.

Heritage Conservation Plan- Chapters 6, 7, 8 & 9

These chapters reference the standards and guidelines that will provide the framework for interventions, Parks Canada's *Standards and Guidelines for the Conservation of Historic Places*. Conservation strategies and principles are defined, and recommendations made for the appropriate conservation methods.

5.0 Description of On-Site Heritage Resources

5.1 Statement of Significance

Description of Heritage Resource

The Koffler Student Services Centre is located at 214 College Street on the University of Toronto's St. George Campus. The building is composed of the original 1909 Beaux-Arts central reference library, a significant 1930 addition in the same style, a smaller rear 1959 modern addition, as well as its 1984 modern renovation to a student centre. Alfred Chapman with Wickson & Gregg designed both the original and the addition. The modern 1984 renovation was completed by Alfred Chapman's son, Howard.

Heritage Value

The property has cultural heritage value based on its design and physical values with its Beaux-Arts styled original library building and its early addition; for its association with Toronto architect Alfred Chapman, its original use as a central reference library and the Carnegie library grants that funded its construction; and for its contextual value as supporting the institutional character along College Street and its importance as a corner landmark at St. George Street.

Its design and physical heritage value lies in its Beaux-Arts style, displayed both on its exterior and in its interior. On the exterior, it is evident in the balanced symmetry and classical detailing of its principle and secondary façades. The 1909 building facades are composed of an ashlar bush hammered sandstone base with expressed bullnose string course at the ground floor and rectangular one at the second floor. The upper levels are clad in a buff brick with a deep dentiled cornice with rosettes and egg and dart detailing. The end pavilion entrances are expressed with arched pediments with the same detailing as the cornice and supported by double pilasters. A clear hierarchy defines the entrances and orients the user. The main entrance leading up to the second floor piano nobile is framed by an oversized architrave and keystone, and a large cartouche. The secondary entrance to its west is at grade, and is framed with two wreathed scroll brackets supporting a balustrade and blind small triangular architrave. Each bay is defined by composite brick pilasters and is composed of a pair or a simple rectangular window in the stone base on which sit tall arched windows with a scroll keystone, and expressed brick panels below and above.

The 1930 building is simpler in its classical detailing. The projecting entrance bay is expressed with a carved architrave, a balustrade and a tall window and cartouche, framed between double pilasters and terminated in a deep cornice with large dentils. The ashlar limestone base is framed with a rectangular string course. The bays are composed of simple second and third floor rectangular windows with projecting brick panels. The cornice above is detailed with small dentils and carved festoon cartouches.

In the interior, the Beaux-Arts principle is expressed through the ordered, axial spatial organization and the clear hierarchy of spaces of the entrance hall, main reading room, and mezzanine, with their stone railings and carved plaster pilasters supporting decorative coffered ceilings. The coffered ceilings in these spaces have been altered since, to accommodate sprinklers, lighting and ventilation requirements.

Its historical and associative values lie in its origin and use as the Central Reference Library for the Toronto Public Library system, its original 1909 building as funded through the Carnegie Library grant; its association with noted architect Alfred H. Chapman; and its later association with Murray Koffler, a noted businessman and philanthropist.

Its contextual value resides in continuing the institutional built form along College Street; its visibility as a corner landmark at College and St. George Streets; and its setback siting in relationship to the street and its wide open public space.

Heritage Attributes

The following features of the Koffler Student Services Centre have been identified as heritage attributes that contribute to its overall cultural heritage value:

- The siting of the Carnegie Library building at the northwest corner of College Street and St. George Street
- The classical Beaux-Arts scale and form of the building's public facades along College Street and St. George Street including:
 - The organization and hierarchy of the façade pavilions and entrances
 - The arched pedimented pavilion entrances, the composite brick pilasters marking the bays supporting the brick entablature and parapet
 - The brick buff field cladding and use of stone for detailing, including stone base, carved keystones, cartouches, balusters, architraves, dentil and rosette cornices, egg-and dart moulding, and string coursing
 - The rhythm of the bays and the alignment of the windows including the double-height arched windows of upper floors and simple rectangular windows on the lower floors
- Interior main reading room and the main entry hall including its mezzanine with their stone detailing, plaster columns and pilasters, and coffered ceilings.

6.0 Condition Assessment

The Proposal, as discussed in Chapter 6.0 of this HIA, will be intervening in selected locations in the building. The areas affected are the ground floor, second floor, and third floor 1909 and 1930 east wings, 1959 addition, the 1984 infill, and the secondary St. George entrance. The interior interventions occur in non-heritage spaces.

Front Entrance

In general, the exterior east elevations are in fairly good condition. The decorative St. George Street entrance retains the detailed stonework and carvings.

Some soiling and staining were observed on the stone cladding. As well, there is localized ferric staining due to run-off from copper flashings of cornices and projecting courses and traces of graffiti on the field cladding. The limestone cladding with dolomite base course of the 1930's section has surface deteriorations primarily at the St. George secondary entrance, at the bullnose course with scaling, and erosion at the base of the entrance surround, likely due to salt damage over time.

This entrance, excluding the stairs and ramp, generally appears to be original to the building, despite subtle differences from the design drawings of 1930 and the current configuration (likely a change during construction). Wood double doors with glazing sit within the stone surround with a three-pane transom above. The transom glazing appears to have been altered as with the glazing panels and hardware on the double doors. The wood doors exhibit typical wear and tear to its finishes; otherwise they are in good condition.

The exterior landscape has also generally remained intact and in good condition. The existing stair and ramp structure providing access to the secondary St. George entrance is a 1984 addition, and is not a heritage element. This stair is in fair condition.

There will likely be damage that will occur once the existing stair structure is removed.

Interior Spaces

The interior spaces are generally in good condition and well maintained, with minimal wear and tear to the finishes.



Figure 28: St. George Entrance (November 2024, EVOQ). Existing wood doors have already been removed to shop for rehabilitation to accommodate the interior demolition already underway in the first stage of work.



Figure 29: St. George Entrance, wood doors in 2020 (2020, EVOQ)



Figure 30: St. George Entrance (November 2024, EVOQ)

7.0 Description of Proposed Development or Site Alterations

The Health and Wellness Centre (HWC) within the Koffler Student Centre is seeking to renovate approximately 3650 square meters of existing interior space in all three floors. As part of this renovation, new circulation areas are required, to meet barrier-free accessible needs; this includes a new elevator tower servicing all three floors and upgrading the entrance stair and ramp structure at the secondary St. George Street access. No additional building height is required to accommodate the proposed work.

The purpose of this project is to centralize mental and physical health services in the building and to increase and improve the HWC spaces to meet student wellbeing needs. This major renovation will modernize HWC and provide an accessibly integrated clinic space. Multiple services will be consolidated at this site; renovations will also include rooms for groups and workshops.

The Design principles are noted as the following:

- Consolidate and expand HWC services in the Koffler Student Centre;
- Modernize HWC;
- Support and enhance student experience through health promotion, wellness and community including access to daylight and views;
- Support and enhance collaboration within the HWC team; and
- Improve circulation and provide barrier-free access

Interior Renovations & Additions

The project is being completed in two phases. The first phase consisted of interior demolitions to base building. This included the demolition of existing HWC clinic areas and additional office spaces in selected areas on the ground, second and third floors. This also includes the removal of the third floor theatre, housing an auditorium, theatre lobby, rehearsal spaces and administrative areas. A portion of the third floor (in the 1959 addition) will remain as shell space, to accommodate future occupants or expansions.

The second phase consists of the interior fit-out of these areas to become the consolidated HWC.

The newly renovated ground floor areas will house reception services and programming spaces for HWC; these will be a mix of multi-purpose rooms, work rooms, reception and waiting area, and small kitchen, as well as and auxiliary spaces such as washrooms and storage.

The second floor will house administrative offices and multipurpose rooms (East Wing) and counselling spaces and mental health offices (North Wing).

On the third floor, the expanded HWC will house the counselling rooms, examination rooms, and administrative offices. The existing metal roof trusses will be exposed, allowing the space to read more spaciouly.

A new central elevator located in the atrium space will provide accessible connections to all the HWC floors and to both the east and north wings of the building. A portion of this element, the elevator lobbies, will extend its form beyond the building envelope by two stories at the rear, above the ground floor roof. There will also be a small addition above the elevator structure to accommodate the elevator overrun.

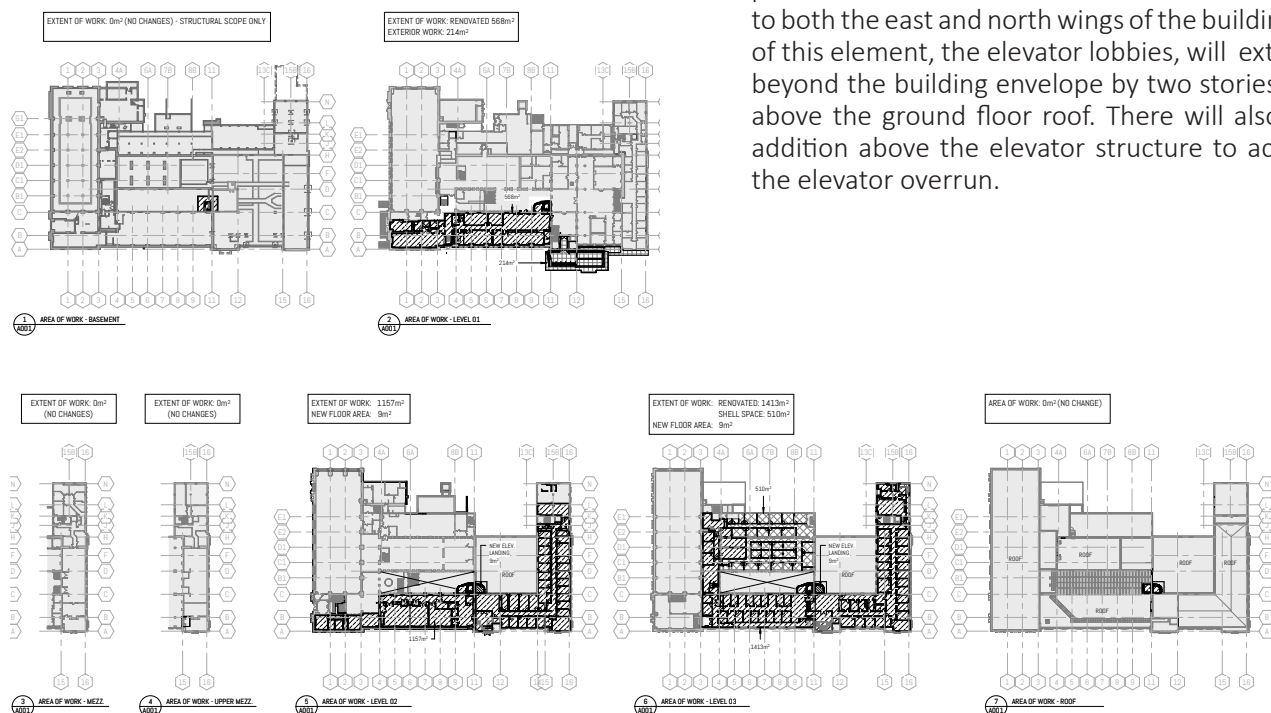


Figure 31: Drawing A001 Details 1-7 showing areas of work (2024, Enform Architects)

There are no interior renovations to the basement spaces. All floors will incorporate smudging rooms. Existing windows will generally remain for all three floors. There are some window replacements, infills and new window openings at the third floor on the rear elevations and overlooking the atrium.

The interiors of the new renovation will be in neutral colours, of grays, whites, and wood tones, designed in a modern and contemporary style. The elevator feature will be emphasized with a ribbed aluminum curtain wall, in anodized bronze.



Figure 32: Ground Floor Reception- North (2024, Enform Architects)



Figure 33: Atrium (2024, Enform Architects)



Figure 34: Ground Floor Reception- South (2024, Enform Architects)



Figure 35: Subwaiting Room (2024, Enform Architects)



Figure 36: Multi-purpose Room (2024, Enform Architects)



Figure 37: Counselling Room Corridor (2024, Enform Architects)

Exterior Entrance & Landscape Works

The exterior St. George entrance will be re-designed as part of this project, to be upgraded with new stair and barrier-free ramp. The existing concrete steps and ramp will be removed. A new concrete stair and ramp structure will be constructed, with interlocking natural stone paving finish. The entrance structure will receive a snow-melt system and trench drains to suit the ramp and stairs, and integrated lighting. Simple welded brass handrails will be constructed to suit the stairs. New concrete planter with seating walls will be constructed adjacent the ramp. A tall deciduous tree with shrub planting will sit within the planter. The surrounding concrete sidewalk will be reinstated, to match existing.

The surrounding masonry around the entrance will be rehabilitated. The existing wood doors and transom will be repaired and restored. Their glass lites and hardware will be upgraded, and an automatic door operator will be installed, on a freestanding post to replace the existing surface mounted accessible door operator affixed to the building.



Figure 38: Rendering of the proposed northeast entrance highlighting the new stairs, ramp, seating, and entry (2024, Enform Architects)



Figure 39: Rendering of the proposed northeast entrance within the context of the existing east elevation (2022, Enform Architects)

DESCRIPTION OF PROPOSED DEVELOPMENT OR SITE ALTERATION

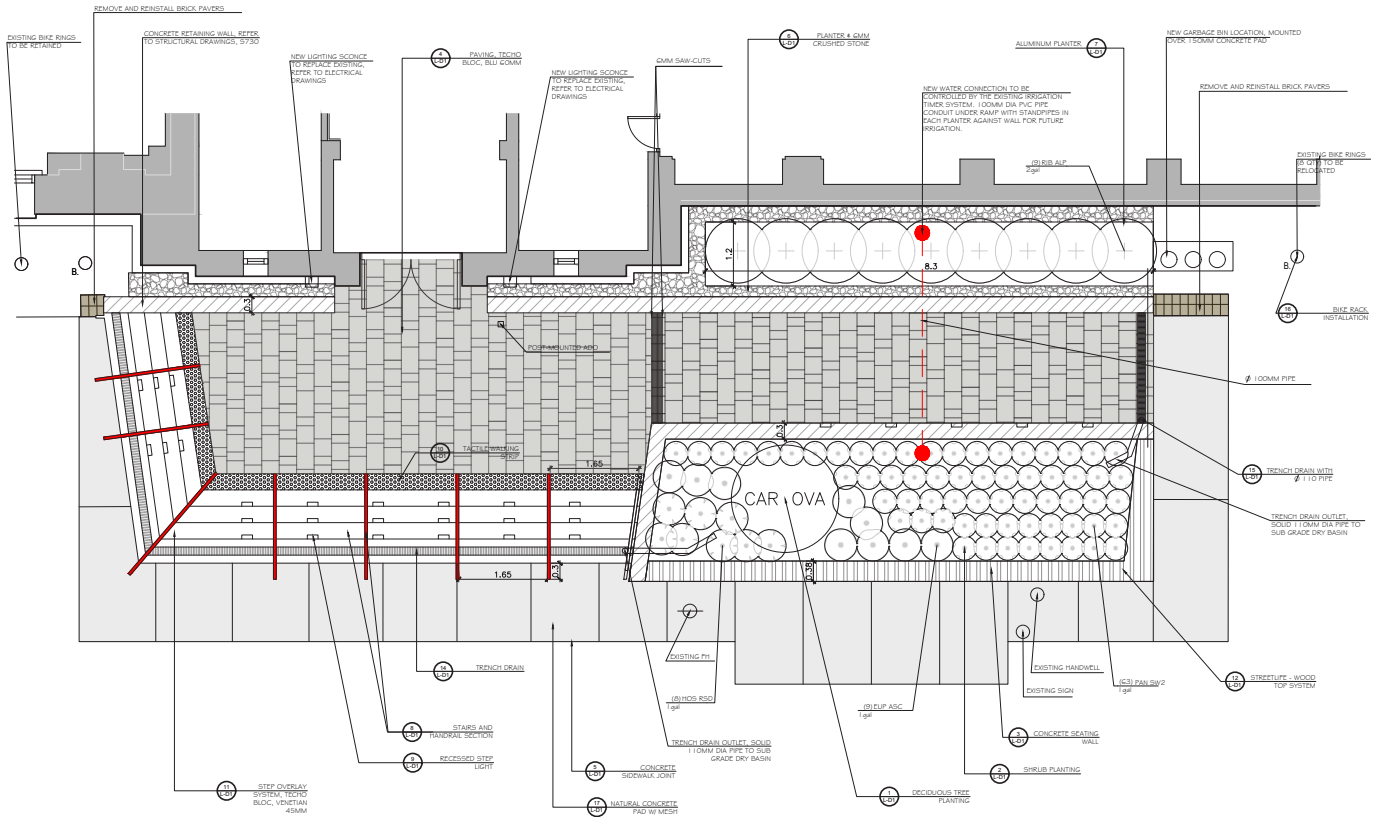


Figure 40: Landscape Plan, Drawing L-L1 (2024, HKLA Landscape Architects & Consulting Arborists)

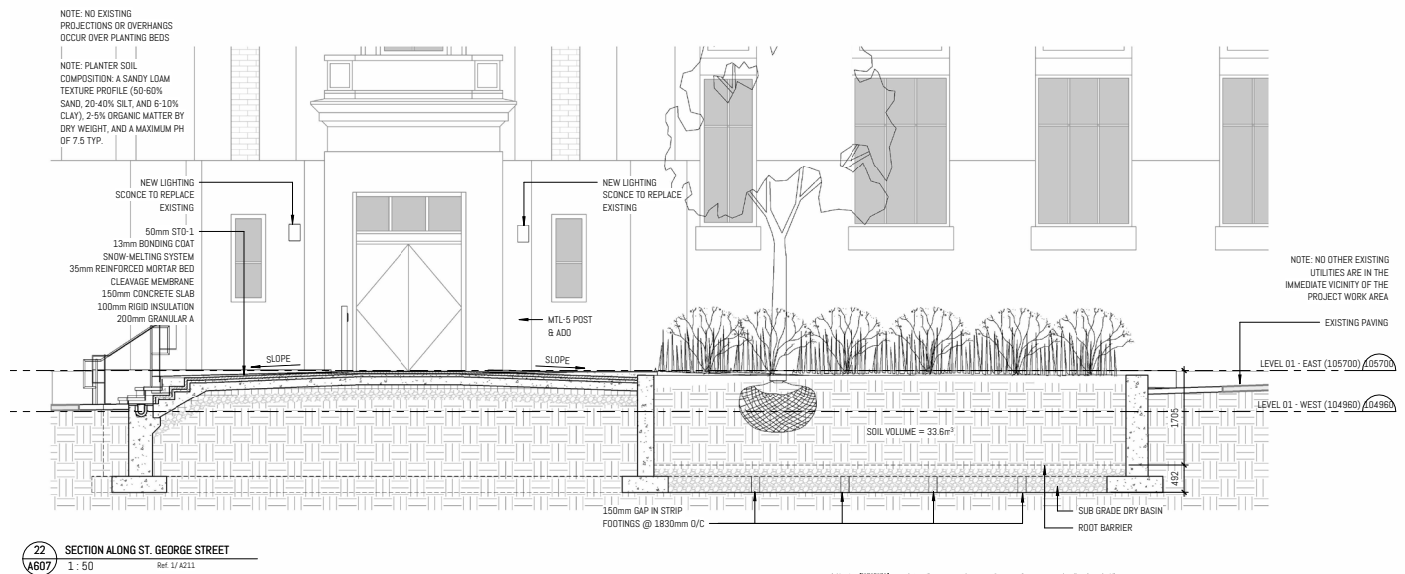


Figure 41: Section Along St. George Street, Detail 22/A607 (2024, , Enform Architects)

8.0 Demolition

No whole removal or demolition of a building, structure or heritage attribute is proposed within the proposed scope of work.

Structural Work

Structural work is limited. Minimal joist upgrades, opening infills and new lintels will be completed as required to suit the programming of the new interior spaces. A new elevator structure in the atrium, with new foundations and pit will be constructed. The existing elevator shaft adjacent the secondary entrance will be decommissioned and re-integrated with the floorplates with new concrete slabs. New structure is also designed to support the new entrance redesign.

Mechanical Works

Mechanical HVAC work will support the renovations. Supply and exhaust systems will be reconfigured and new extensions added as required. VAV boxes replaced, new exhaust fans, make-up units, ductwork, fans and split air condition units installed to suit the variety of new programming, such as the specialized multi-purpose rooms, washrooms, and new kitchen. Existing radiators are to be removed and replaced with new hydronic radiators, with associated required piping and controls.

Plumbing work will also be constructed to suit. New domestic cold and hot water service and sanitary system will service the new washrooms, kitchens, and laundry areas. New plumbing fixtures to be provided. A new floor drain will be provided for the new elevator pit. Drainage will also be provided for the exterior snow melt system.

Electrical Works

Electrical work will be supporting the expansion through upgrading of servicing and new lighting. New electrical distribution panels will be connected to existing electrical system. The renovated areas will receive a new emergency lighting system and the existing fire alarm system updated to suit, with new fire alarm zones. Receptacles will be installed as required, along with new LED lights. Rough-ins are to be provided for AV system, a new data/communication system installed, and door hardware/security devices will be provided for entry points as needed.

9.0 Analysis of the Impact of Development

There are three types for the impacts that a proposed development may have on an identified cultural heritage resource: positive, neutral, or negative. Positive impacts may include retaining a property or element of cultural heritage value; protecting it from loss or removal; maintaining or restoring heritage attributes; or constructing sympathetic alterations and additions. Negative impacts may include the demolition or removal of heritage attributes; alterations that are unsympathetic or incompatible; the isolation of a cultural heritage resource from its setting or context; or the obstruction of heritage attributes. Neutral impacts have neither positive nor negative effects, and therefore no impact, on the cultural heritage resource.

These impacts may in turn be direct, when a development physically or aesthetically alters a cultural heritage resource, or indirect, when a development affects the character and expression of an adjacent or nearby cultural heritage resource. These classifications are determined through analysis based on the integrity and conservation of the cultural heritage resources as stipulated in the Official Plan, the Ontario Heritage Act and PPS policies.

9.1 Impact Analyses and Rationale

Overall, the Proposal has a positive impact on the cultural heritage value of the building. The exterior intervention of the new stair and ramp structure upgrades the entrance to current barrier-free standards while being compatible with the heritage character of the existing building. The new elevator structure will provide barrier-free accessibility to all levels of HWC with no impact to the heritage value of the building.

St. George Street Entrance

The existing stair and ramp were later additions and are not considered heritage attributes. The proposed stair and ramp design is a similar layout to what currently exists, with the main difference being the proposed ramp is wider and has a shallower slope, while the proposed stairs adds steps to the south and the addition of a new planter. It has been designed to be contemporary, minimal in profile for entrance ramp, stairs, and planters enabling the legibility of the existing original 1909 and 1930 facades to be read.

The new stair and ramp structure will be set back from the face of the foundations, with minimal connection at the slab level. The existing foundations will be parged below-grade, and new waterproofing and drainage board applied to ensure the water will shed down and away from the existing masonry. Gravel will be installed between the wall and structure to further ensure water shedding.

The masonry will be repaired in kind at areas where the existing stair and ramp structure is removed.

For the existing doors, only their glass will be replaced and their hardware upgraded to suit current building code egress and accessibility requirements. The proposed barrier-free automatic door operator buttons and associated conduits will be installed on a pedestal in front of the entrance. There will be no negative impacts associated with the button as it will not be installed on the masonry.

Overall, the Proposal is compatible with the existing restrained detailing of the St. George Street entrance and facade and will have limited heritage impact.

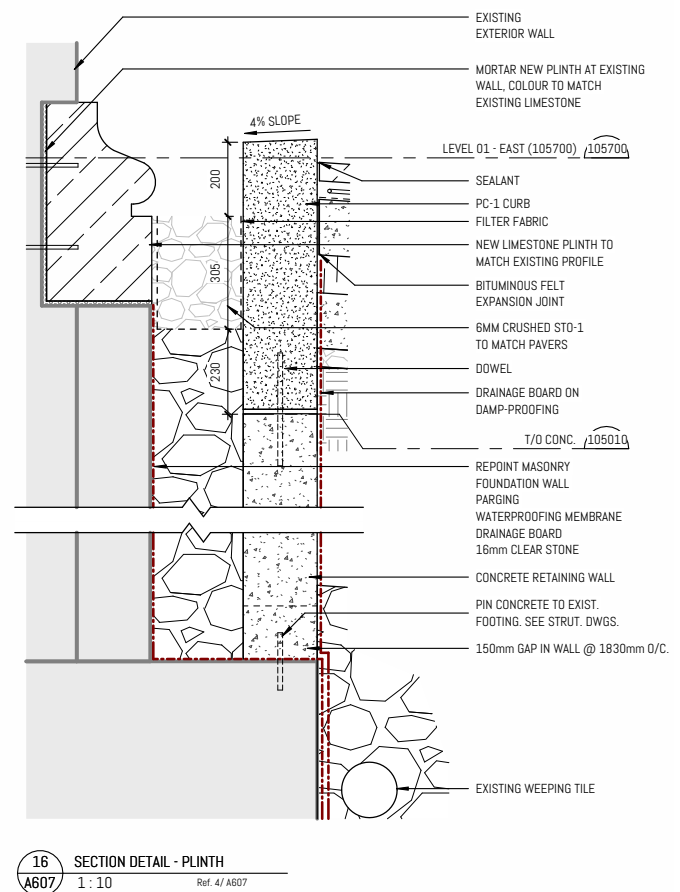


Figure 42: Section Detail - Plinth, Detail 16/A607 (2024, Enform Architects)

Elevator

The new elevator and lobby structure will be located in the existing atrium space and extend two floors above the ground floor roof at the rear. The structure will be clad in a contemporary fashion with an anodized-bronze aluminum curtain wall. The new elevator will be located in the atrium, a non-heritage space. Where it extends above the roof, it will be minimally visible from the public realm. The new elevator overrun and structure will be located behind the existing skylight structure and not visible to the public realm. The additions will not exceed the heights of the existing roof lines. The rear elevation and atrium space are not considered to have heritage value. There is no heritage impact due to this addition.

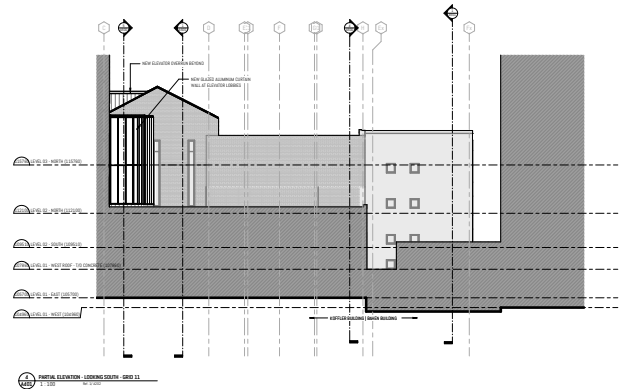


Figure 43: Partial Elevation- Looking South- Grid 11, Detail 4/A401 (2024, Enform Architects)

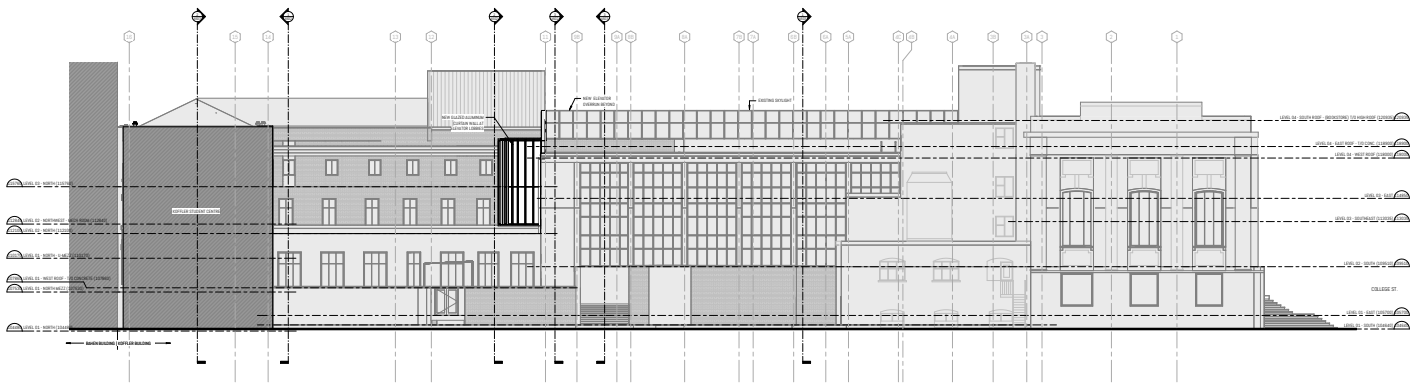


Figure 44: Exterior Elevation- West, Detail 2/A400 (2024, Enform Architects)



Figure 45: Rear Elevation from the Koffler Building (2020, EVOQ)



Figure 46: View of the rear elevation at ground level, where new elevator lobby structure will be located (November 2024, EVOQ)

Windows and Openings

The minimal window openings, window replacements and brick infills at the third floor will have no heritage impacts. They will be constructed at the non-heritage rear of the building or in the non-heritage atrium space.

Interiors

The interior renovations do not occur in areas of heritage value; there is no heritage impact from proposed scope of work.

Exploratory openings completed in the 1930s reading room, during the design and investigative phases of work will be repaired in kind. These openings are small, and were created to review the feasibility of structural upgrades. They are located in the 1930s reading room. Mitigation strategies outlined in Chapter 11 will ensure the repair methodologies and processes will conserve the heritage fabric.

9.2 Integrity

The Toronto Official Plan defines “integrity” as follows:

Integrity: as it relates to a heritage property or an archaeological site/resource, is a measure of its wholeness and intactness of the cultural heritage values and attributes. Examining the conditions of integrity requires assessing the extent to which the property includes all elements necessary to express its cultural heritage value; is of adequate size to ensure the complete representation of the features and processes that convey the property’s significance; and the extent to which it suffers from adverse affects of development and/or neglect.

The proposed development is respectful of the existing heritage property. The proposal is primarily an interior renovation project, intended to renew the HWC centre. The Koffler Centre’s existing form and character remain fully legible and expressed. The necessary addition of the elevator tower is discrete and strategically placed at the rear, minimally visible to the public. No interior heritage attributes are impacted.

The critical heritage attributes that contribute to the heritage value of the Koffler Centre will continue to allow for a full and rich reading of the building.

9.3 Temporary Construction Impacts

In general, for all construction activities proposed, care will be taken during the work to ensure no inadvertent damage occurs to any of the heritage fabric. During construction, the installation of temporary hoarding and protection will be required, both at the proposed scopes of work and any paths of travel for construction personnel, materials and equipment. The heritage building will be adequately protected from any potential indirect impact arising from these temporary facilities.

9.4 Impacts to Adjacent Heritage Resources

There are no heritage impacts to adjacent heritage resources.

The new elevator rear addition to the Koffler Student Services Centre is not visible in terms of sight lines to or from these heritage resources.

The revised St. George Street entrance, with its new ramp and stair structure, will not impact adjacent heritage resources as its visibility will not interfere with either the public faces of the heritage buildings nor create shadows on them.

10.0 Engineering Considerations

Engineering studies are not required for this project. The proposal does not contemplate partial in situ or facade-only retention, temporary removal or relocation of a building or structure. The building also does not have a compromised structure.

11.0 Mitigations

There are minimal heritage impacts to the building's exterior. Design decisions that mitigate the impacts are discussed as part of Section 9.0. The strategies outlined below are to ensure the heritage attributes remain legible and are maintained throughout construction.

Regarding areas of heritage value requiring temporary construction and hoarding, heritage protection is proposed for all heritage cladding and finishes to remain in-situ, including areas outside the scope of work but in the path of construction access. In addition, clear dismantling and deconstruction methodologies are included to provide guidance where demolition work (including architectural, mechanical, electrical, and structural) is to be completed on or adjacent to heritage elements.

Detailed drawings and specifications have been produced to indicate the necessary heritage conservation scope and repair methodologies to ensure the conservation work is completed to the appropriate standard. Documentation strategies are noted for all conservation work.

As well, electrical, mechanical and communications servicing work should minimize any disturbance to heritage elements. Where there is necessary cutting through existing finishes to suit the installation of this work, it is required to minimize impact and carefully document conditions prior and during construction.

12.0 Conservation Strategy

The primary conservation treatment is preservation with a secondary treatment of rehabilitation. The heritage attributes impacted are intact and in good condition. The conservation strategy involves protecting and maintaining the existing heritage attributes, and ensuring its continuing as part of the proposed interventions.

The conservation strategy follows the guidelines outlined by *Parks Canada's Standards and Guidelines for the Conservation of Historic Places in Canada*. The general standards and those related to rehabilitation are listed below and annotated with comments.

| | Guideline | Comments |
|---|--|--|
| 1 | Conserve the heritage value of an historic place. Do not remove, replace or substantially alter its intact or repairable character-defining elements. Do not move a part of an historic place if its current location is a character-defining element. | This standard is applicable. The heritage value of the Koffler Student Services Centre building is to be maintained, particularly the east public façade and the 1930 reading room. Minimal removals, replacements or alterations of exterior or interior character-defining elements are proposed. |
| 2 | Conserve changes to an historic place that, over time, have become character-defining elements in their own right. | N/A. This standard is not applicable. |
| 3 | Conserve heritage value by adopting an approach calling for minimal intervention. | This standard is applicable. The guideline of minimal intervention will be followed. |
| 4 | Recognize each historic place as a physical record of its time, place and use. Do not create a false sense of historical development by adding elements from other historic places or other properties, or by combining features of the same property that never coexisted. | This standard is applicable. No additional historical elements or combination of features will be added. The new east entrance will be contemporary and designed to be compatible with the original historic façade. |
| 5 | Find a use for a historic place that requires minimal change or no change to its character-defining elements. | This standard is applicable. There will be no change of use as part of the interventions and no change to its character defining elements |
| 6 | Protect and, if necessary, stabilize an historic place until any subsequent intervention is undertaken. Protect and preserve archaeological resources in place. Where there is potential for disturbing archaeological resources, take mitigation measures to limit damage and loss of information. | N/A. This standard is not applicable. |
| 7 | Evaluate the existing condition of character-defining elements to determine the appropriate intervention needed. Use the gentlest means possible for any intervention. Respect heritage value when undertaking an intervention. | This standard is applicable. Existing condition of character-defining elements have been examined and assessed. A site review (visual/tactile) of the character-defining elements was completed and their conditions documented, in both text and photographs. The approach of minimal intervention to character-defining elements has been followed to ensure the building's heritage value is respected. |
| 8 | Maintain character-defining elements on an ongoing basis. Repair character-defining elements by reinforcing their materials using recognized conservation methods. Replace in kind any extensively deteriorated or missing parts of character-defining elements, where there are surviving prototypes. | This standard is applicable. The character-defining elements will be maintained. Localized replacement and repairs in-kind will be completed for elements that will be intervened. Repair and replacement methodologies are to be carefully detailed and mock-ups are to be completed. |

| 9 | Make any intervention needed to preserve character-defining elements physically and visually compatible with the historic place and identifiable on close inspection. Document any intervention for future reference. | This standard is applicable. The interventions will preserve the character-defining elements. The new front entrance stair and ramp structure will be visually compatible, subordinate and distinguishable to the existing heritage façade. All interventions to the character-defining elements will be documented. |
|----|--|---|
| | Guideline | Comments |
| 10 | Repair rather than replace character-defining elements. Where character-defining elements are too severely deteriorated to repair, and where sufficient physical evidence exists, replace them with new elements that match the forms, materials and detailing of sound versions of the same elements. Where there is insufficient physical evidence, make the form, material and detailing of the new elements compatible with, and subordinate to and distinguishable from the historic place. | This standard is applicable. The existing character-defining elements will be repaired in kind. |
| 11 | Conserve the heritage value and character-defining elements when creating any new additions to an historic place or any related new construction. Make the new work physically and visually compatible with, and subordinate to and distinguishable from the historic place. | This standard is applicable. The heritage value and character-defining elements will be conserved and maintained. The new proposed front entrance work and the rear elevator structure are contemporary in design. The new additions are compatible, and subordinate, and distinguishable to the character-defining elements. |
| 12 | Create any new additions or related new construction so that the essential form and integrity of an historic place will not be impaired if the new work is removed in the future. | This standard is applicable. The new two-storey rear elevator structure will not impact the essential form and integrity of the character-defining elements of the historic place. The new ramp and stair structure has been designed to limit any impacts to the existing building and foundations, to be easily reversible in the future. |

As noted above, the conservation strategy is primarily concerned with the protection and maintenance of the heritage attributes. The attributes are in fairly good condition. The proposed conservation scope is related to the preservation and rehabilitation of character-defining heritage elements affected due to accessibility upgrades.

Prior to construction work, all existing conditions are to be thoroughly photographed and documented in order to establish a historic record of the building prior to construction. The heritage materials are to be tagged, catalogued, photographed, and documented prior to their dismantling. Protection measures are to be specified to ensure all heritage materials to remain in-situ will not inadvertently be damaged.

Recommended protection measures include:

- Providing protection at all interior paths of travel during construction.
- Providing a live vibration monitoring system to track construction-related vibrations that could potentially impact the heritage structures
- Ensuring any adjacent structural work does not cause damage to interior heritage attributes.

Careful oversight is required during the construction process to ensure no inadvertent negative impacts will occur, such as demolition or damage of heritage attributes. This will include heritage elements located within the proposed area of scope as well as areas of construction access outside of the proposed scope of work, where there are existing heritage elements.

13.0 Statement of Professional Opinion

Recommended dismantling measures include:

- Ensuring the dismantling of stone elements is carefully executed by qualified heritage masons
- Care is to be taken for the proper handling and storage of all salvaged heritage materials to be reinstalled on the building so as to not inadvertently damage these materials during the construction process.
- Careful dismantling of the existing east exit ramp and stairs to minimize damage to the building's stone wall.

The following repairs are included in the proposed work:

- Repairs to the exterior masonry wall behind and where the existing entrance structure is being removed
- Repointing of all stonework within the scope of work.
- Repairing any anchor holes in the exterior masonry surrounding the entrance from existing lighting, access fixtures signage
- Rubbing and scaling back loose stone surfaces, poulticing to remove embedded salts, localized sculptural mortar repairs.
- Plaster repairs in-kind at exploratory openings, completed in the previous phase of investigations.

Should any concealed materials or systems that may potentially be heritage in nature be discovered within the site during work, activities should be halted at that location immediately and the Consultant should be notified to review.

This Heritage Impact Assessment finds that the proposed addition and interventions to the Koffler building will conserve the cultural heritage values of the Subject Property.

The proposal will:

- Provide contemporary additions that is sympathetic and subordinate to the existing building;
- Conserve the heritage attributes located within the Subject Property;
- Maintain the integrity of the existing architectural language; and
- Improve the use and layout of the interior of the building.

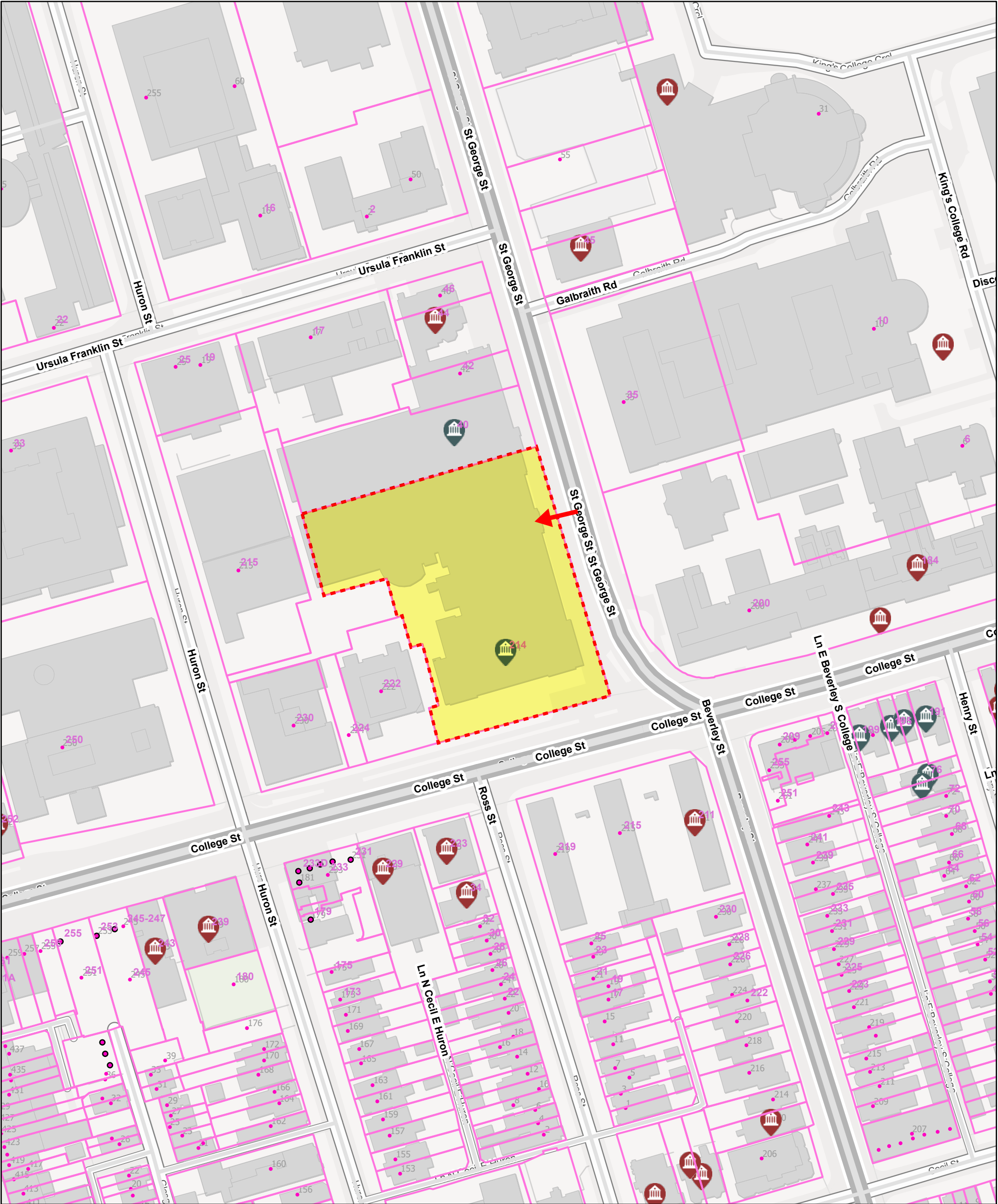
The proposed design meets the test of Standard 11 of compatibility, distinguishability and subordination from the *Parks Canada Standards and Guidelines for the Conservation of Historic Places in Canada*. The new additions integrates into the existing building composition through its volume and massing; its distinguishable architectural style and expression of its façade; and its subordinate relationship to the original building.

This HIA concludes that the proposal complies with the heritage framework outlined as per Parks Canada's *Standards and Guidelines* and exemplifies an appropriate conservation of a heritage building. It will have an overall positive impact, by upgrading the accessibility of the building and renewing the interiors, to allow the building to continue to serve the University of Toronto community.

Appendix A

LOCATION PLANS,
SCALED

Toronto Maps



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Property Parcel

Heritage Register

Listed

Designated Under Part IV Of The Heritage Act

Address

REGULAR

RESERVED

Centreline

Major Arterial

Minor Arterial

Local

Other

Laneway

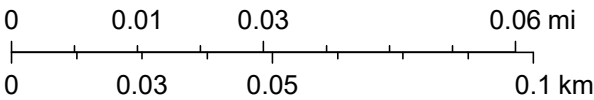


Subject Property



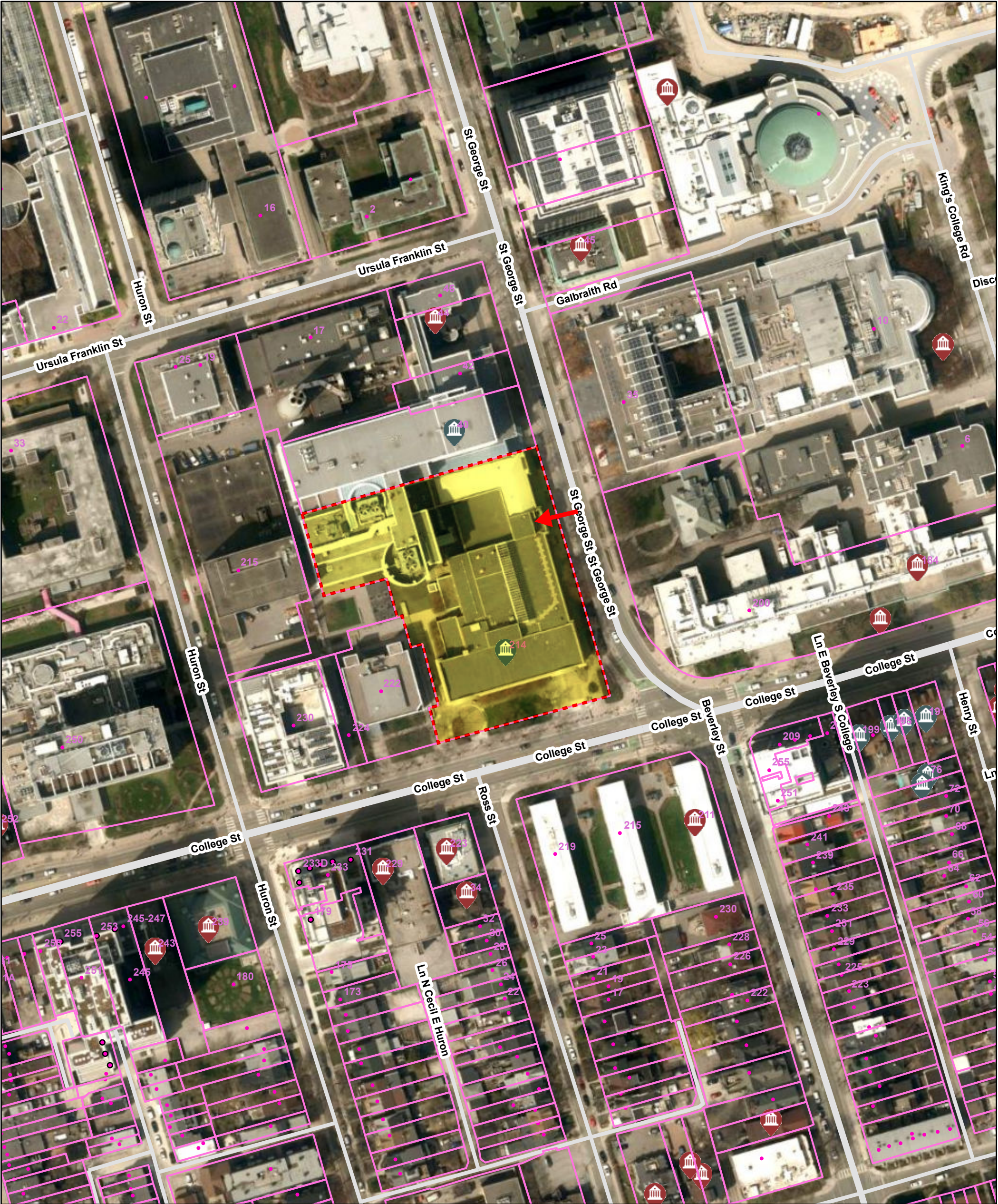
Entrance for Restoration

1:2,000



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, City of Toronto, Province of Ontario, Esri Canada, Esri,

Toronto Maps



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Property Parcel

Heritage Register

Listed

Designated Under Part IV Of The Heritage Act

Address

REGULAR

RESERVED

Centreline

Major Arterial

Minor Arterial

Local

Other

Laneway

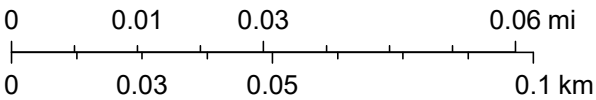


Subject Property



Entrance for Restoration

1:2,000



City of Toronto

Appendix B

HERITAGE
CONSERVATION PLAN

EVOQ

ARCHITECTURE

HEALTH AND WELLNESS CENTRE - KOFFLER CENTRE RENOVATION

Conservation Plan

UNIVERSITY OF TORONTO
214 COLLEGE STREET
TORONTO, ONTARIO

PROJECT NO. EVOQ: 9385-20

ISSUED: NOVEMBER 15, 2024



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1.0 INTRODUCTION

This Conservation Plan has been prepared by EVOQ Architecture Inc. for the University of Toronto as a part of a proposed renovation and expansion of the Koffler Health and Wellness Centre within the Koffler Student Services Centre Building. The building is located at 214 College street, and is home to essential student services for the university, such as the Campus Bookstore, academic and career departments, the Health and Wellness Centre, housing support services and the Family Care Office. The property is included on the City of Toronto Heritage Register and is designated Part IV under the Ontario Heritage Act. By-law 509-75, hereby referred to as the By-law, was passed by City Council on November 26, 1975.

The proposed interventions to the Koffler Student Centre Building, hereby referred to as the Proposal, include the renovation of selected interior spaces, the addition of two storeys to the existing structure and the rear, structural upgrades as required, and a new accessible entrance along Saint George Street.

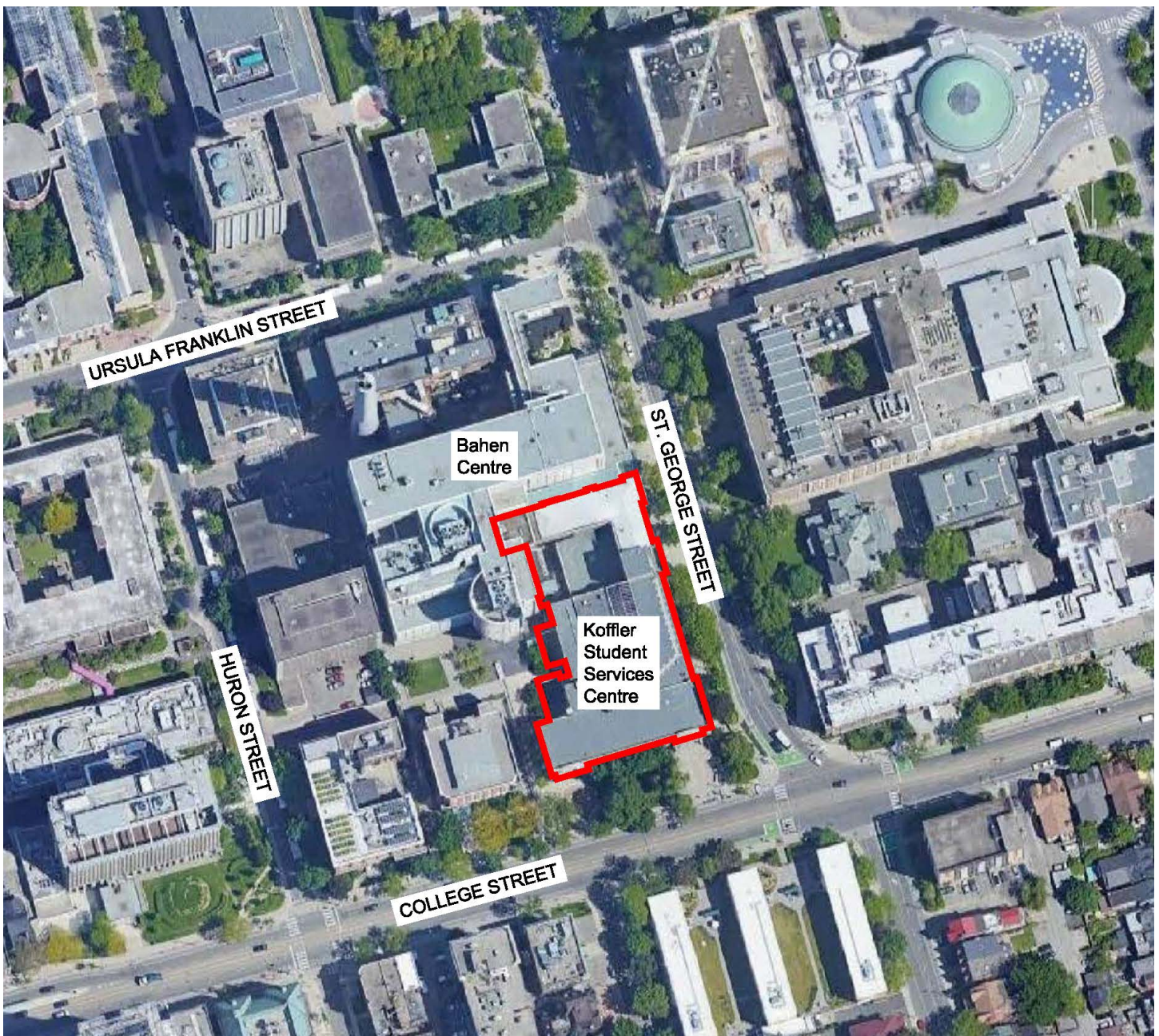


Figure 1. Context Map of Koffler Student Services Centre
EVOQ ARCHITECTURE

2.0 HISTORY AND EVOLUTION OF THE BUILDING

The Koffler Student Services Centre, formerly known as the Metro Toronto Central Library, and the Carnegie Library Building, located at 214 College St is designated under Part IV of the OHA through the By-law passed by the City of Toronto (refer to appendix A). The reasons for designation listed under Schedule 'B' of the By-law include references to *the Beaux Arts style of classicism, both externally and internally, in the main reading room*, in addition to its contextual importance and relation to the street, and open green space.

The original building was constructed in 1910, in the Beaux-Arts style, as the central reference library for the City of Toronto. This library contained the main reference library (upper floors) with a double height reading room, and upper exhibition space along its east wing, a ground floor circulating library with its own entrance, and a rear five-level stack space for book storage. In 1930, an addition to the north of the building was constructed, including new reading rooms and stacks, a library for youth, a theatre and exhibition space, and expansion to book storage and cataloging space. In 1959, there was a rear infill. In 1984, there was a significant renovation transforming the central library into the new student centre for the University of Toronto; this included the enclosure of the courtyard as well as reconfiguration of the levels in the stack spaces and the exhibition spaces. This renovation in general retained the original 1920 and 1930 facades. In 2002, its northern facade was enclosed by the construction of adjacent Bahen Centre for Information Technology. Both the 1957 rear infill and the 1984 interior alterations and addition are excluded from the By-law.

The principal facade is along College Street, symmetrical with its end entrances marked by paired composite brick pilasters supporting a dentiled round-arched pediment. The east entrance to the central reference library is defined by a large set of stairs; the more modest west entrance leads directly to the ground floor circulating library. Both the principal and secondary (along Saint George Street) elevations are punctuated by ground floor paired rectangular windows in stone cladding with double-height round-arched windows on its buff brick field cladding in the upper floors. Its bays are defined by brick pilasters supporting a brick entablature and parapet above. Stone ornamentation includes exaggerated keystones and decorative cartouches. Slight differentiations are observed between the 1910 and 1930 sections, with bush-hammered sandstone in the 1909 building and limestone in the 1930. The secondary Saint George entrance is also more restrained in its detailing. It should be noted that the existing ramp and stairs are not original to the building.

The interior of the building still retains some of the ordered, symmetrical and axial Beaux-Arts style, with its clear hierarchies. A grand ceremonial staircase leads into the main entrance hall, reading room and mezzanine of the original 1910 building. The reading room in the Saint George addition also retains some of its detailing. These spaces are highly decorative, with pilasters, columns and coffered ceilings. This area of the building has undergone some interior renovations.

The following sections provide a detailed evolution of the site and building.

2.1 Development History of the Site & Building

The Natural Landscape and Early Settlement

Approximately 13,000 years ago, the last of the ice age glaciers melted northward and left an ancient glacial lake in its stead. Known as 'Lake Iroquois', it was a melt water lake whose water levels stood 40 metres higher than the current Lake Ontario. The property would have been submerged under Lake Iroquois; its shoreline was located north along what is now Davenport Road.

Around 11,700 years ago, the Laurentian glacier at St. Lawrence River gave way allowing Lake Iroquois to retreat towards St. Lawrence River, creating the smaller Lake Admiralty, with its shoreline approximately 20 kilometres south of the current Lake Ontario. Early hunter-gatherer inhabitants moved in from the south, though little evidence of their life remains given that many of their campsites are now submerged by Lake Ontario.

By 6000BCE, the climate began changing and warming. With the climbing temperatures came rising water levels, temperate forests and fauna as well as wild game from the south. The lake, now known as Lake Ontario, began to rise in water levels and take shape to form its current shoreline. The early inhabitant population increased as hunting and fishing became important. An overland portage trade route known as the 'Carrying Place' developed, linking Lake Ontario to Georgian Bay and Lake Huron. The land began supporting crop production and farming. Inhabitants would create semi-permanent villages, providing them with a base while hunting/gathering and for the farming of crops, such as corn, beans and squash. Evidence of Iroquoian villages, in the forms of longhouses, defensive stockades and cultivated farms, as well as material artifacts, has been found in the greater Toronto region.

In the 14th century, the Iroquoian-speaking bands in the Ontario region began consolidating their tribes to become larger social groups. One such group, the Huron-Wendat, adopted the Toronto region as part of their territory. However, the Huron-Wendat preferred settlement around Georgian Bay; reasons speculated have included better fishing opportunities, waterway access, and creating tribal relations with neighbours. Toronto, thus, was sparsely populated between the 14th and 16th centuries.

17th and 18th Centuries

The advent of the 1600s brought increasing European contact, namely the fur traders and missionaries. Their presence also brought foreign diseases to the area and a great number of Indigenous peoples perished. In addition, the Iroquois from New York moved into the Indigenous territories in Ontario, looking to defeat and absorb those groups into their tribe. They captured the Huron territory and brought it under Iroquois control. In the late 1600s, the Iroquois tribe of Seneca settled in the Toronto region. Evidence exists of two communities in Toronto, one at the mouth of Rouge River and the other on the Humber River, both strategically located along the Carrying Place trail. The Senecas were soon displaced by a tribe of Algonkians, later known as the Mississaugas.

By the 17th century, the European presence increased, with both the French and the British vying for strategic dominance of northeastern North America and their trade waterways. During these conflicts, the region was claimed by the French and an outpost, known as Fort Rouille, was constructed in 1750 on what is now Toronto. However, by 1760 the French were soundly defeated by the British around the Great Lakes region and forced to retreat northwards to Montreal, passing the region to British rule. Shortly after, the American Revolution was waged to the south (1775-83). With American independence achieved in 1783, a number of loyalist refugees looked to move northwards to settle in the region to remain within British territory.

Thus, the British looked for both a suitable place to establish a settlement as well as a site that could support military operations around the Great Lakes. They negotiated with the Mississaugas and purchased the lands north of Lake Ontario in 1787, chosen for both its access to the Carrying Place and its protected harbour to defend against potential invasions by the Americans. The land was cleared for farming, settlers moved into the area, and it was decided that the provincial capital of Upper Canada would be established on this site. In 1793, Lieutenant General John Graves Simcoe constructed Fort York at the mouth of the harbour; in tandem, a town site was located to the east of the Fort, known as 'York'.

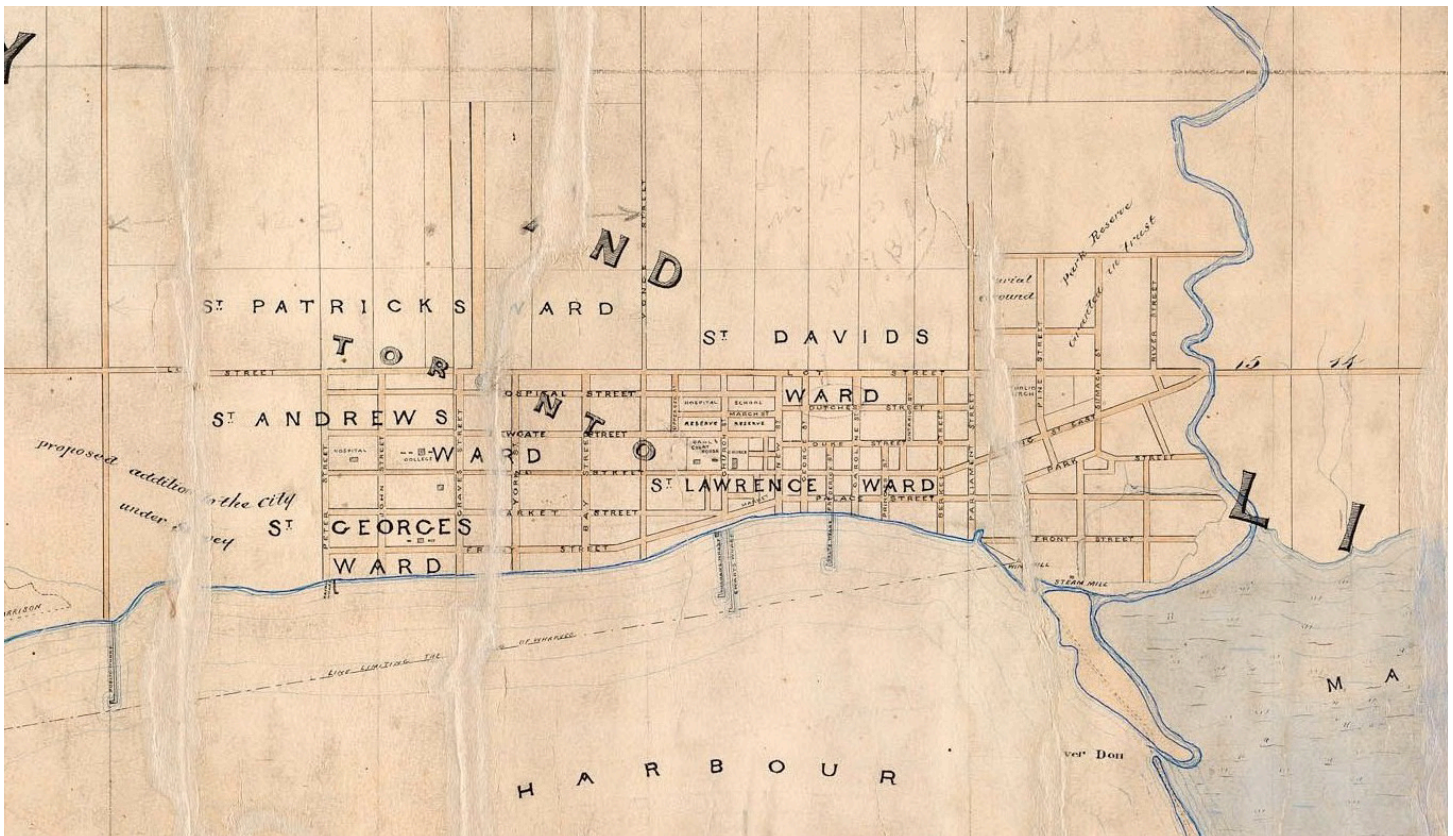


Figure 1: Plan of the City of Toronto and Liberties (J. G. Chewett, 1834, City of Toronto Archives: MT 401)

19th Century to Early 20th Century

As part of the town site, Simcoe had a portion of the land north of the town surveyed as park lots. These were 100-acre lots along Lot Street (now Queen Street). They had narrow frontages (660 feet) but were deep (6600 feet) reaching north to what is now Bloor Street. Each lot would have access to the town and harbour. There were 32 lots, starting with Lot 1 by the Don River spanning to Lot 32 by the Humber River. These lots were used to reward the gentry (often military or government officials) for aiding the governance of the town. The lots would be patented (given title) once settlement duties, which included clearing of the land, construction of a house on site as well as maintenance of common roadways were completed.

The Subject Property is situated on what was once Park Lot 14. First granted to Peter Russell and patented in 1798, the lot spanned from present-day Queen to Bloor Streets between Beverley/St. George and Huron Streets. Peter Russell was an Irish-born government official and politician from England who was brought to Upper Canada by John Graves Simcoe in 1790 to serve on the Executive Council and Legislative Council, later acting as interim administrator of Upper Canada upon Simcoe's leave of absence in 1796. After settling in York, Russell acquired the adjacent park lots 15

and 16 to the west, and upon his death, he granted the lots to his half-sister, Elizabeth, who then willed the properties to her cousins Maria Willcocks and Phoebe Baldwin, wife of Dr. William Warren Baldwin. Maria Willcocks left her property to Phoebe upon her death, and thus, the three park lots passed to the Baldwin family and formed part of the Baldwin estate.

The Baldwins were among the Town of York's early elite families, serving in various prominent religious and governmental roles, and they consequently amassed significant land holdings in the early 19th century. At its peak, the Baldwin estate measured roughly 1,100 acres stretching from Queen Street up to what is now Eglinton Avenue.

As early as the 1840s, historical maps indicate that the Baldwins were subdividing and selling off their southern lands for development on the former park lots 14 through 16. Development of these lands began in the south, near Queen Street, and gradually worked its way north over the following decades. Frederick Perkins entered into a mortgage agreement with the Baldwin family in 1857 for a property located at the northwest corner of College Street and St. George Street. He received the deed of land in 1867.

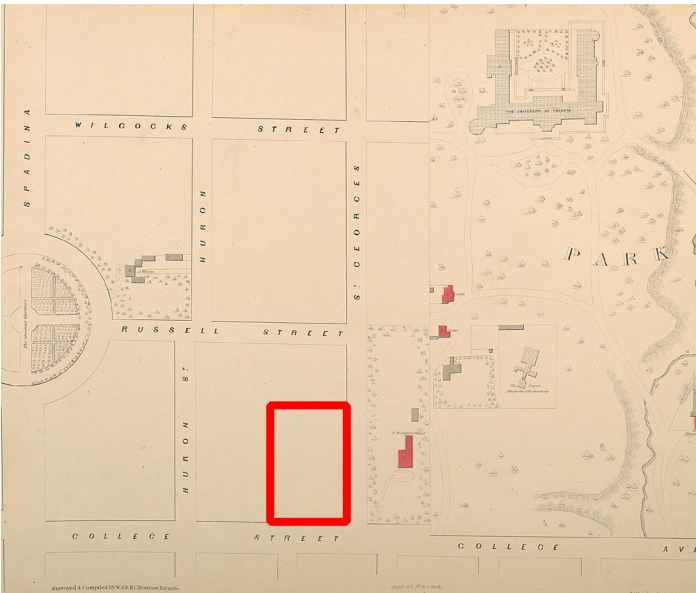


Figure 2: Atlas of Toronto, Plate 5, extract (1858, W.S. & H.C. Boulton, Toronto Public Library); red box indicates Subject Property

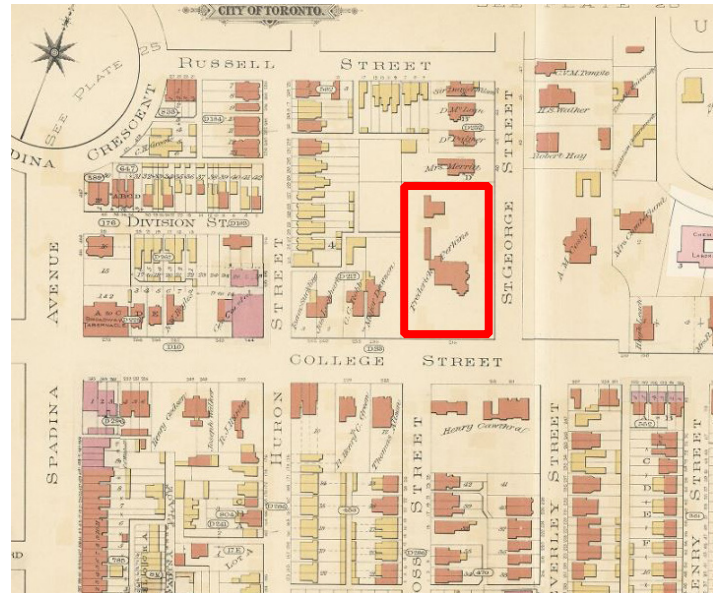


Figure 4: Atlas of the City of Toronto and Suburbs, Plate 14 extract (1899, C.E. Goad, City of Toronto Archives); red box indicates Subject Property

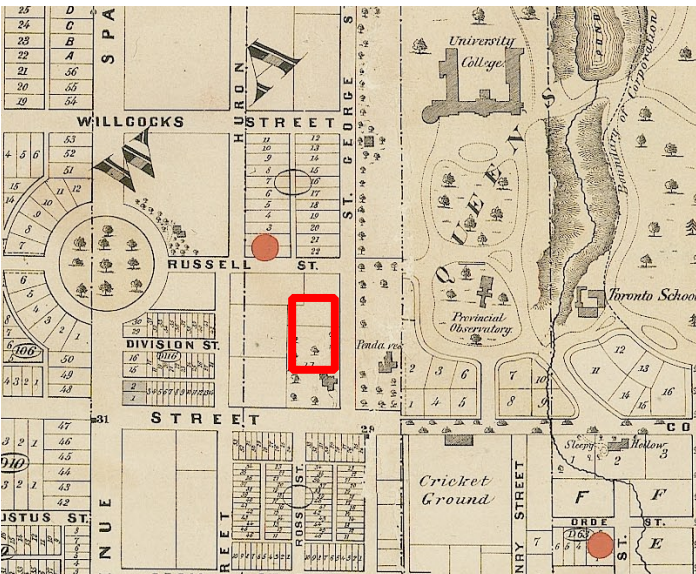


Figure 3: Map of the City of Toronto, extract (1972, Wadsworth & Unwin, Library and Archives Canada: NMC25641); red box indicates Subject Property



Figure 5: Frederick Perkins' House, College Street, northwest corner of St. George Street (1904, Toronto Public Library)

Frederick Perkins was a wholesale grocer, in business since 1836 first Hart & Co, then in 1843 as F. & G. Perkins, and finally as Perkins, Ince & Co, which continued under this name after his retirement in 1874. The company carried groceries, wines and liquors; their five-storey warehouse was located at 41 - 43 Front Street East. That warehouse, known as F.G. Perkins Block and designed by A. McDougall & F. Darling, is currently still in existence and is designated as having cultural heritage value.

Perkins' property on College Street was known as Parkhurst and consisted of a stately mansion within a generous acreage, surrounded by other wealthy estates. The house was likely completed by 1862, the year Perkin's name made its first appearance on College Street in the Toronto Directory.

The property remained within the Perkins family until it was sold to the City in late 1904 for \$75,000, as the site for its new Central Reference Library. The house and its associated outbuildings were demolished.

Toronto Public Library & the Carnegie Grant

Toronto's first library was the Toronto Library, a private subscription library that began in 1810. The York Mechanics Institute (later Toronto Mechanic's Institute) began a library of reference and circulation in 1830, namely to educate mechanics through classes and to provide technical references. Both types of libraries were open only to paying members; these library models proliferated in the 1800's with additional subscription libraries and mechanic institutes established throughout Toronto. Library facilities were lacking for the general public, as the paying member fees were fairly high, and other libraries, such as the parliamentary library or the University College Library were not accessible to the public.

The passing of the Free Libraries Act in 1882 under premier Oliver Mowat marked a pivotal shift for the history of Toronto libraries. The act had four principles. Libraries were to be financially supported by public funds, to be free, to be open to all citizens, and to be operated and managed by an independent board. Petitions were made to Toronto City Council, and a local by-law passed in 1883 for the creation of the Toronto Public Library. The Toronto Mechanics Institute offered its building and its collection, thus Toronto Public Library officially opened in 1884.

Over the next few decades, the population of Toronto continued to grow, but the library was thwarted from significant development due to the library board's deteriorated relationship with the City Council because of insufficient funding. By 1900, the library system included the central library housed at the Mechanics Institute building, which was old, in disrepair, and small, and five branch libraries that were located in rented premises. This

need for funding was finally alleviated by a Carnegie grant of \$350,000, offered to the City of Toronto in 1903 for the construction of purpose-built libraries.

Andrew Carnegie was a steel magnate turned philanthropist, with a deep interest in providing free libraries throughout the world. Over his lifetime, he donated more than \$56 million for the construction of libraries, including more than \$25 million for 125 library projects in Canada alone. Two unsuccessful grant application attempts by the City finally led to a successful one in 1903. The bulk of the grant was given over to the building of a new central library and \$25,000 each was provided for three additional branch libraries. The grant imposed conditions that the money be used solely for building. The library was to supply its own books and furnishings. The City would provide for a yearly operating budget, and the land for the building.

The site for the central library was under discussion between the City Council and the Library Board, with council preferring a more downtown location and the Library Board who preferred a more uptown location, reflecting the direction of population growth. The Library Board won out, with the purchase of the Perkins site at the northwest corner of College Street and St. George Street in December 1904.

An architectural competition call was initiated in 1905



Figure 6: Metropolitan Toronto Central Library (1914, City of Toronto Archives: Fonds 1231 File 1231 Item 0307)

Central Reference Library

for the design of the new Central Reference Library. Detailed programming specifications were included in the competition; the winning prize was \$750. The jury consisted of the Mayor, a city councillor, a public library trustee, the Chief Librarian (James Bain at the time), the City Architect, and one non-competing architect. 19 entries were submitted, though none were chosen. \$1000 was divided between four firms who were asked to resubmit, with Alfred Chapman in association with Wickson & Gregg winning the commission. Construction began in 1906 and was completed in 1909.

The library was designed in the Beaux-Arts Style. Undoubtedly, Chapman was influenced by his time studying at the Ecole des Beaux-Arts in Paris from 1901 to 1903 and his work experience in New York City prior to his return to Toronto in 1906 to establish his architectural practice. The Central Reference Library was one of his first commissions. To this design, he brought a sense of planning, proportion and spatial organization that continues in much of his later works, as part of the partnership Chapman & Oxley. This architectural style was prevalent for public and commercial buildings throughout Canada in the early 19th century.

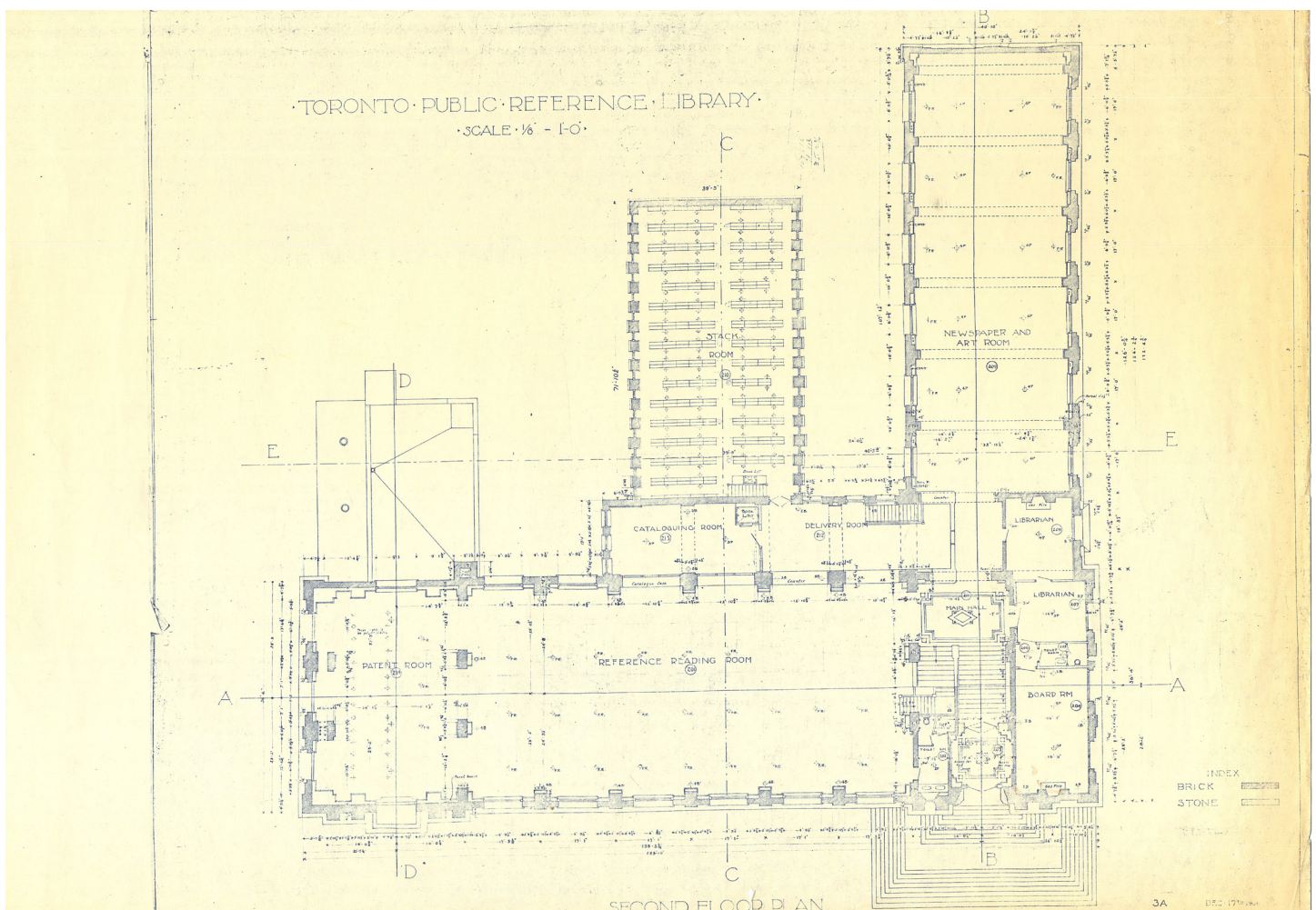


Figure 7: 1906 Drawing of Second Floor Plan (Chapman and Wickson & Gregg, 1906, University of Toronto)

The original 1909 library building is grand and dramatic, sited prominently at the northwest corner of College and St. George Street. The library contained the main reference library (upper floors) with a double height reading room, the College Street circulating branch library (ground floor) as well as a five-level stack space constructed of iron and glass at the rear, book storage and sorting spaces, and offices. In addition, it included exhibition space on the upper floor east wing.

The main buff-brick symmetrical façade is located along College Street, with entrances at either end. The entries are marked by paired composite brick pilasters on either side supporting a dentiled round-arched pediment. The east main entry is defined by a large set of steps leading to the entrance of the central reference library; the west more modest entry leads into the ground floor, originally the circulating library. The ground floor principal elevation is punctuated by paired rectangular windows set within a smooth sandstone base. Double-height round-arched windows on the upper floors are set within the brick façade; its bays are marked by composite brick pilasters, supporting a dentiled brick entablature with brick parapet above. The secondary St. George elevation continues this detailing, which includes a side street entrance originally for library staff.



Figure 9: Reference Reading Room (Pringle & Booth, 1920, Toronto Public Library); looking west



Figure 10: Lower Art Room, looking north-east (1912, Toronto Public Library); it has now been altered, subdivided and converted into offices



Figure 11: Interior, Gallery (1913, Toronto Public Library); the skylights have since been closed off



Figure 8: Interior, main entrance, looking upwards to mezzanine (Pringle & Booth, 1909, Toronto Public Library)

The spatial organization of the spaces were ordered, symmetrical and axial, with the hierarchy of the well-proportioned rooms clearly defined in their ornamentation. The main entrance hall and reading room had decorative columns and pilasters and coffered ceilings; the art gallery space originally included numerous skylights. The stacks and service rooms were more plainly detailed.

The library opened on September 8, 1909. It was highly frequented. The library system was slowly evolving, introducing an open-shelf system where anyone could retrieve the books, open membership to anyone listed in the City Directory, and an integrated library cataloguing and ordering system. Librarian education courses, held at the library, began in 1911 until they moved to the University of Toronto in 1928 becoming an academic course. A children's library was also started in the branch library.

In 1930, Chapman (with Oxley) and with Wickson & Gregg completed an addition to the library. The initial idea to expand the library was conceived by Chapman during the initial design, thus this new wing was seamlessly inserted to the north of the original 1909 library. Costing \$430,000, this addition included new reading rooms and open stacks for the public on the ground and mezzanine floors, a library area for the youth, an assembly space with a theatre and an exhibition gallery on the third floor. This gallery space was named the John Ross Robertson Gallery and exhibited his generous collection of paintings, engravings and Canadian prints that he had been slowly gifting to the library since 1911.

Spaces for the library staff and library functions were expanded, such as new receiving and delivery spaces, an expansion to the five-storey closed stack volume, and areas for bindery, finishing, cataloguing and ordering. New technology, such as a mechanical book conveyor was incorporated into the design.



Figure 12: Central Reference Library as seen from St. George Street (c1920, City of Toronto Archives, Fonds 1244, Item 3011)

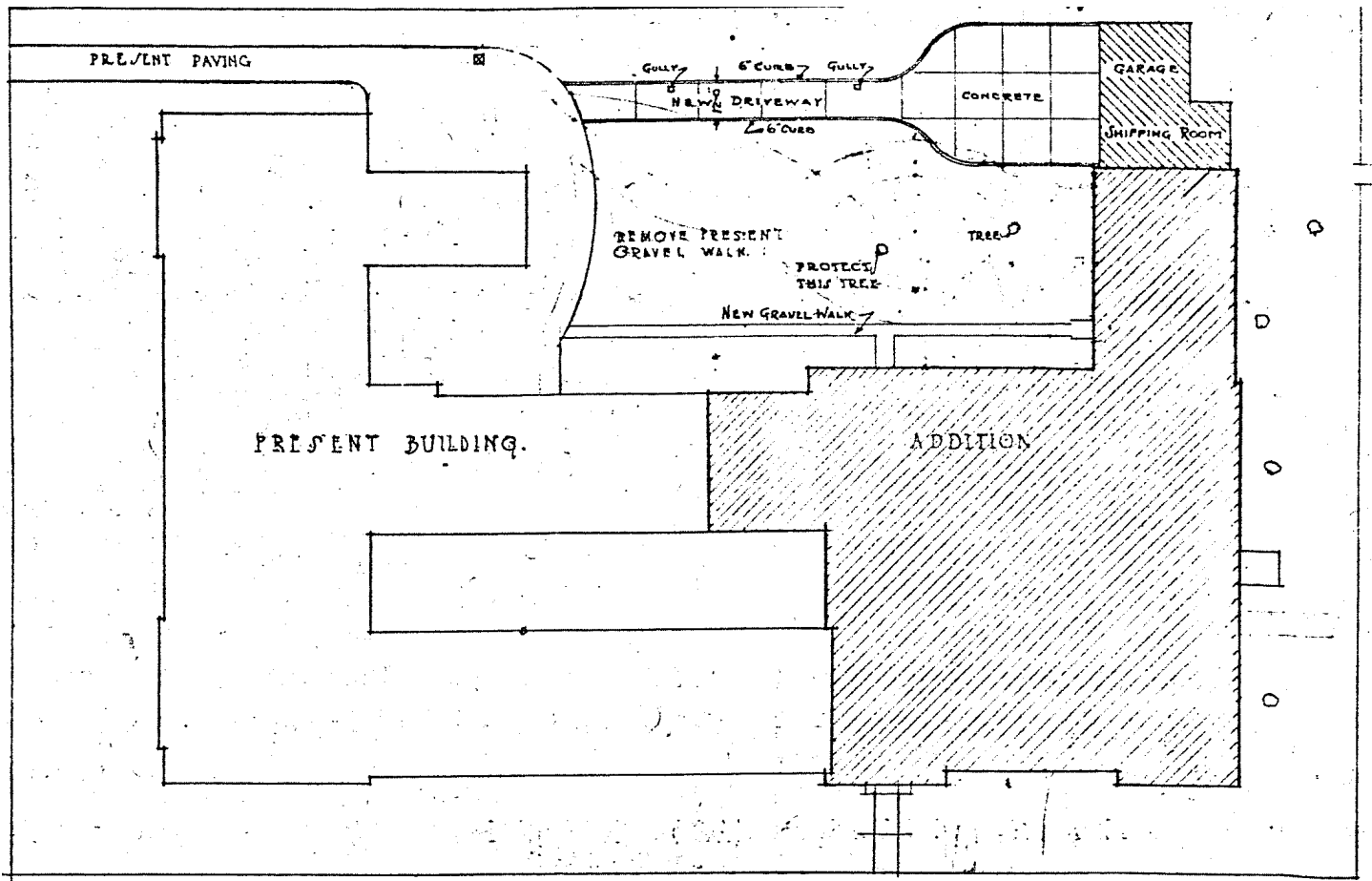


Figure 13: Site Plan (Chapman & Oxley with Wickson & Gregg, 1928 design drawings, University of Toronto); 1930 addition adjacent to original 1909 building

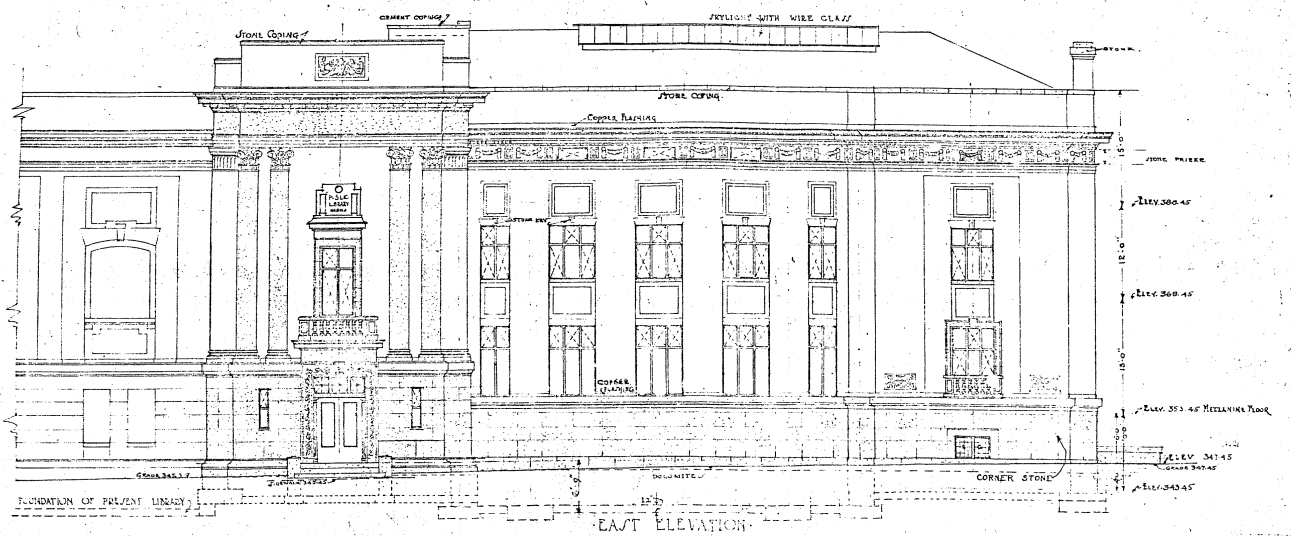


Figure 14: East Elevation (Chapman & Oxley with Wickson & Gregg, 1928 design drawings, University of Toronto); addition to existing 1909 building



Figure 15: Interior, Bindery and Book Repair Department (Pringle and Booth, 1930, Toronto Public Library); this area has now been altered and converted into offices



Figure 16: Interior, Central Circulating Library (Pringle & Booth, 1930, Toronto Public Library); new reading room along St. George Street

The interiors retained the hierarchal relationship of ornamentation, with coffered ceilings and wainscoting, and included a new skylight.

During the 1930's depression, the library was very popular. The Hallam Room, a technical and commercial section, was added to meet the citizen's needs for technical reference books. After the Second World War, the library added to its programming more extensive public education courses. With the increasing demands for books, the book-stack capacity was extended, and repairs and additions to the building were constructed. This included a 1959 rear infill, between the five-storey stacks volume and the mechanical space. A new elevator and link between these two volumes were provided which were originally only accessible through the reference reading room. In the 1960s, the third storey library auditorium was renovated into a working theatre with a new apron stage, working lighting equipment, and seating on risers for 209 occupants. The theatre was rented out to non-commercial theatre groups in the City.

This central reference library was in use for 60 years until 1977, when it was relocated to its current home on Yonge Street and Asquith. This move came about due to the establishment of the Municipality of Metropolitan Toronto on January 1, 1954, a federated municipal government that incorporated a number of outlying suburbs. Legislative



Figure 17: 1959 Rear Addition (c1980-1998, City of Toronto Archives, Series 1465, File 200, Item 13)

amendments in 1967 consolidated the local libraries into a metro library. Thus, the library set out a plan consolidate the library's catalogue, memberships, and research. A new and larger building was commissioned at a more central location. City council approved the plans and site in 1974, and chose Raymond Moriyama as its architect. The new reference library opened on October 19, 1977.

Koffler Student Services Centre, University of Toronto

The building at College and St. George was no longer used as a reference library. The University of Toronto, whose St. George campus is located in the neighbourhood, had been expanding. A fundraising campaign by the university begun in 1976 raised over \$36million to renew the university. Murray Koffler pledged \$1 million for a new student centre. Koffler, an alumni of the School of Pharmacy at the university, became a successful entrepreneur, founding Shoppers Drug Mart as well as co-founding the Four Seasons Hotels Ltd. He also became a noted philanthropist, forging a close relationship with University of Toronto over the years with significant support for education, student assistance, and research across the campus including a 350-hectare land donation, Jokers Hill, for scientific research.

This pledge led to the acquisition of the old Central Reference Library for the university in 1980, and to its conversion into the Koffler Student Services Centre. The student services centre would centralize student services on campus into one location. Such services include assisting students and staff in searching for housing, accessing daycare services, and providing physical and mental health care. Such services are still offered on campus, some of them continue to be located in the Koffler Student Services Centre. The University of Toronto bookstore would be relocated to this building in 1984. The bookstore, which begun in 1897 as the Students' Books Department, formed an integral part of campus life providing necessary academic books. The theatre was renamed the Robert Gill Theatre (after a former Hart House Theatre artistic director and noted university drama instructor) and became part of the University's Centre for Drama, Theatre & Performance Studies program. Howard Chapman, son of Alfred Chapman, was commissioned to complete this project; the building opened to the students in 1984.

In 1975, the building was designated by the City of Toronto, through By-Law 509-75, as an example of Beaux-Arts style. Its external architecture and some of its internal features such as the reading room were noted in the designation. The adaptive reuse of the building into a student centre generally maintained the exterior facades; and the reading room was converted into the University of Toronto bookstore. The other large spaces, with the exception of the theatre, were partitioned into smaller offices and auxiliary spaces. The open courtyard space between the original building and the 1930 addition was enclosed with a new skylight. The original skylights on the third floor were covered. Additional circulation and stairs were provided to connect the varied levels of the original building and additions, new

penthouses were installed on the roofs and a new loading dock constructed. The original five-levelled stack room with its very low ceiling heights was converted into three floors, to allow for additional programming.

The Bahen Centre for Information Technology, constructed in 2002, now abuts the north elevation of the Koffler building, enclosing its original north façade in the building's east entrance.

The Koffler Student Service Centre continues to provide essential student services for the university. The bookstore is one of the largest university campus bookstores, carrying over 21,600 individual titles focuses on academic and trade books; they also host book events and provide other student items. The building houses important University of St. George Campus student services, including the academic and career departments, the Health and Wellness Centre, housing support and the Family Care Office. The building continues to serve a central role within the University supporting students to build skills, engage with the community and integrate their learning.

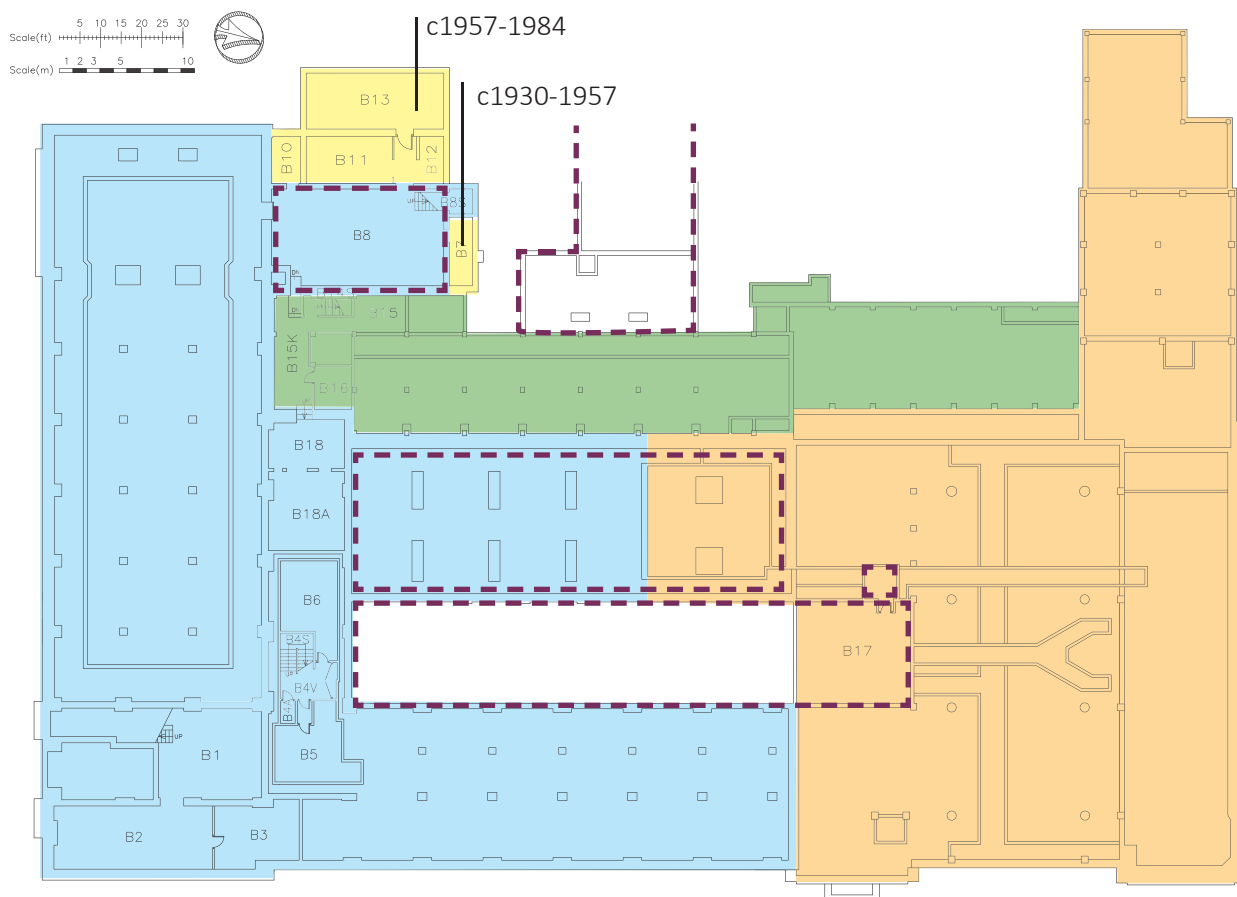


Figure 18: Adam and Tiana Koffler, whose father donated for the building, in atrium (Frank Lennon, 1985, Toronto Public Library)

3.2 Illustrated Evolution of the Building

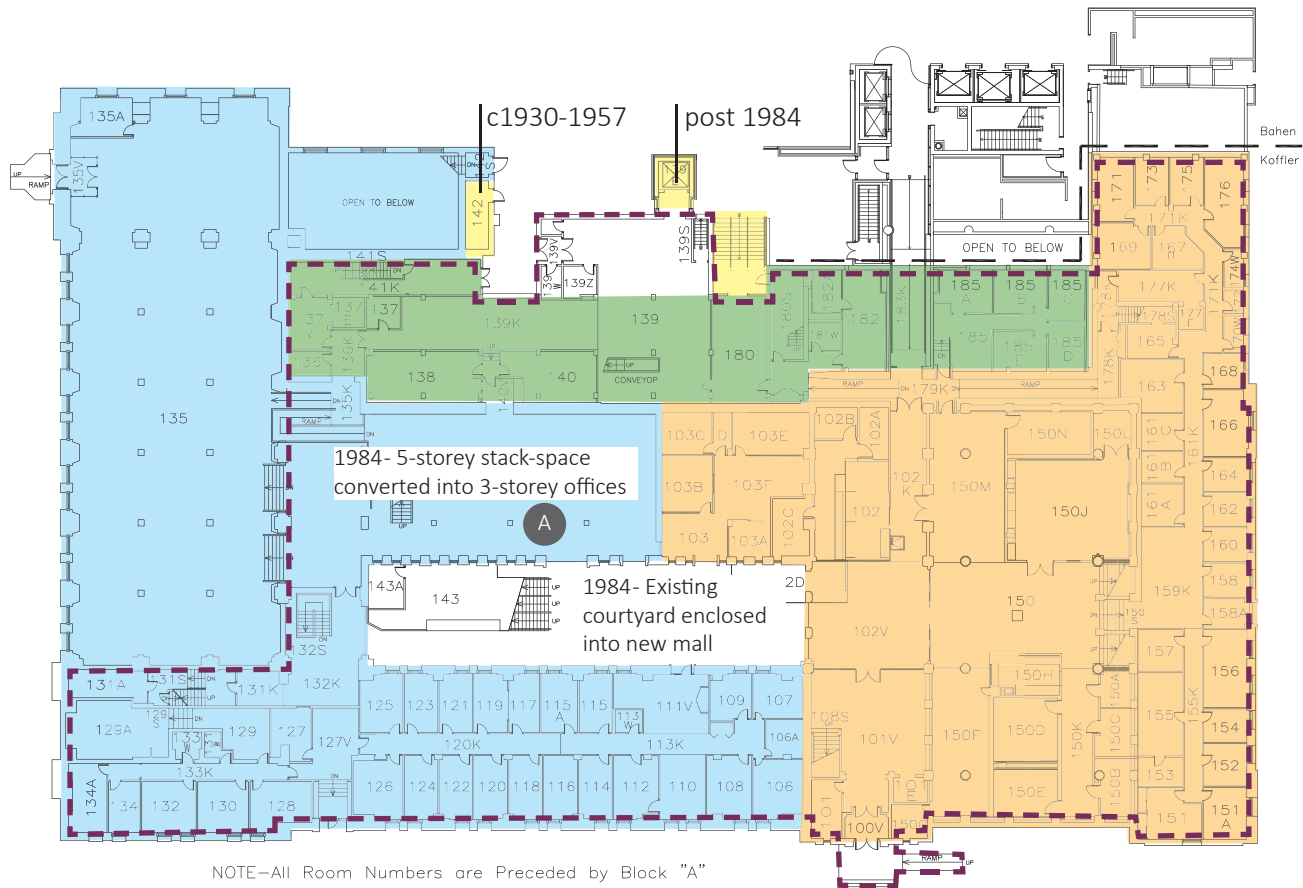
Evolution of the Building:

- 1909 Original Building
- 1930 Addition
- 1957 Addition
- 1984 Interior Renovation / Addition
- Undated Additions (refer to annotations)
- A Annotations on building changes

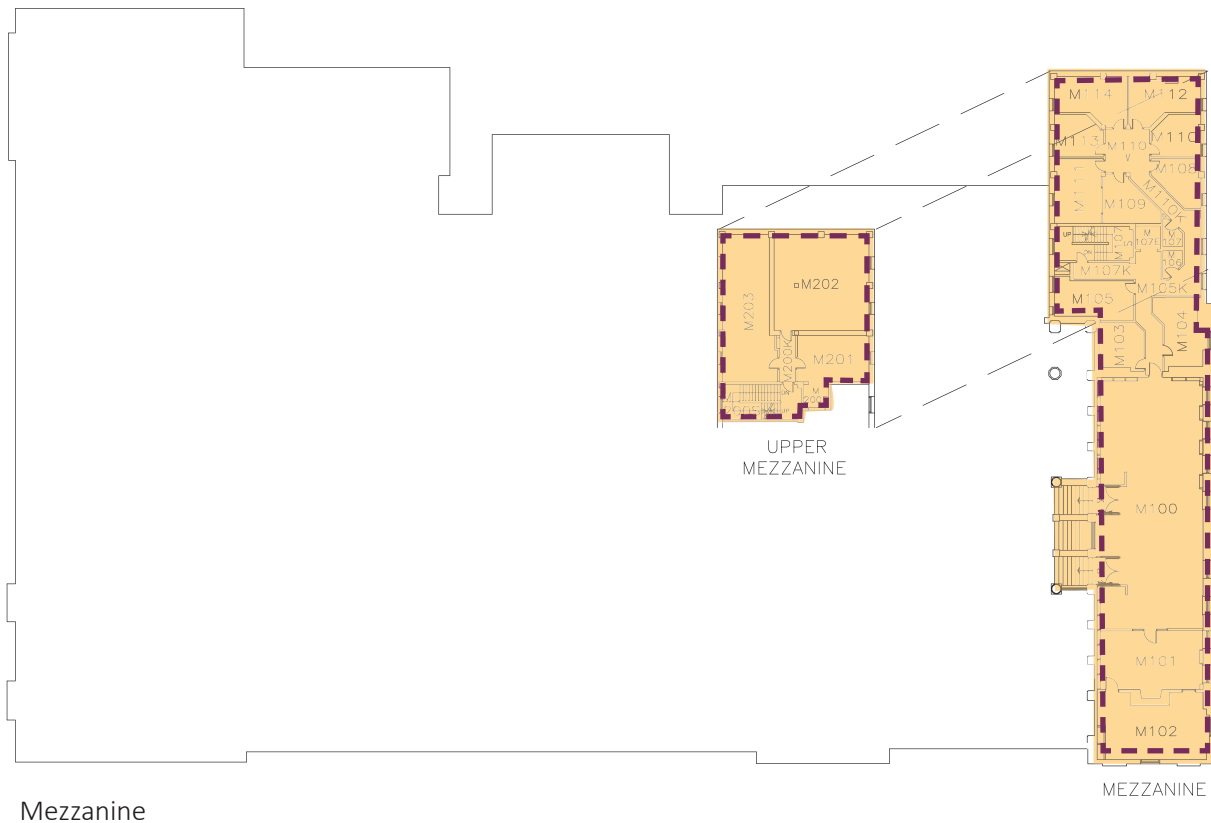


Basement Floor

HISTORY AND EVOLUTION OF THE BUILDING

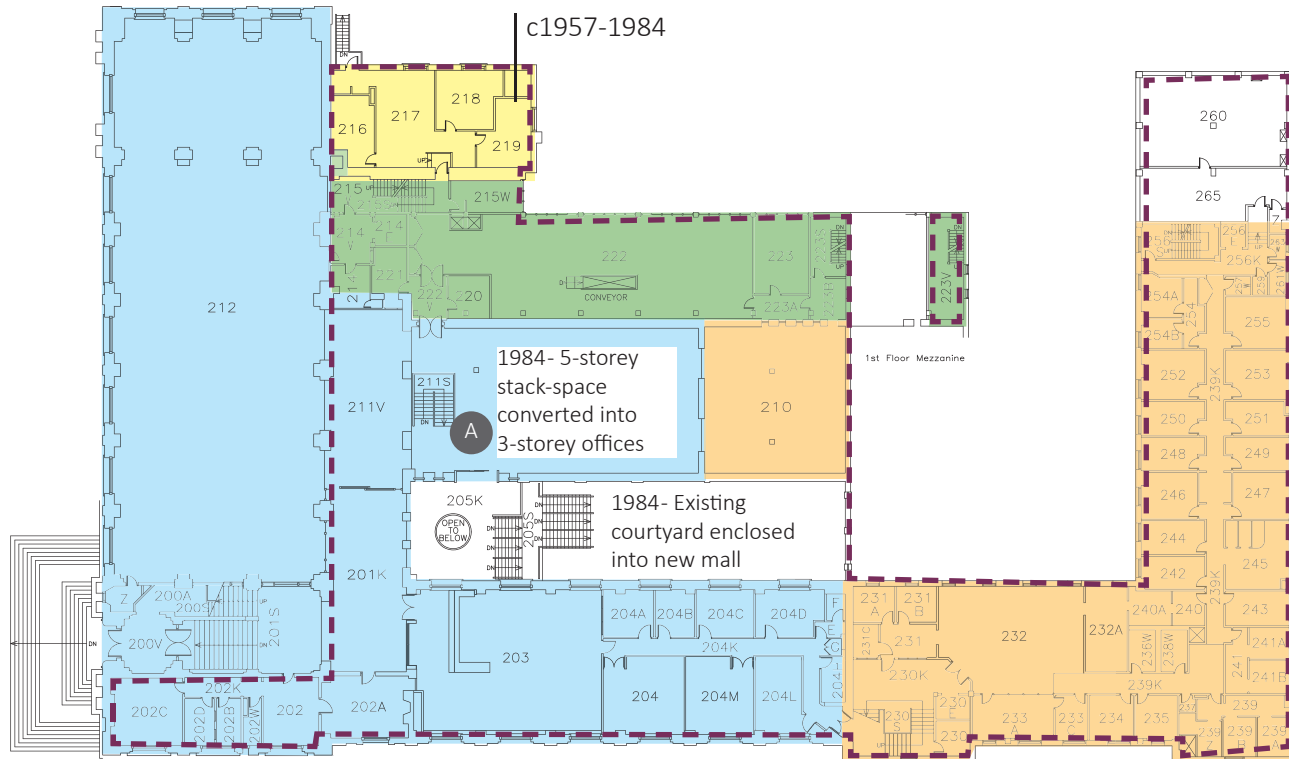


Ground Floor

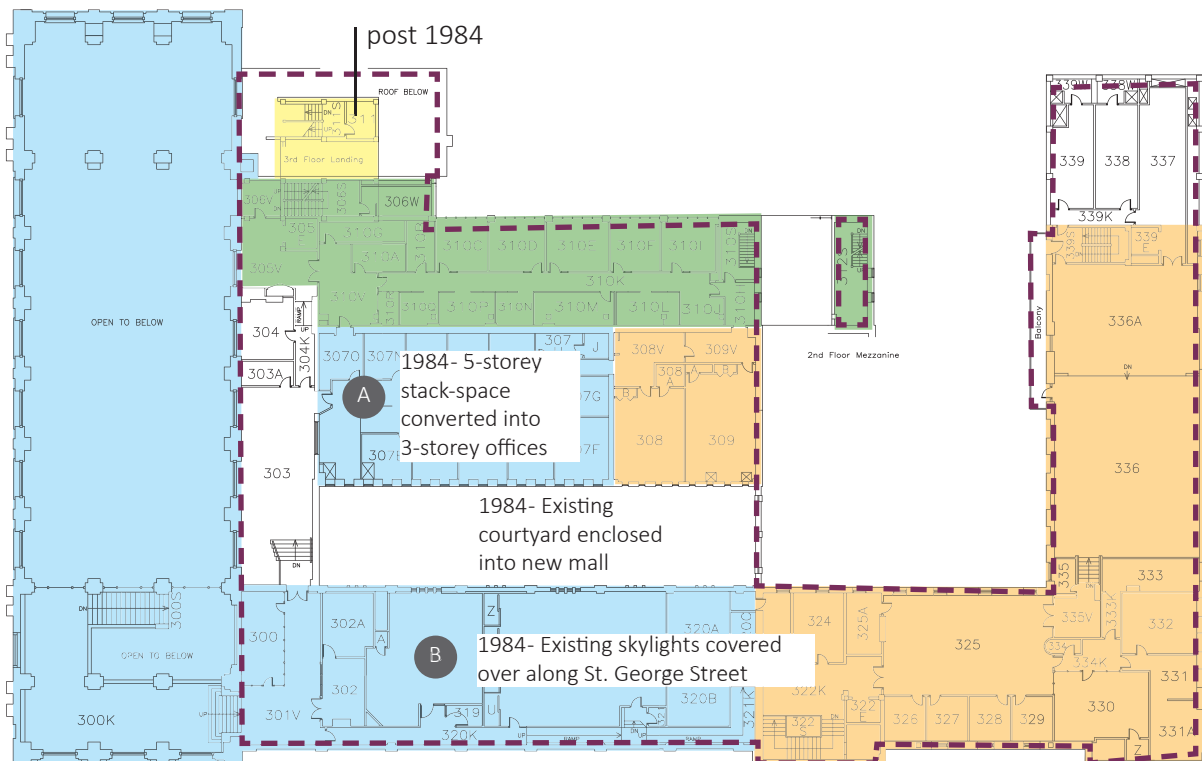


Mezzanine

HISTORY AND EVOLUTION OF THE BUILDING

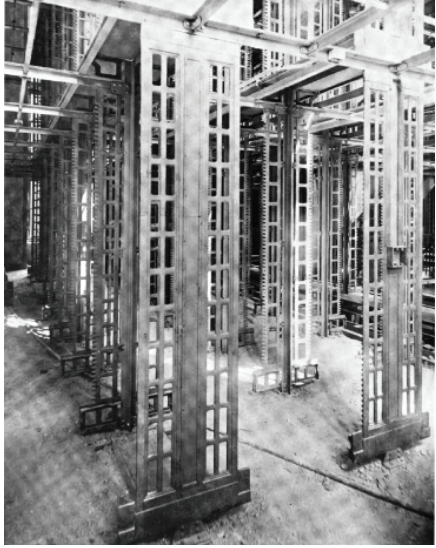


Second Floor



Third Floor

A

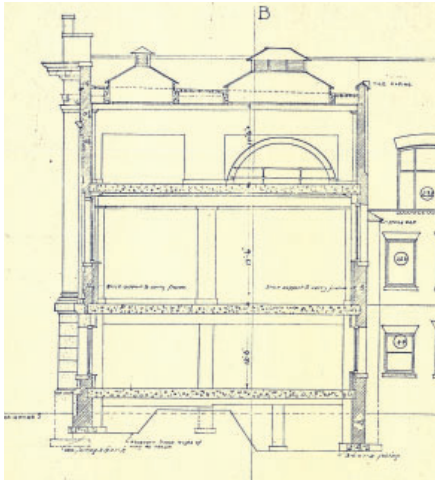


Library Stack Construction

Typical example of early 20th Century library stack construction. The building's library stack was removed in 1984 during its conversion into a student centre for the university, and three standard-height floors were constructed in its stead.

Widener Library under construction, c1914, Snead & Co. Iron Works from the book Library planning, bookstacks, and shelving, with contributions from the architects' and librarian's points of view

B



Third Floor Skylights

Original roof skylights illuminated the building's third floor along St. George Street. These skylights were covered over in the 1984 conversion.

Extract of section in original design drawings, 1906, Chapman and Wickson & Gregg, courtesy of University of Toronto

3.0 Assessment of Cultural Heritage Value

The property is currently designated under By-Law no. 1975-0509. The reasons for the designation of the Carnegie library building at no. 214-220 College Street are:

The Carnegie Library building, 214-220 College Street at St. George Street (SW); 1906-1907 by Wickson & Gregg, and A.H. Chapman; 1926 Addition by Wickson & Gregg, and Chapman and Oxley, is designated to be of architectural value as an outstanding example of the Beaux Arts style of classism, both externally and internally, in the main reading room. The building also has contextual importance as a continuation of the line of University buildings westward along College, as a corner element at St. George Street and College Street, and for its relation to the street with a maximum of open green space.

Although the above is helpful in establishing an overall understanding of the heritage value of the building, the building has undergone renovations and changes since the bylaw was legislated in 1975, namely the conversion of the building into the Koffler Student Services Centre for the University of Toronto in 1980's. To complete a more detailed analysis, research into the building's history, a review of archival drawings, as well as a photographic survey of the exterior and interior were completed.

This research informed the following re-evaluation of the building's heritage value which was carried out under the framework of Ontario Regulation 09/06. This analysis clarifies in more detail the building's heritage value and its heritage attributes, and will guide subsequent conservation strategies and building interventions.

| Ontario Regulation 09/06 Criteria | Applicable |
|---|------------|
| 1. The property has design value or physical value because it is a rare, unique, representative or early example of a style, type, expression, material or construction method. | Yes |
| 2. The property has design value or physical value because it displays a high degree of craftsmanship or artistic merit. | Yes |
| 3. The property has design value or physical value because it demonstrates a high degree of technical or scientific achievement. | No |
| 4. The property has historical value or associative value because it has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community. | Yes |
| 5. The property has historical value or associative value because it yields, or has the potential to yield, information that contributes to an understanding of a community or culture. | Yes |
| 6. The property has historical value or associative value because it demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community. | Yes |
| 7. The property has contextual value because it is important in defining, maintaining or supporting the character of an area. | Yes |
| 8. The property has contextual value because it is physically, functionally, visually or historically linked to its surroundings. | Yes |
| 9. The property has contextual value because it is a landmark. | Yes |

DESIGN/PHYSICAL VALUE

The Koffler Student Centre Building is a representative example of the Beaux-Arts Style, as noted in its designation by-law. This style is expressed both in its exterior form and detailing, and in its interior organization in plan and decorative detailing.

The symmetrical main façade is located along College Street, with entrances at either end. The entries are marked by paired composite brick pilasters on either side supporting an ornate dentiled round-arched pediment. The east main entry is defined by a large set of steps leading to the entrance of the central reference library; the west more modest entry leads into the ground floor, originally the circulating library. The ground floor principal elevation is punctuated by paired rectangular windows set within a light ashlar bush-hammered sandstone (in the 1909 building) and limestone (in the 1930 addition). Double-height round-arched windows on the upper floors are set within the buff brick façade; its bays are marked by composite brick pilasters, supporting a brick entablature with brick parapet above. Stone ornamentation includes exaggerated keystones and decorative cartouches. The secondary St. George elevation continues this detailing, which includes a side street entrance originally for library staff as well as the 1930's entrance. This secondary entrance is more restrained in its design, with a subtle change in detailing to a flat arched pediment. The third floor of both the original building and 1930 building is a blind façade, originally illuminated with skylights, which were removed during the 1984 conversion.

The spatial organization of the spaces are ordered, symmetrical and axial, with the building's original hierarchy of well-proportioned rooms clearly defined in their ornamentation. A grand ceremonial staircase leads into the main entrance hall, main reading room and mezzanine; the spaces retain decorative columns and pilasters and coffered ceilings. The reading room along St. George Street, part of the 1930 addition also maintains this detailing. The coffered ceilings in the main reading room and entrance hall have been altered, to receive new sprinklers, flush lighting fixtures and ventilation grilles. The secondary reading room along St. George no longer has its hanging pendants; the ceiling has been altered to receive new surface-mounted lighting fixtures and sprinklers.

The building has heritage value through its Beaux-Arts form and planning. This is evident on its public facades along College Street and St. George Street of both its original 1909 and its 1930 addition, the principle 1909 College Street entrance with a mezzanine leading to the main reading room, and the 1930 reading room along St. George Street. The rear 1959 addition as well as the 1984 conversion and changes do not have any heritage value.

Note: To clarify the dates written in the By-Law, the building officially opened in 1909 (design drawings are dated 1906, construction noted as 1907-1908), and the addition was opened in 1930 (with design drawings dated 1928, construction noted as 1928-1930).

Historical / Associative Value

The building is associated with well-known Toronto architects Alfred H. Chapman and Wickson & Gregg, both for its original building and its 1930 addition. This was one of Chapman's earlier work; he went on to later gain prominence for the Toronto Harbour Commission Building, Canadian National Exhibition structures (Prince's Gate, Palais Royale, Ontario Government Building), the Sterling Tower, and Holy Blossom Temple, a synagogue.

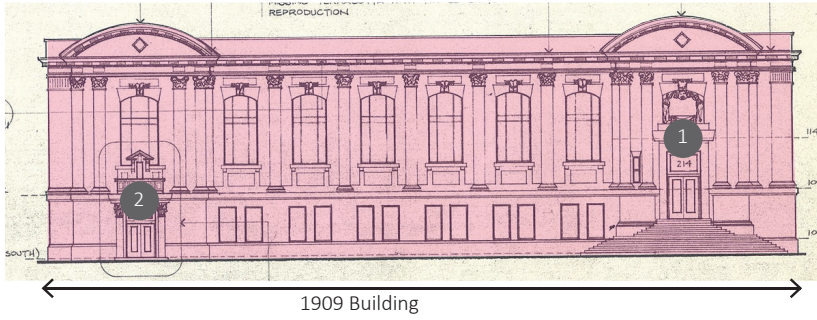
The building, in its previous use as a Central Reference Library, is also associated with the history of the Toronto Public Library system and with the Carnegie Library grant. The central library was the first purpose-built library commissioned by the City of Toronto. The funding for its construction in 1909 was provided through a Carnegie Grant, a philanthropic grant began by Andrew Carnegie for the purpose of building free libraries in municipalities around the world. Its later addition in 1930 did not receive a grant. It is one of 125 Carnegie libraries in Canada.

The building functions as a student services centre for the University of Toronto within the campus of St. George. It is associated with and now named after Murray Koffler, a noted Canadian pharmacist, businessman and philanthropist, who funded the student centre services conversion. Koffler had significantly supported the University of Toronto through education, student and research initiatives as well as supported numerous organizations throughout Toronto.

Contextual Value

The Koffler Student Services Centre has contextual importance through its relationship to and its continuity with the institutional buildings along the north side of College Street. The building is as a visible marker and landmark at the corner of St. George and College Streets. The prominence of its setting is accentuated by its set back from the street and the generous landscaping and forecourt.

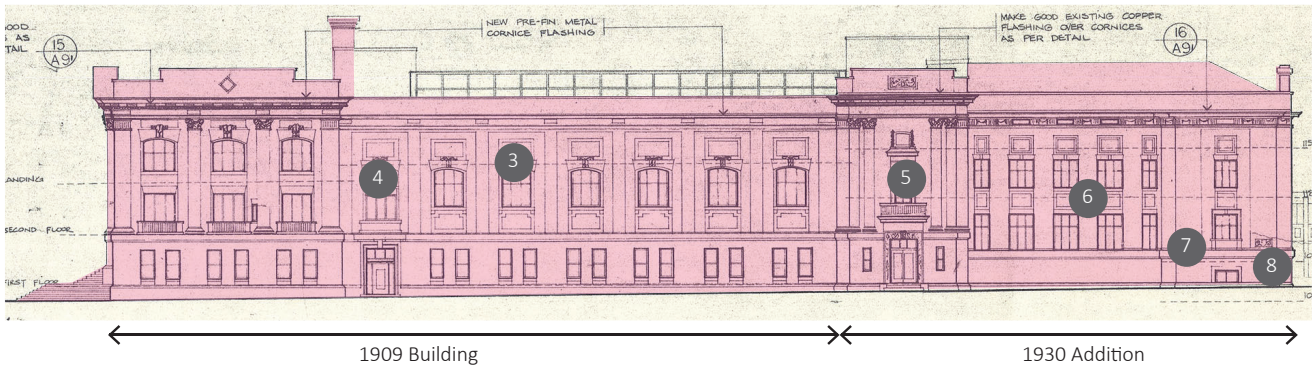
3.1 Illustrated Heritage Attributes



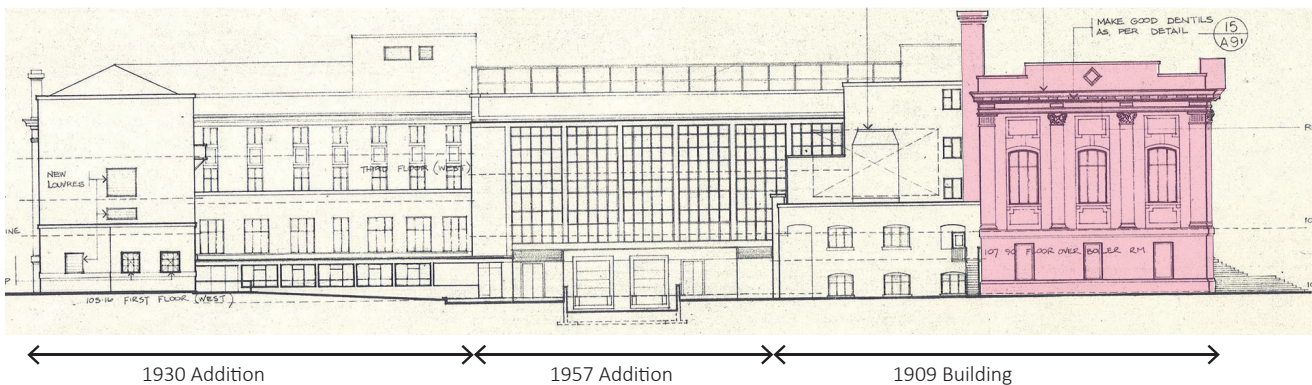
College Street (South) Elevation

Heritage Mapping (Elevations):

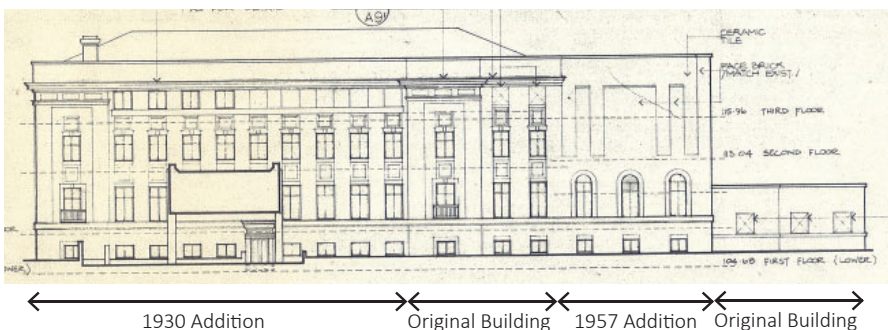
- Elevations retaining heritage value
- 1 Refer to detailed photographs for illustrated heritage attributes



St. George Street (East) Elevation



West Elevation



North Elevation

Illustrated Heritage Attributes:

1



Main Entry Pavillion, 2020, EVOQ

Primary Entrance & Typical Detailing

- brick parapet with stone cap
- arched entrance pediments with deep dentiled cornice (typ for both front entrances)
- buff brick facade
- paired composite brick pilasters
- framed entrances
- bush-hammered ashlar sandstone base
- ceremonial exterior entry stair leading to interior ceremonial stair



Main East Entrance, 2020, EVOQ



Main entrance with oversized architrave and keystone, with a large cartouche



Architrave Detailing, 2020, EVOQ

Deep dentiled cornice with rosettes and egg-and-dart moulding, the architrave with stone detailing, and the capitals of the paired entry pavillion pilasters

2



Secondary College Street entrance at grade

blind triangular architrave

balustrade

wreathed scroll bracket

Secondary Front Entrance, 2020, EVOQ

3



Typical original 1909 building elevations

brick pilasters

decorative scrolls

round-arched windows

projecting brick panels

rectangular string course

paired ground floor rectangular windows

expressed bullnose string course

East Elevation, 1909 building, 2020, EVOQ

4



Inscription and scrollwork above east side entrance, in the original 1909 portion of the building, including projecting decorative brickwork.

Detail above east side entrance, 1909 building, 2020, EVOQ

5



St. George Street Entrance, 1930 Addition

- deep cornice with large dentils, and brick parapet above
- paired stone pilasters
- carved architrave and balustrade, with tall window and cartouche above
- square string course
- ashlar limestone base

St. George Street Entrance, 1930 Addition, 2020, EVOQ



Scrollwork above the entry door and ornamentation on the surround; cartouches above the dentiled cornice; stone detailing above entrance

Stone detailing, 1930 Addition, 2020, EVOQ

6



Typical 1930 building elevations

- projecting brick panels
- rectangular windows
- brick facade
- square string course
- ashlar limestone base

Typical Exterior Elevation, 1930 Addition, 2020, EVOQ



Dentiled cornice, architrave with carved cartouches along the St. George Street facade

Stone Detailing, 2020, EVOQ

7



Cartouche detailing on the building above the square stringcourse on the northwest bay along St. George Street

Cartouche Detailing, 2020, EVOQ

8



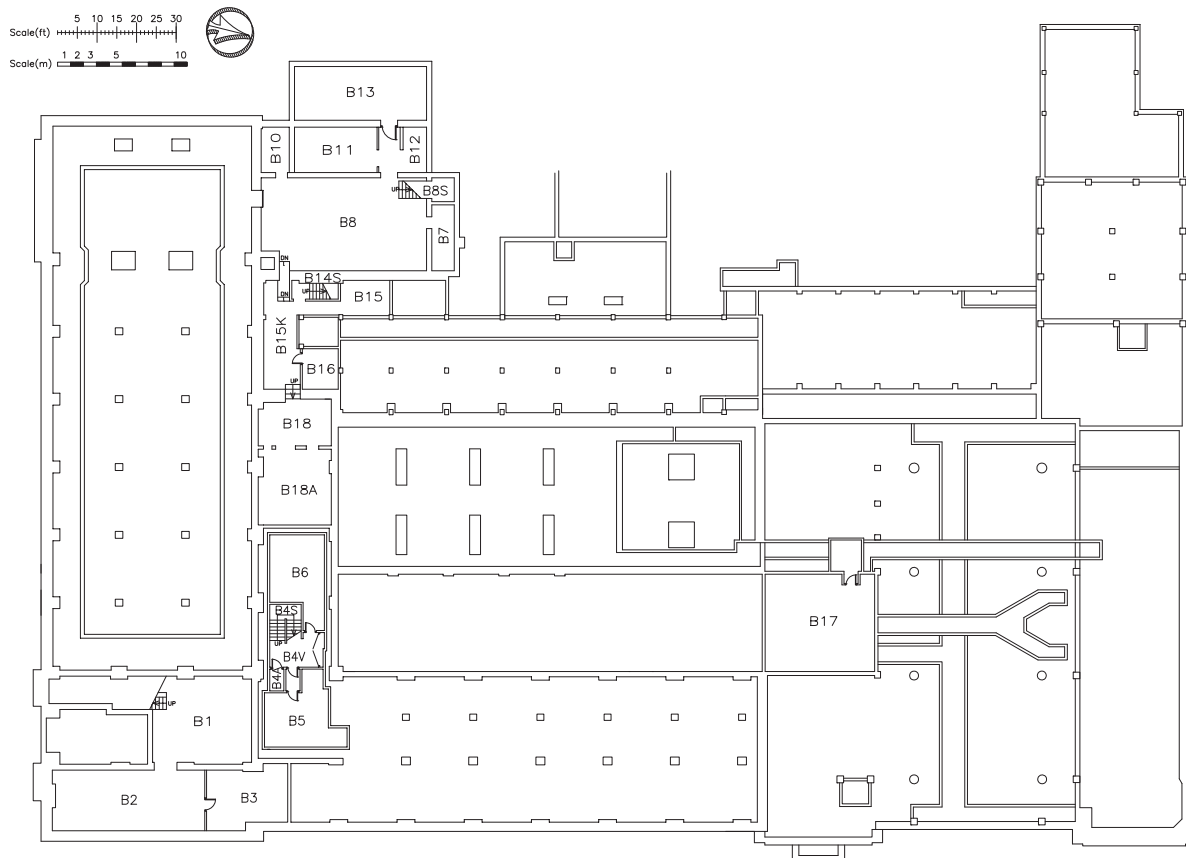
Dates stone on the northeast corner of the building

Date Stone, 1930 Addition, 2020, EVOQ

3.2 Heritage Mapping

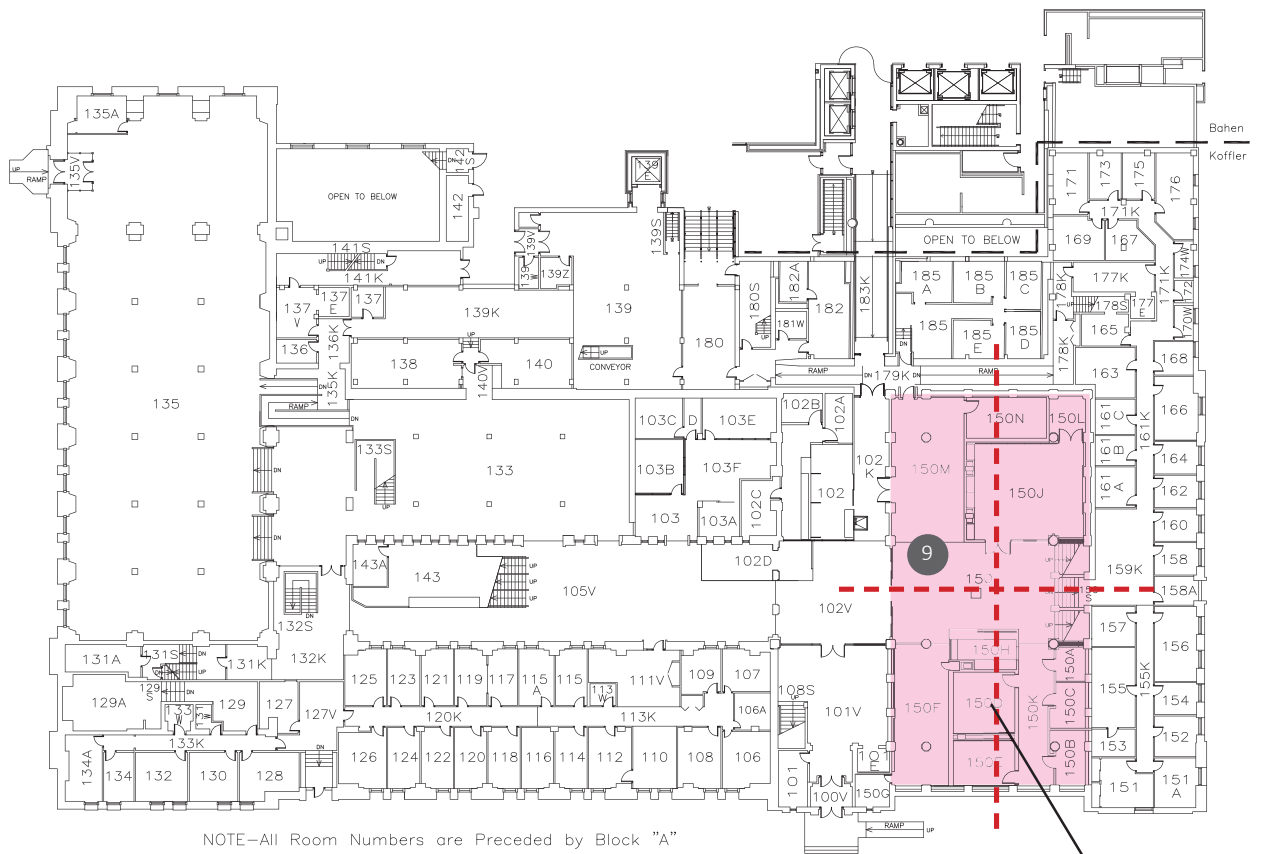
Heritage Mapping (Plan):

- Areas of heritage value
- Interior heritage organizational attributes
- 1 Refer to photographs for annotated heritage attributes



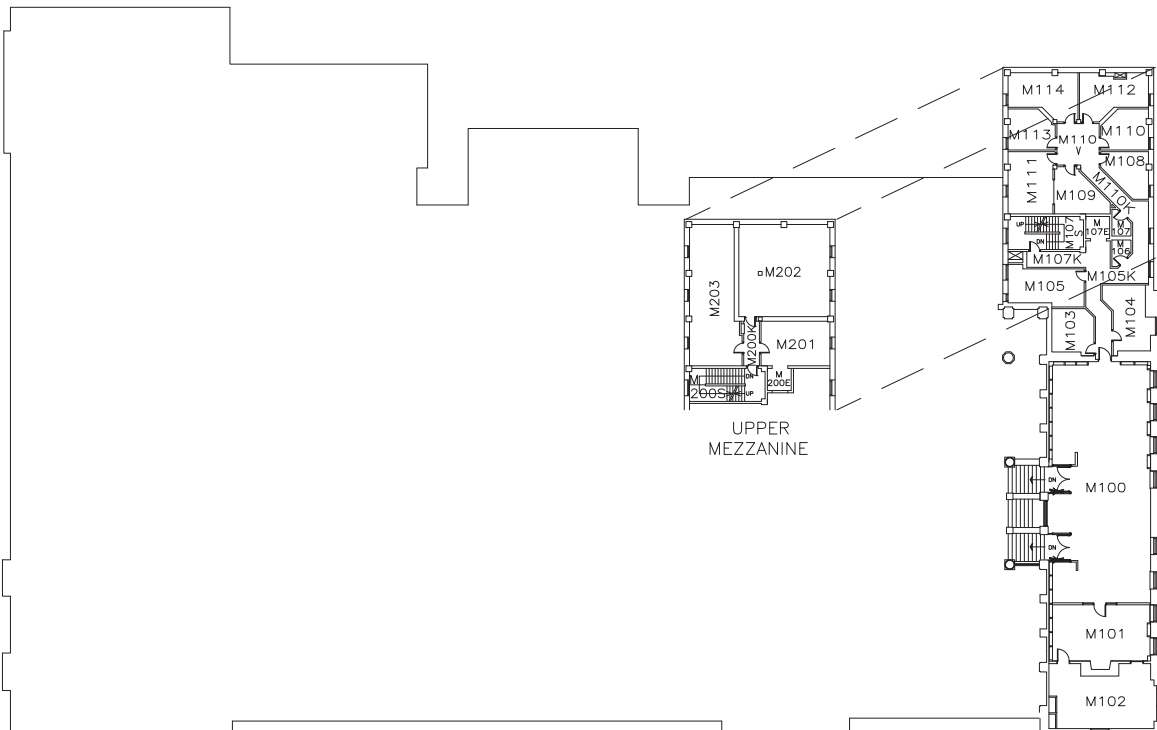
Basement Floor

ASSESSMENT OF CULTURAL HERITAGE VALUE



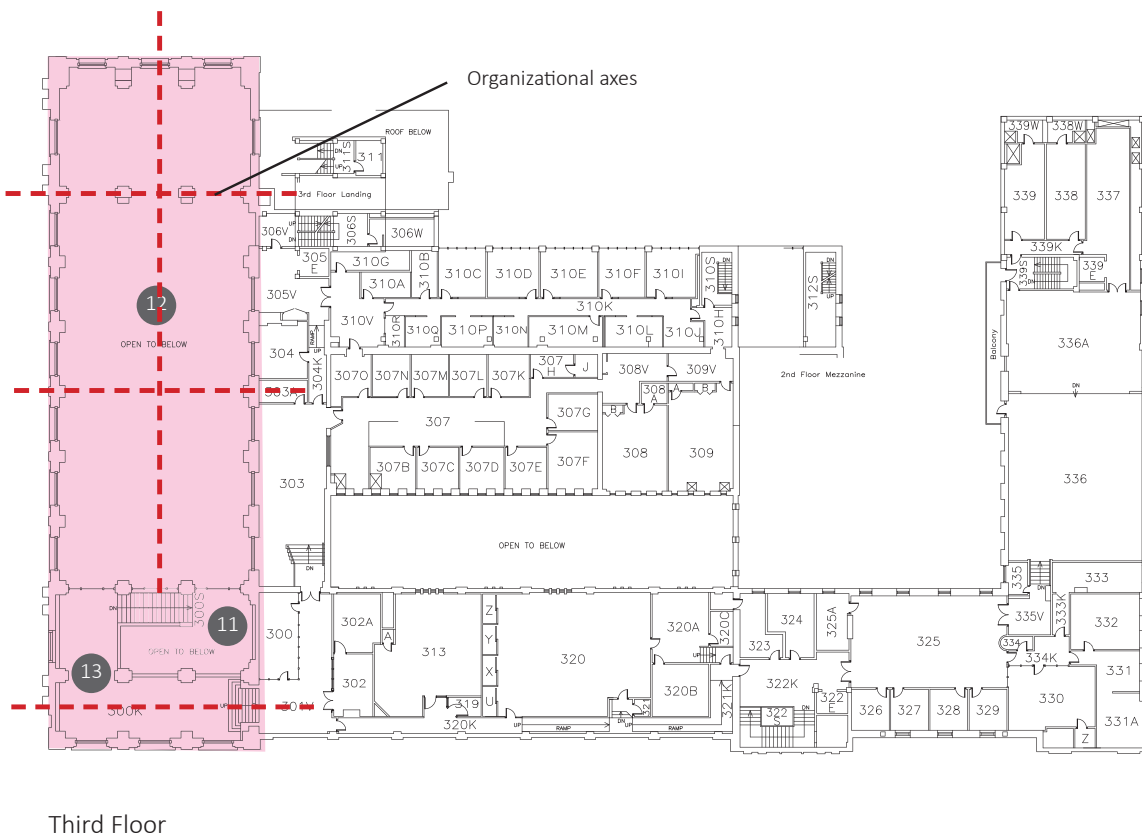
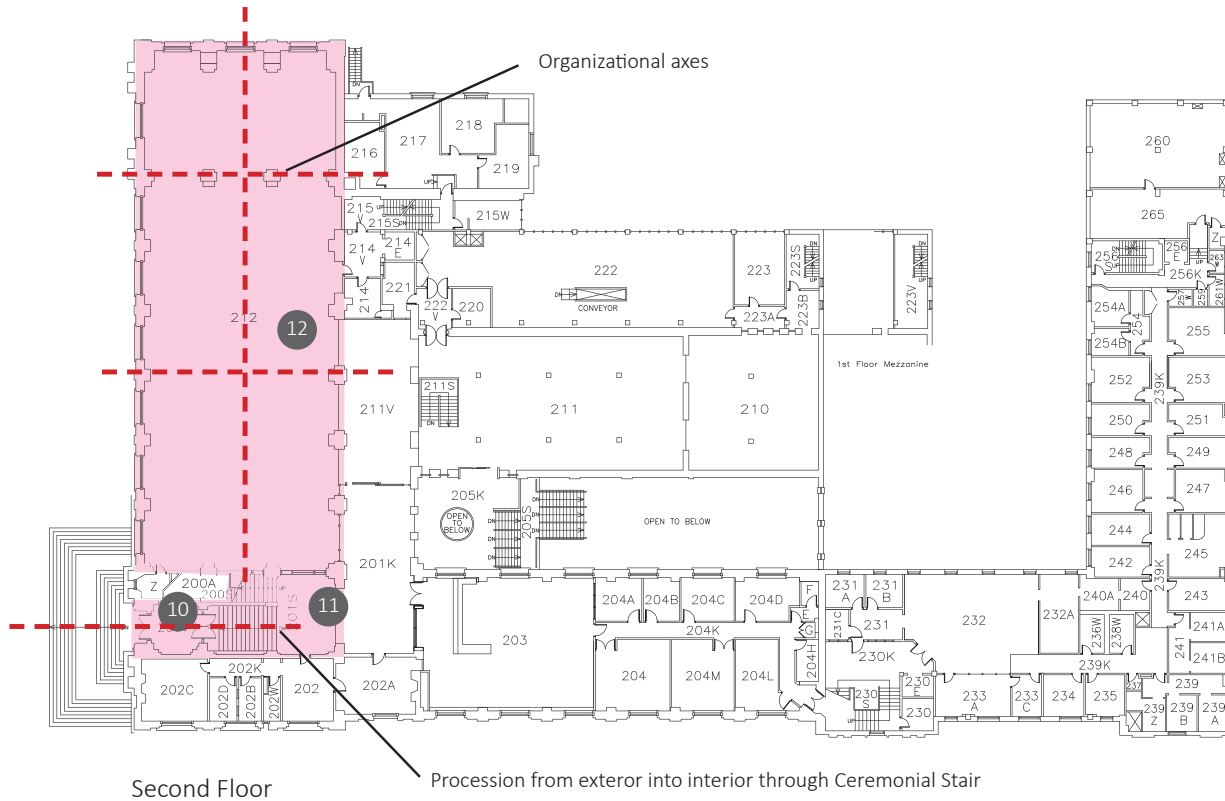
Ground Floor

Organizational axes



Mezzanine

MEZZANINE



9

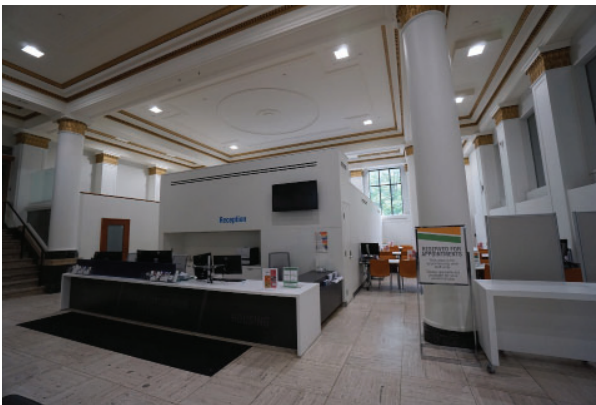


Interior, Central Circulating Library, 1930, Pringle & Booth, courtesy of Toronto Public Library

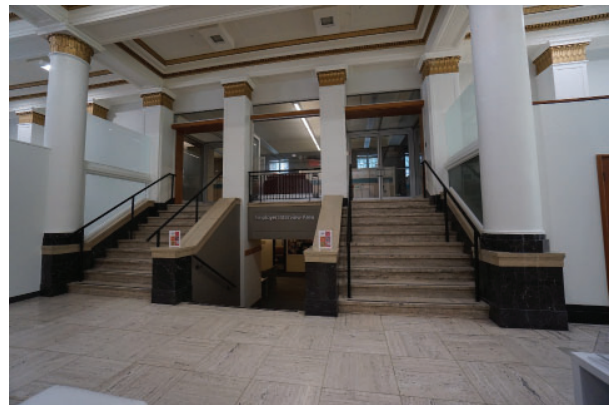
Photographs of the interior currently and in 1930, when it first opened. Detailing within the space include carved pilasters and columns supporting the ceilings; since altered to accommodate electrical and mechanical.



Detailing in Room 150, 1930 Addition, 2020, EVOQ



Room 150, 1930 Addition, 2020, EVOQ, facing east



Room 150, 1930 Addition, 2020, EVOQ, facing north

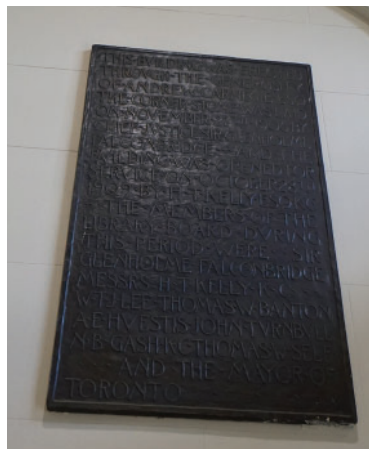
10



Room 200V, original building, 2020, EVOQ, facing east

Room 200V (formerly main entrance into Central Reference Library)

Photographs of the interior currently showing detailing within the space, including an original placque commemorating the construction of the building.



Placque, 2020, EVOQ

11



Interior, Entrance, 1909, Pringle & Booth, courtesy of Toronto Public Library



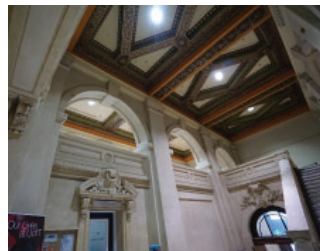
Entrance Foyer, 2020, EVOQ

Room 101S / 300S (formerly main foyer of the Central Reference Library)

Photographs of the foyer interior, archival and current, showing the ceremonial stairs into the former reading room, its stone detailing, and the coffered ceiling.



Carved detailing, coffered ceiling, 2020, EVOQ



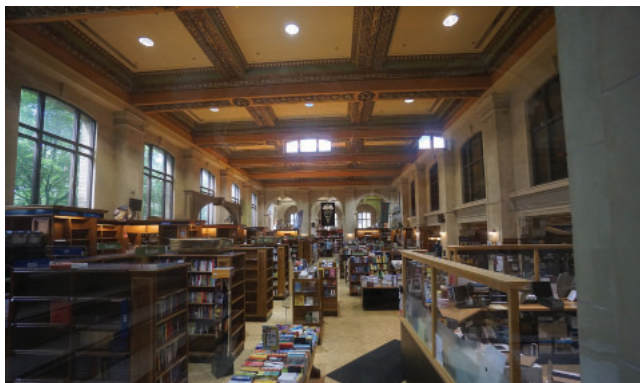
12



Reference Reading Room, looking east, 1920, Pringle & Booth, courtesy of Toronto Public Library

Room 212 (formerly main reading room in the Central Reference Library)

Photographs of the reading room, archival and current, illustrating the importance of the space, reflected in the pilaster and column detailing, arches, the decorative coffered ceilings, and its symmetrical spatial organization.



Room 212 (Bookstore), 2020, EVOQ, looking west

13



Room 300K, 2020, EVOQ, looking east

Room 300K (formerly mezzanine over the main Central Reference Library entrance)

Photographs of the current interior showing the mezzanine, the pilasters, the arches with exaggerated keystones, decorative railings and coffered ceiling.



Room 300K, 2020, EVOQ, looking north

4.0 Statement of Significance

Description of Heritage Resource:

The Koffler Student Services Centre is located at 214 College Street on the University of Toronto's Saint George Campus. The building is composed of the original 1909 Beaux-Arts central reference library, a significant 1930 addition in the same style, a smaller rear 1959 modern addition, as well as its 1984 modern renovation to a student centre. Alfred Chapman with Wickson & Gregg designed both the original and the addition. The 1984 renovation was completed by Alfred Chapman's son, Howard.

Heritage Value:

The property has cultural heritage value based on its design and physical values with its Beaux-Arts styled original library building and its early addition; for its association with Toronto architect Alfred Chapman, its original use as a central reference library and the Carnegie Library grants that funded its construction; and for its contextual value as supporting the institutional character along College Street and its importance as a corner landmark at Saint George Street.

Its design and physical heritage value lies in its Beaux-Arts style, displayed both on its exterior and in its interior. On the exterior, it is evident in the balanced symmetry and classical detailing of its principle and secondary façades. The 1909 building facades are composed of an ashlar bush hammered sandstone base with expressed bullnose string course at the ground floor and rectangular one at the second floor. The upper levels are clad in a buff brick with a deep dentiled cornice with rosettes and egg-and-dart detailing. The end pavilion entrances are expressed with arched pediments with the same detailing as the cornice and supported by double pilasters. A clear hierarchy defines the entrances and orients the user. The main entrance leading up to the second floor piano nobile is framed by an oversized architrave and keystone, and a large cartouche. The secondary entrance to its west is at grade, and is framed with two wreathed scroll brackets supporting a balustrade and blind small triangular architrave. Each bay is defined by composite brick pilasters and is composed of a pair or a simple rectangular window in the stone base on which sit tall arched windows with a scroll keystone, and expressed brick panels below and above.

The 1930 building is simpler in its classical detailing. The projecting entrance bay is expressed with a carved architrave, a balustrade and a tall window and cartouche, framed between double pilasters and terminated in a deep cornice with large dentils. The ashlar limestone base is framed with a rectangular string course. The bays are composed of simple second and third floor rectangular windows with projecting brick panels. The cornice above is detailed with small dentils and carved festoon cartouches.

In the interior, the Beaux-Arts principle is expressed through the ordered, axial spatial organization and the clear hierarchy of spaces of the entrance hall, main reading room, and mezzanine, with their stone railings and carved plaster pilasters supporting decorative coffered ceilings. The coffered ceilings in these spaces have been altered since, to accommodate sprinklers, lighting and ventilation requirements.

Its historical and associative values lie in its origin and use as the Central Reference Library for the Toronto Public Library system, its original 1909 building as funded through the Carnegie Library grant; its association with noted architect Alfred H. Chapman; and its later association with Murray Koffler, a noted businessman and philanthropist.

Its contextual value resides in continuing the institutional built form along College Street; its visibility as a corner landmark at College and Saint George Streets; and its setback siting in relationship to the street and its wide open public space.

Heritage Attributes

The following features of the Koffler Student Services Centre have been identified as heritage attributes that contribute to its overall cultural heritage value:

- The siting of the Carnegie Library building at the northwest corner of College Street and Saint George Street.
- The classical Beaux-Arts scale and form of the building's public facades along College Street and Saint George Street including:
 - The organization and hierarchy of the façade pavilions and entrances.
 - The arched pedimented pavilion entrances, the composite brick pilasters marking the bays supporting the brick entablature and parapet.
 - The brick buff field cladding and use of stone for detailing, including stone base, carved keystones, cartouches, balusters, architraves, dentil and rosette cornices, egg-and dart moulding, and string coursing.
 - The rhythm of the bays and the alignment of the windows including the double-height arched windows of upper floors and simple rectangular windows on the lower floors.
- Interior main reading room and the main entry hall including its mezzanine with their stone detailing, plaster columns and pilasters, and coffered ceilings.

5.0 CONDITION ASSESSMENT

The Proposal will be intervening in selected locations in the building. The areas affected are the east end of the ground floor and second floors of the original 1909 building, 1930 east wing of the ground, second and third floor, selected areas within the third floor of the 1959 addition, the 1984 infill, and the secondary Saint George entrance.

In general, the exterior form, materials and detailing are unchanged from their initial 1909 and 1930 construction. In particular, the affected exterior east and north elevations are in fairly good condition. The pilaster, cornices, and parapet, the fenestration openings, the decorative entrances, the detailed stonework and carvings and field brick facades are all legible and intact.

Some soiling and staining were observed on the stone cladding, sills, and string-courses. As well, there is localized cupric staining due to run-off from copper flashings of cornices and projecting courses. Stone deteriorations are more pronounced on the sandstone cladding of the 1909 section, with localized scaling along the base of the building, entrances, and beneath the windows. The limestone cladding and base course of the 1930's section has surface deteriorations primarily at the secondary entrance, at the bullnose course with scaling and erosion at the base of the entrance surround, likely due to salt damage over time. Faint traces of removed graffiti on this cladding were noted as well as staining from embedded fasteners. The field brick in both 1909 and 1930 sections have soiling, but are generally in good condition. The brick façade along the exposed north façade return has been cleaned more recently than the remaining facades. The above provides a general account of the exterior condition of the building.

The proposal impacts the Saint George Street entrance. This entrance appears to be original to the building, despite subtle differences from the design drawings of 1930 (likely a change during construction). Wood double doors with glazing sit within the stone surround with a three-pane transom above. The transom glazing appears to have been altered as were the glazing panels and hardware on the double doors.

The existing stair and ramp structure providing access to the secondary Saint George entrance is a 1984 addition, and is not a heritage element. The stair is in fair condition.



Figure 19: Cupric (copper) staining and atmospheric soiling (2020, EVOQ)



Figure 20: Atmospheric soiling and scaling of stonework (2020, EVOQ)



Figure 21: Saint George Entrance (2020, EVOQ)

The interior organization of the main heritage spaces has not changed significantly over the years, including the main entrance hall, ceremonial stairs, and the reading rooms. The 1930 reading room shell is generally original; however, the space has since been subdivided by partial-height partitions to suit the programming of the Student Success Centre. The floor tile, columns, and dentiled trimwork on the coffered ceilings appear original. The ceiling itself has been altered though; original hanging pendant light fixtures have been removed, new surface mounted lighting fixtures and concealed sprinklers have been installed. The mezzanine space, originally connected to the reading room has since been enclosed, and is now used as office space.

The materials exhibit typical wear and tear; otherwise, they are in good condition. No detailing was observed to be either missing or heavily deteriorated, with the exception of localized areas of water damage observed in the Student Success Centre. Plaster delamination and some loss of detailing were noted along the coffered plaster ceiling, cornices and above some columns.



Figure 22: Student Success Centre (2020, EVOQ)



Figure 23: Plaster delamination and water damage (2020, EVOQ)



Figure 24: Plaster deterioration on ceilings and columns (2020, EVOQ)

6.0 APPLICATION OF PARKS CANADA STANDARDS AND GUIDELINES

Given its designation under *Part IV* of the Ontario Heritage Act, the recommended Conservation Strategy for Koffler HWC follows the *Standards and Guidelines for the Conservation of Historic Places in Canada*. The primary conservation treatment is “preservation”, with a secondary treatment of “rehabilitation”.

Preservation: *the action or process of protecting, maintaining, and/or stabilizing the existing materials, form, and integrity of an historic place, or of an individual component, while protecting its heritage value.*

Rehabilitation: *the action or process of making possible a continuing or compatible contemporary use of an historic place, or an individual component, while protecting its heritage value.*

The heritage attributes impacted are intact and in good condition. The conservation strategy involves protecting and maintaining the existing heritage attributes, and ensuring its continuing as part of the proposed interventions. The conservation strategy follows the guidelines outlined by *Parks Canada's Standards and Guidelines for the Conservation of Historic Places in Canada*. The general standards and those related to rehabilitation are listed below and annotated with comments.

Standards and Guidelines for the Conservation of Historic Places in Canada (2010): General Standards for Preservation, Rehabilitation and Restoration

1. Conserve the heritage value of an historic place. Do not remove, replace or substantially alter its intact or repairable character defining elements. Do not move a part of an historic place if its current location is a character-defining element.

EVOQ: This standard is applicable. The heritage value of the Koffler Student Services Centre building is to be maintained. Minimal removals, replacements or alterations of character-defining elements are proposed.

2. Conserve changes to an historic place that, over time, have become character-defining elements in their own right.

EVOQ: This standard is not applicable.

3. Conserve heritage value by adopting an approach calling for minimal intervention.

EVOQ: This standard is applicable. Minimal intervention approach will be followed.

4. Recognize each historic place as a physical record of its time, place and use. Do not create a false sense of historical development by adding elements from other historic places or other properties, or by combining features of the same property that never coexisted.

EVOQ: This standard is applicable. No additional historical elements or combination of features will be added. The new east entrance ramp and stairs will be contemporary and designed to be compatible with the original historic façade.

5. Find a use for an historic place that requires minimal or no change to its character-defining elements.

EVOQ: This standard is applicable. There will be no change of use as part of the interventions. No change to heritage attributes is anticipated.

6. Protect and, if necessary, stabilize an historic place until any subsequent intervention is undertaken. Protect and preserve archaeological resources in place. Where there is potential for disturbing archaeological resources, take mitigation measures to limit damage and loss of information.

EVOQ: This standard is not applicable.

7. Evaluate the existing condition of character-defining elements to determine the appropriate intervention needed. Use the gentlest means possible for any intervention. Respect heritage value when undertaking an intervention.

EVOQ: This standard is applicable. The existing condition of character-defining elements have been examined and assessed. A site review (visual/tactile) of the character-defining elements was completed and their conditions documented via. text, photographs, and 3D point cloud scans. The approach of minimal intervention to character-defining elements will be followed to ensure the building's heritage value is respected.

8. Maintain character-defining elements on an ongoing basis. Repair character-defining elements by reinforcing their materials using recognized conservation methods. Replace in kind any extensively deteriorated or missing parts of character-defining elements, where there are surviving prototypes.

EVOQ: This standard is applicable. The character-defining elements will be maintained. Localized replacement and repairs in-kind will be completed for elements that will be intervened. Repair and replacement methodologies are to be carefully detailed and mock-ups are to be completed.

9. Make any intervention needed to preserve character-defining elements physically and visually compatible with the historic place and identifiable on close inspection. Document any intervention for future reference.

EVOQ: This standard is applicable. The interventions will preserve the character-defining elements. The new front entrance stair and ramp structure will be visually compatible, subordinate and distinguishable to the existing heritage façade. All interventions to the character-defining elements will be documented.

Additional Standards Relating to Rehabilitation

10. Repair rather than replace character-defining elements. Where character-defining elements are too severely deteriorated to repair, and where sufficient physical evidence exists, replace them with new elements that match the forms, materials and detailing of sound versions of the same elements. Where there is insufficient physical evidence, make the form, material and detailing of the new elements compatible with the character of the historic place.

EVOQ: This standard is applicable. The existing character-defining elements that will be repaired with like materials where existing deteriorations are present.

11. Conserve the heritage value and character-defining elements when creating any new additions to an historic place or any related new construction. Make the new work physically and visually compatible with, subordinate to and distinguishable from the historic place.

EVOQ: This standard is applicable. The heritage value and character-defining elements will be conserved and maintained. The impact of the new proposed front entrance work will be mitigated to ensure its compatibility and subordination to the building.

12. Create any new additions or related new construction so that the essential form and integrity of an historic place will not be impaired if the new work is removed in the future.

EVOQ: This standard is applicable. The new construction of an elevator tower will occur within the 1980s infill construction. This addition will only be evident along the rear elevation, thus will not impact the essential form and integrity of the historic place. Mitigation strategies will be in place to ensure the installation of the new entrance ramp and stair structure will be reversible.

7.0 APPLICATION OF PARKS CANADA STANDARDS AND GUIDELINES: CONSERVATION STRATEGY TABLES

Using the *Standards and Guidelines*, the team will break down the work plan with specific reference to the appropriate project-specific guideline. Generally, these relate to a building component. Each section will be updated throughout the project life, as new findings are made, and the surveys and investigations completed. Thus, the relationship between each reference guideline and details of its application within the project will remain clear (and trackable) from the project's beginning to end.

General Guidelines for Preservation, Rehabilitation and Restoration - Exterior Form

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|--|---|
| 1 | Understanding the exterior form and how it contributes to the heritage value of the historic building. | The form of the building reflects the Beaux-Arts style and contributes to the heritage value of the building. |
| 2 | Understanding the design principles used by the original designer or builder, and any changes made to the exterior form over time. | Design principles typical of the Beaux-Arts style are noted in the buildings form and subsequent additions and have been documented to distinguish them from the original construction. |
| 3 | Documenting the building's exterior form before undertaking an intervention, including the form and massing, and views, sunlight and natural ventilation patterns. | Research into the buildings history, a review of archival drawings, as well as a photographic survey of the exterior was completed. |
| 4 | Assessing the condition of the building's exterior form early in the planning process so that the scope of work is based on current conditions. | A photographic survey and assessment of the building's current exterior condition was conducted. |
| 5 | Protecting and maintaining elements of the building's exterior form through cyclical or seasonal maintenance work. | Not applicable. |
| 6 | Retaining the exterior form by maintaining proportions, colour and massing, and the spatial relationships with adjacent buildings. | Exterior form, proportion, colour and massing, and the spatial relationship with adjacent buildings will be maintained on the south, east and north facades. The elevator shaft addition on the west facade is not visible from the street and is already obscured by a neighboring building and the 1957 addition which is not defined as a heritage attribute under the By-law. |
| 7 | Stabilizing deteriorated elements of the exterior form by using structural reinforcement and weather protection, or correcting unsafe conditions, as required, until work is undertaken. | Not applicable. |
| 8 | Protecting adjacent character-defining elements from accidental damage or exposure to damaging materials during maintenance or repair work. | Existing masonry around the east entrance should be protected during demolition of the existing concrete steps and construction of the new entrance. |
| 9 | Documenting all interventions that affect the exterior form, and ensuring that the documentation is available to those responsible for future interventions. | A full set of construction documents has been produced for the project. The documentation of all existing conditions will also be required from the contractor prior to construction. |

General Guidelines for Preservation, Rehabilitation and Restoration - Exterior Form (cont.)

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|---|---|
| 10 | Reinstating the exterior form by recreating missing, or revealing obscured parts to re-establish character-defining proportions and massing. | Missing stone plinth profile will be reinstated at the east entrance. |
| 11 | Accommodating new functions and services in non-character-defining interior spaces as an alternative to construction of a new addition. | Non-heritage interior spaces are being reconfigured to accommodate additional programming. |
| 12 | Selecting a new use that suits the existing building form. | Not applicable. |
| 13 | Selecting the location for a new addition that ensures that the heritage value of the place is maintained. | The addition will not be visible from the east, south, or north sides of the building when viewed from the public realm, at grade. |
| 14 | Designing a new addition in a manner that draws a clear distinction between what is historic and what is new. | The form, materiality, and construction of the new addition is wholly distinct from the original building, and its previous additions. |
| 15 | Designing an addition that is compatible in terms of materials and massing with the exterior form of the historic building and its setting. | Materials and massing of the new addition are generic enough to be compatible and to not detract from the original building in any adverse way. |
| 16 | Adding new features to meet health, safety or security requirements, such as an exterior stairway or a security vestibule in a manner that respects the exterior form and minimizes impact on heritage value. | A new entrance podium with stairs and ramp will replace the existing to enhance accessibility and functionality of the entrance. The design, materiality, and form of the new entrance do not detract from the heritage value of the existing building. |
| 17 | Working with code specialists to determine the most appropriate solution to health, safety and security requirements with the least impact on the character-defining elements and overall heritage value of the historic building. | Not applicable. |
| 18 | Finding solutions to meet accessibility requirements that are compatible with the exterior form of the historic building. For example, introducing a gently sloped walkway instead of a constructed ramp with handrails in front of an historic building. | Proposed design for the new entrance ramp is gently sloping and does not require handrails. The necessary proposed handrails for the new front stairs is mitigated by its low profile and compatible material to existing historic place. |
| 19 | Working with accessibility and conservation specialists and users to determine the most appropriate solution to accessibility issues with the least impact on the character-defining elements and overall heritage value of the historic building. | Not applicable. |
| 20 | Adding new features to meet sustainability requirements, such as solar panels or a green roof, in a manner that respects the exterior form and minimizes impact on character-defining elements. | Not applicable. |

General Guidelines for Preservation, Rehabilitation and Restoration - Exterior Form (cont.)

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|---|--|
| 21 | Working with sustainability and conservation specialists to determine the most appropriate solutions to sustainability requirements with the least impact on the character-defining elements and overall heritage value of the historic building. | Not applicable. |
| 22 | Complying with energy efficiency objectives in a manner that minimizes impact on the character-defining elements and overall heritage value of the historic building. | Not applicable. |
| 23 | Accommodating functions requiring a controlled environment, such as artifact storage or exhibits in an addition, while using the historic building for functions that benefit from existing natural ventilation and/or daylight. | Not applicable. |
| 24 | Reinstating the building's exterior form from the restoration period, based on documentary and physical evidence. | Not applicable. |
| 25 | Removing any non-character-defining features of the building's exterior form, such as an addition built after the restoration period. | The exterior non-character-defining stair at the east entrance will be removed and replaced with a contemporary design that is acceptable. |
| 26 | Recreating missing features of the exterior form that existed during the restoration period, based on physical or documentary evidence; for example, duplicating a dormer or restoring a carport that was later enclosed. | Not applicable. |

General Guidelines for Preservation, Rehabilitation and Restoration - Exterior Walls

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|---|---|
| 1 | Understanding the exterior walls and how they contribute to the heritage value of the historic building. | The material organization and ornamentation of the exterior walls surrounding the Saint George Street entrance are compatible with the Beaux-Arts style. They support the heritage value of the building. |
| 2 | Understanding the properties and characteristics of the exterior walls as well as changes and previous maintenance practices. | Surveys and exploratory openings were conducted to understand the exterior wall characteristics. |
| 3 | Documenting the composition, form, materials, details, dimensions and condition of exterior wall assemblies before undertaking an intervention. This includes geometry, scale, proportions, openings, form and supporting frames or structures. | Site visits included thorough photographic surveys of the exterior walls surrounding the areas subject to work. |
| 4 | Assessing the condition of wall assemblies and their materials early in the planning process so that the scope of work is based on current conditions. | The proposed treatments of the exterior wall were based on the survey and further detailed review of notes and photographs taken on site. |

General Guidelines for Preservation, Rehabilitation and Restoration - Exterior Walls (cont.)

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|--|---|
| 5 | Determining the cause of distress, damage or deterioration of exterior walls through investigation, monitoring and minimally invasive or non-destructive testing techniques. | Causes of deterioration were determined during the visual survey. |
| 6 | Protecting and maintaining exterior walls by cleaning and repairing damaged materials, and checking exterior wall assemblies for moisture penetration and insect infestation, taking corrective action, as necessary and as soon as possible. | Cleaning of select exterior masonry elements have been scoped in the projects drawings set and specifications. Mock ups will be completed prior to starting the work. |
| 7 | Retaining sound or deteriorated exterior wall assemblies that can be repaired. | The principle of minimal intervention will continue to inform the proposed work. The majority of the exterior wall is in sound condition and will be preserved, or is not included in the scope of work. |
| 8 | Stabilizing deteriorated exterior walls by using structural reinforcement, weather protection, or correcting unsafe conditions, as required, until repair work is undertaken. | Not applicable. |
| 9 | Repairing parts of exterior walls by patching, piecing-in, consolidating, or otherwise reinforcing, using recognized conservation methods. Repair may also include the limited replacement in kind, or with a compatible substitute material, of extensively deteriorated or missing parts of the exterior wall assembly. Repairs should match the existing work as closely as possible, both physically and visually. | Generally, existing material will be left in place or reinstated. When the proposed work requires new materials, the project's specifications require a close match to the existing that will be confirmed with a mock-up. |
| 10 | Protecting adjacent character-defining elements from accidental damage or exposure to damaging materials during maintenance or repair work. | Protective measures will be put in place to ensure windows and ornamental stone details are protected during construction as described in the project specifications. |
| 11 | Replacing in kind extensively deteriorated or missing parts of exterior wall assemblies where there are surviving prototypes. | All replacement material will be new and match existing. |
| 12 | Testing proposed interventions to establish appropriate replacement materials, quality of workmanship and methodology. This can include reviewing samples, testing products, methods or assemblies, or creating a mock-up. Testing should be carried out under the same conditions as the proposed intervention. | Mock-ups are outlined in the project specifications for the interventions on the exterior wall. The specifications outline variables that must be controlled to ensure the final work matches the mock-ups (for example weather conditions during time or work, personnel completing the work, etc.). |
| 13 | Documenting all interventions that affect the exterior walls, and ensuring that the documentation is available to those responsible for future interventions. | A set of construction documents including drawings and specifications outlines the proposed interventions. |

General Guidelines for Preservation, Rehabilitation and Restoration - Exterior Walls (cont.)

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|--|--|
| 14 | Repairing an exterior wall assembly, including its functional and decorative elements, by using a minimal intervention approach. Such repairs might include the limited replacement in kind, or replacement using an appropriate substitute material of irreparable or missing elements, based on documentary or physical evidence. Repairs might also include dismantling and rebuilding a masonry or wood wall, if an evaluation of its overall condition determines that more than limited repair or replacement in kind is required. | The principle of minimal intervention will continue to inform the proposed work. The majority of the exterior wall is in sound condition and will be preserved. Interventions on these elements will be performed in-situ, and will be minimal. Elements of the stone entrance surround are deteriorated and will require a dutchman repair using appropriate substitute material as outline in the projects specifications. |
| 15 | Improving the drying ability of exterior wall assemblies through suitable heating and/or ventilation measures. | Not applicable. |
| 16 | Accommodating the thermal expansion and contraction of masonry, concrete and curtain wall assemblies, by introducing expansion or control joints, and incorporating those joints into existing crack patterns, where feasible, to minimize impact on character-defining elements. | Character-defining elements will not be interfaced with new assemblies. |
| 17 | Replacing in kind an irreparable exterior wall assembly, based on documentary and physical evidence. If using the same kind of material is not environmentally sound, or technically or economically feasible, then a compatible substitute material may be considered. | Not applicable. |
| 18 | Replacing missing historic features by designing and constructing a new portion of the exterior wall assembly, based on physical and documentary evidence, or one that is compatible in size, scale, material, style and colour. | Elements of the wall surrounding the main entrance will be replicated and reinstated to their original condition upon removal of the 1984 stairway and ramp. |
| 19 | Modifying exterior walls to accommodate an expanded program, a new use, or applicable codes and regulations, in a manner that respects the building's heritage value. | Not applicable. |
| 20 | Designing a new addition in a manner that preserves the character-defining exterior walls of the historic building. | The character-defining existing exterior walls of the building will be maintained. |
| 21 | Complying with health, safety and security requirements in a manner that conserves the heritage value of the exterior wall assembly and minimizes impact on its character-defining elements. | Not applicable. |

General Guidelines for Preservation, Rehabilitation and Restoration - Exterior Walls (cont.)

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|--|-----------------|
| 22 | Working with code specialists to determine the most appropriate solution to health, safety and security requirements with the least impact on the character-defining elements and overall heritage value of the historic building. | Not applicable. |
| 23 | Removing or encapsulating toxic materials, using the least- invasive abatement methods possible, and only after thorough testing has been conducted. | Not applicable. |
| 24 | Protecting exterior walls against loss or damage by identifying and assessing specific risks, and by implementing an appropriate fire-protection and blast protection strategy that addresses those risks. | Not applicable. |
| 25 | Complying with energy efficiency objectives in upgrades to exterior wall assemblies in a manner that respects the building's character-defining elements, and considers the energy efficiency of the building envelope and systems as a whole. | Not applicable. |
| 26 | Assessing the potential impacts of adding insulation to the building envelope, such as displacing the dew point and creating thermal bridges. | Not applicable. |
| 27 | Working with energy efficiency specialists to determine the most appropriate solution to energy efficiency requirements with the least impact on the character-defining elements and overall heritage value of the historic building. | Not applicable. |

General Guidelines for Preservation, Rehabilitation and Restoration - Masonry

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|--|--|
| 1 | Understanding the properties and characteristics of the masonry of the historic place. | Surveys were conducted to understand the exterior masonry characteristics. |
| 2 | Documenting the form, materials and condition of masonry before undertaking an intervention. For example, identifying the particular characteristics and source of the type of stone or brick used, and the composition of the mortar. | Site visits included thorough photographic surveys of the exterior walls. |
| 3 | Protecting and maintaining masonry by preventing water penetration, and maintaining proper drainage so that water or organic matter does not stand on flat surfaces, or accumulate in decorative features. | Where the new entrance structure will be installed, the new concrete retaining wall will be separated and clear from the existing building. This gap will be filled with crushed gravel to drain water down to the existing weeping tile. Parging will be applied to the existing masonry foundations, with a layer of waterproofing and drainage board applied to further protect the existing masonry from water damage. |

General Guidelines for Preservation, Rehabilitation and Restoration - Masonry (cont.)

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|---|--|
| 4 | Applying appropriate surface treatments, such as breathable coatings, to masonry elements as a last resort, only if masonry repairs, alternative design solutions or flashings have failed to stop water penetration, and if a maintenance program is established for the coating. | Not applicable. |
| 5 | Sealing or coating areas of spalled or blistered glaze on terracotta units, using appropriate paints or sealants that are physically and visually compatible with the masonry units. | Not applicable. |
| 6 | Cleaning masonry, only when necessary, to remove heavy soiling or graffiti. The cleaning method should be as gentle as possible to obtain satisfactory results. | Select masonry will be gently cleaned of atmospheric soiling. |
| 7 | Carrying out masonry cleaning tests after it has been determined that a specific cleaning method is appropriate. | Mock-up of cleaning methods described in specifications to be demonstrated prior to widespread application. |
| 8 | Inspecting painted masonry surfaces to determine whether paint can successfully be removed without damaging the masonry, or if repainting is necessary. Testing in an inconspicuous area may be required. | Not applicable. |
| 9 | Removing damaged or deteriorated paint only to the next sound layer, using the gentlest method possible; for example, hand scraping before repainting. | Not applicable. |
| 10 | Re-applying compatible paint or coatings, if necessary, that are physically compatible with the previous surface treatments and visually compatible with the surface to which they are applied. | Not applicable. |
| 11 | Retaining sound and repairable masonry that contributes to the heritage value of the historic place. | The original masonry is being conserved. |
| 12 | Stabilizing deteriorated masonry by structural reinforcement and weather protection, or correcting unsafe conditions, as required, until repair work is undertaken. | Not applicable. |
| 13 | Repairing masonry by repointing the mortar joints where there is evidence of deterioration, such as disintegrating or cracked mortar, loose bricks, or damp walls. | Joints in need of repointing are noted in the construction documents. |
| 14 | Removing deteriorated or inappropriate mortar by carefully raking the joints, using hand tools or appropriate mechanical means to avoid damaging the masonry. | Joints in need of raking out are noted in the construction documents. The careful use of hand tools will be specified. |
| 15 | Using mortars that ensure the long-term preservation of the masonry assembly, and are compatible in strength, porosity, absorption and vapour permeability with the existing masonry units. Pointing mortars should be weaker than the masonry units; bedding mortars should meet structural requirements; and the joint profile should be visually compatible with the masonry in colour, texture and width. | Analysis of existing stone will be undertaken and mortar selection carefully indicated in the specifications and reviewed prior to construction. |

General Guidelines for Preservation, Rehabilitation and Restoration - Masonry (cont.)

| Standards and Guidelines for the Conservation of Historic Places in Canada – 2010 | | |
|---|--|--|
| 16 | Duplicating original mortar joints in colour, texture, width and joint profile. | Analysis of existing mortar will be undertaken and selection carefully indicated in the specs and reviewed prior to construction. Mortar joints will be repointed in kind. |
| 17 | Replacing in kind extensively deteriorated or missing parts of masonry elements, based on documentary and physical evidence. | Elements of the wall surrounding the main entrance where required will be replicated and reinstated to their original condition upon removal of the 1984 stairway and ramp. Deteriorated stone in similar area to be repaired by means of cutting out damaged portion and replaced in a manner using recognized heritage conservation methods. |
| 18 | Repairing masonry by patching, piecing-in or consolidating, using recognized conservation methods. Repair might include the limited replacement in kind, or replacement with a compatible substitute material, of extensively deteriorated or missing masonry units, where there are surviving prototypes. Repairs might also include dismantling and rebuilding a masonry wall or structure, if an evaluation of its overall condition determines that more than limited repair or replacement in kind is required. | All work involving masonry repair to be executed under supervision of heritage architect. |
| 19 | Replacing in kind any irreparable masonry element, based on documentary and physical evidence. | Both documentary and physical evidence were used to determine the look of replacement elements. |
| 20 | Removing hazardous materials from masonry, using the least-invasive abatement methods, and only after adequate testing has been conducted. | Not applicable. |
| 21 | Selecting replacement materials from sustainable sources, where possible. For example, replacing deteriorated stone units using in-kind stone recovered from a building demolition. | To be practiced where applicable. |
| 22 | Repairing, stabilizing and securing masonry elements from the restoration period, using recognized conservation methods. Repairs should be physically and visually compatible and identifiable on close inspection for future research. | All work involving heritage repair or stabilization to be executed in a manner using recognized heritage conservation methods. |
| 23 | Replacing in kind a masonry element from the restoration period that is too deteriorated to repair, based on documentary and physical evidence. The new work should be well documented and unobtrusively dated to guide future research and treatment. | Replacement elements to be documented in the construction document set. |

8.0 CONSERVATION STRATEGY & TREATMENTS

As noted above, the conservation strategy is primarily concerned with the protection and maintenance of the heritage attributes. These attributes are in fairly good condition. The proposed conservation scope is related to the preservation and rehabilitation of character-defining heritage elements affected due to accessibility upgrades.

Careful oversight is required during the construction process to ensure no inadvertent negative impacts will occur, such as damage of heritage attributes. This will include heritage elements located within the proposed area of scope as well as areas of construction access outside of the proposed scope of work, where there are existing heritage elements. Prior to construction work, all existing conditions are to be thoroughly photographed and documented in order to establish a historic record of the building. Where heritage materials are to be dismantled and reinstated, they are to be tagged, catalogued, photographed, and documented prior to their dismantling. Care is to be taken for the proper handling and storage of all salvaged heritage materials to be reinstalled on the building so as not to inadvertently damage these materials during the construction process. Protection measures are to be outlined to ensure all heritage materials to remain in-situ will not be inadvertently damaged. Should any concealed materials or systems that may potentially be heritage in nature be discovered within the site during work, activities should be halted at that location immediately and the consulting heritage architect should be notified to review.

The conservation treatments proposed for the masonry and entrance are described below. The methodology, tools and products for each treatment are described in the specifications and reflect recognized conservation repair methods. Mock-ups are required by the contractor to ensure that they are able to complete the work as per the prescribed methodology, and to provide a standard of quality for the overall work.

Masonry

Repointing: Includes the raking, repointing and tooling of a masonry joint. **Raking:** the removal of loose/deteriorated mortar until sound mortar is reached. **Repointing:** filling and finishing of masonry joints from which mortar is missing or has been raked out, and includes grouting, backpointing and finish pointing. **Tooling:** finishing of masonry joints using tool to provide final contour.

Cleaning: Several types of cleaning will be required: general cleaning and specialized cleaning (atmospheric soiling, biological growth removal, ferrous staining removal).

Rubbing back: Rub back friable stone to remove loose detail with wooden tools blocks to prevent marking of stone.

Dressing back: Dress scaled stone surfaces down to a sound stone face. At scaling, work using hand tools and stone-carving chisels to remove the loose material. Strict caution must be used to avoid aggressive removal of material from the surface. Bevel the edge of any edges of surface plates to ensure water shedding.

Tooling back: Tool back scaled or loose stone surfaced down to solid stone. Recreate certain original tooling details such as margins.

Stone pinning- removed stone: Remove stone to be repaired by first removing mortar around perimeter, and removing stone from wall and parapet without damaging arises. Maintain support to surrounding masonry as necessary. Clean surfaces to be repaired. Drill holes for dowels to re-anchor stone together. Set dowels with epoxy. Apply lime putty mortar to entire faces of stone to be bonded. Clamp stone using softwood shims to protect arises. Allow epoxy and lime putty mortar to set. Cut back mortar upon initial set and fill to surface with lime shelter coat. Promptly remove excess mortar from crack to prevent staining. Re-lay repaired stone on bedding mortar. Pin back loose and friable stone to sound stone substrates. Mask off surrounding areas to prevent the spread of dust. Re-lay repaired stone.

Stone pinning- in situ: Pin back loose and friable stone to sound stone substrates. Mask off surrounding areas to prevent the spread of dust. Drill holes 50 percent larger in diameter than dowels. Use dowels sized to suit application. Clean dust from holes using acetone and cotton swabs. Size dowel length to provide sufficient depth for mortar plug at surface. Mask surface below dowel holes to protect stone from epoxy over-spills. Place sufficient epoxy into hole to set ends of dowel. Use fine tools or hypodermic syringes. Spread epoxy on dowel and place in hole, temporarily plug ends with cotton swabbing or pottery clay as necessary to retain epoxy in hole. Fill deep and large diameter holes with repair mortar. Fill shallow and small diameter holes with the lime shelter coat.

Crack injections – Fissure in stone: Flush crack with clean water until all dirt and loose material are removed. Carry out final flushing with 10% ethyl alcohol solution. Prepare lime injection mortar by diluting with de-mineralized water up to 30 %. Inject mortar full into cracks. Repeat applications as necessary. Dam deep cracks to ensure complete filling. Clean surface of stone free of mortar as work progresses. Do not allow grout to be absorbed into surface. Where appropriate, use mortar undiluted to fill outer parts of crack or where width of crack warrants. Allow mortar to harden. Inject shelter coat over mortar to mask white colour. Fill crack flush with adjacent surface. Immediately clean up spills or runs.

Composite/mortar repairs: Prepare surfaces to receive repair mortar by removing previous repair materials and cleaning out loose debris from host stone. Wet host stone surface prior to application. Place repair mortars in maximum 15 mm layers. Allow mortar to achieve thumb-hardness before applying successive layers (lifts). Slightly overfill at surface and cover with damp absorbent towel. At the appropriate time, finish mortar flush with adjacent stone. Texture surface of mortar to match adjacent surface. Maintain mortar damp for minimum seven days. Repair faces of stone with where proprietary grout anchors have been installed.

Dutchman repair: Select new stone for dutchman to match colour and characteristics of host stone, free from defects and with same direction of bedding as adjacent work. Cut piece of sufficient surface area to cover area of damage. Cut to rectangular or square frame, minimum 50 mm deep. Finely rub and finish bed faces true with uniform rises, with maximum 1 mm joint between host stone and dutchman. Transfer outline onto damaged area by scribing. Hand chisel cut-out accurately to lines free of rough edges and spalled surfaces. Slightly undercut bed joints for tight fit of dutchman insert. Drill out host stone to receive dowels. Dutchman will be blind-pinned only. Fill holes and coat dowels with epoxy. Prepare lime slurry and butter cavity to receive stone. Carefully insert stone into cavity with dowels properly located in holes. Clean off mortar from face. Leave face of stone piece with slight projection. Finish to match host stone by rubbing back or tooling. Rubbing back or tooling marks on existing stone are not permitted.

Replacement: Provide temporary supports. Cut open joints and loosen stone with hardwood wedges. Free large stones using Lewis pins on top bed and lift out with nylon belts. Remove in one piece without placing stress at fracture points. Prepare wall to receive new stone. Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight. Set large stones on water soaked softwood wedges to support stone in proper alignment until bedding mortar has set. Remove wedges when dry, do not break off. Remove mortar dropping from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses. Fill all voids around connectors with mortar.

Dismantling and rebuilding: Marking and identifying the stones and bricks being dismantled. Shoring temporarily as required to ensure the overall stability of the area being dismantled. Loosening the bricks and stones by removing the surrounding mortar, installing shims as required. Using wood wedges, hoisting belts and other materials to lift stones. Cleaning stones and bricks and removing all excess mortar. Identifying all stones and bricks to be salvaged for reuse. Installing anchors. Relaying bricks and stones (in original locations – refer to Replacement above), installing bedding and finish pointing.

Entrance Doors

Wood repair: Remove hardware for cleaning and reinstallation at end of repair work. Strip existing paint, varnish, and or stain to fresh wood. Apply borate treatment to surface of any wood decay. Epoxy repair holes from old hardware or minor damages. Perform dutchman repairs as required. Stabilize joinery if required. Refinish with paint or varnish as directed in the contract documents and specifications.

Glazing replacement: Soften existing putty to safely remove and salvage glass where being retained, clean existing glass to be reused, reinstall existing clean glass or new glass on new putty bed.

Weatherproofing repair: To consist of the installation of new weatherstripping and or sealant around operable door or window perimeter.

9.0 RECOMMENDATIONS

The scope of work as defined in this conservation plan complies with the Parks Canada's *Standards and Guidelines for the Conservation of Historic Places in Canada*. A detailed survey and documentation of the exterior was completed to assess current conditions, determine the causes of deteriorations and to develop appropriate repair strategies. The scope of work from this survey is to be reflected in the Construction Document drawings and their accompanying specifications.

Repair strategies for the east entrance include cleaning select masonry to remove salt buildup and general atmospheric soiling and repairing damages to the stone, such as anchor holes in masonry from previous light fixtures. Additionally large portions of masonry will be repointed with localized dutchman repairs at select areas of the entrance, particularly near the base where the effects of weathering have been most detrimental to the stone. In instances where stone elements are missing due to previous intervention, patches will be removed and replacement stone elements will be reinstated, such as the missing plinth profile at the base of the building.

Where the new entrance structure will be installed, replacing the existing to be demolished, the new concrete retaining wall will be separated and clear from the existing building. This gap will be filled with crushed gravel to drain water down to the existing weeping tile. Parging will be applied to the existing masonry foundations, with a layer of waterproofing and drainage board applied to further protect the existing masonry from water damage.

The entrance door and transom will also be conserved as a part of this intervention. Existing door and door frames will be cleaned and repaired from atmospheric soiling and damage. Epoxy repairs are required to fill cracks, scratches, holes or any checking. Wooden elements will be stripped of existing varnish or paint and a new stain or paint is to be applied as indicated. New glass with building identification signage to be installed in the existing door, with the existing glass in the transom to be cleaned and reinstalled on a new putty bed. Existing door hardware is to be removed, cleaned and reinstalled. Lastly new weatherstripping will be installed to improve the performance of the doors.

For all areas including marble or stone details, plaster ceiling, and any heritage elements adjacent to the work being performed, including interior paths of travel of construction machinery and workers, protective barriers are required to protect them from damage and physical impacts. Direct attachment of barriers or construction heritage elements is prohibited. Any inadvertently damaged finishes must be reinstated immediately.

Lastly, construction vibration will be monitored as much as possible. Vibration and displacement monitoring are to conform to the Toronto Municipal Code Chapter 363, Building Construction and Demolition.

APPENDIX A

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APPENDIX B

IN THE MATTER OF THE ONTARIO HERITAGE ACT, 1974,
S.O. CHAPTER 122

AND IN THE MATTER OF THE DESIGNATION OF THE PROPERTY
KNOWN AS THE CORNEST LIBRARY BUILDING AT 214 COLLEGE STREET

NOTICE OF PASSING OF BY-LAW

To:

Metropolitan Toronto
c/o Metropolitan Toronto
Library Board,
214 College St.,
Toronto, Ontario.
M5T 1R2.

✓ Ontario Heritage Foundation.

Take notice that the Council of the Corporation of the City
of Toronto has passed by-law No. 509-75 to designate the above property.
(Reference File 0675).

DATED at Toronto this 20th day of February, 1976.

Ray V. Henderson
RAY V. HENDERSON
City Clerk.

No. 509—75. A BY-LAW

To designate the Carnegie Library building at No. 214-220 College Street of architectural value.

[Passed November 26, 1975.]

Whereas The Ontario Heritage Act, 1974, authorized the Council of a municipality to enact by-laws to designate real property, including all the buildings and structures thereon, to be of historic or architectural value or interest; and

Whereas the Council of The Corporation of the City of Toronto has caused to be served upon the owner of the lands and premises known as the Carnegie Library building at No. 214-220 College Street and upon the Ontario Heritage Foundation notice of intention to so designate the aforesaid real property and has caused such notice of intention to be published in a newspaper having a general circulation in the municipality once for each of three consecutive weeks; and

Whereas the reasons for the designation are set out as Schedule 'B' hereto; and

Whereas no notice of objection to the said proposed designation has been served upon the clerk of the municipality;

Therefore, the Council of The Corporation of the City of Toronto enacts as follows:

1. There is designated as being of architectural value or interest the real property, more particularly described in Schedule 'A' hereto, known as the Carnegie Library building at No. 214-220 College Street.
2. The City Solicitor is hereby authorized to cause a copy of this by-law to be registered against the property described in Schedule 'A' hereto in the proper land registry office.
3. The City Clerk is hereby authorized to cause a copy of this by-law to be served upon the owner of the aforesaid property and upon the Ontario Heritage Foundation and to cause notice of this by-law to be published in a newspaper having general circulation in the City of Toronto.

ARTHUR C. EGGLETON,
Presiding Officer.
COUNCIL CHAMBER,
Toronto, November 26, 1975.
(L.S.)

ROY V. HENDERSON,
City Clerk.

SCHEDULE 'A'

All and singular that certain parcel or tract of land and premises situate, lying and being in the City of Toronto, in the Municipality of Metropolitan Toronto, formerly in the County of York and Province of Ontario being composed of part of Park Lot 14 in the First Concession from the Bay in the original Township of York, but now in the said City of Toronto; part of lot D according to a plan registered in the Registry Office for the Registry Division of Toronto as D-252 and part of lot 1 according to a plan registered in the said Registry Office for Toronto as D-217, the boundaries of the said parcel being described as follows:

Commencing at the intersection of the westerly limit of St. George Street with the northerly limit of College Street;

Thence northerly along the said westerly limit of St. George Street 426.53 feet more or less to the southerly limit of lot C according to the said plan D-252;

Thence westerly along the southerly limit of the said lot C 147.23 feet more or less to a line of fence forming the existing limits between lots C and D according to the said plan D-252;

Thence northerly along the said line of fence 10.42 feet more or less to a point therein distant 20.00 feet measured southerly thereon from the north-easterly angle of the said lot D;

Thence westerly along a line drawn parallel to the northerly limit of the said lot D 93.77 feet;

Thence continuing westerly along a line drawn parallel to the southerly limit of Russell Street 81.46 feet more or less to the easterly limit of a parcel of land used as a lane;

Thence southerly along the said easterly limit of lane 208.73 feet more or less to its intersection with the northerly limit of the easterly part of a lane according to the said plan D-217, the said intersection being a point in the said northerly limit of lane distant 154.67 feet east of the aforesaid easterly limit of Huron Street measured along the said northerly limit of lane and the westerly production thereof;

Thence easterly along the said northerly limit of lane 83.92 feet more or less to the easterly limit of the lands included in the said plan D-217;

Thence southerly along the said easterly limit of the lands included in the said plan, being along the easterly limit of the last-mentioned lane, a distance of 10.00 feet more or less to the northerly limit of lot 1 according to the said plan D-217;

Thence westerly along the said northerly limit of lot 113.53 feet more or less to the westerly limit of the northerly portion of the said lot;

Thence southerly along the said westerly limit of the northerly portion of lot, 67.42 feet more or less to its intersection with a line drawn parallel to and at the perpendicular distance of 150.00 feet northerly from the northerly limit of College Street;

Thence easterly along the said parallel line 21.63 feet more or less to its intersection with a line drawn parallel to the westerly limit of the said lot 1 through a point in the southerly limit thereof distant 26.63 feet measured easterly thereon from the said westerly limit thereof;

Thence southerly along the last-mentioned parallel line 150.00 feet more or less to the said southerly limit of lot 1;

Thence easterly, in part along the said southerly limit of lot 1, being along the aforesaid northerly limit of College Street, a distance of 330.53 feet more or less to the point of commencement.

SCHEDULE 'B'

Reasons for the designation of the Carnegie Library building at No. 214-220 College Street

The Carnegie Library building, 214-220 College Street at St. George Street (SW); 1906-1907 by Wickson & Gregg, and A. H. Chapman; 1926 Addition by Wickson & Gregg, and A. H. Chapman; 1930 Addition by Wickson & Gregg, and Chapman and Oxley, is designated to be of architectural value as an outstanding example of the Beaux Arts style of classicism, both externally and internally, in the main reading room. The building also has contextual importance as a continuation of the line of University buildings westward along College, as a corner element at St. George Street and College Street, and for its relation to the street with a maximum amount of open green space.

Appendix C

ABRIDGED
ARCHITECTURAL
DRAWING PACKAGE

HEALTH AND WELLNESS CENTRE - KOFFLER CENTRE RENOVATION
UNIVERSITY OF TORONTO

214 COLLEGE STREET, TORONTO, ON M5T 3A1

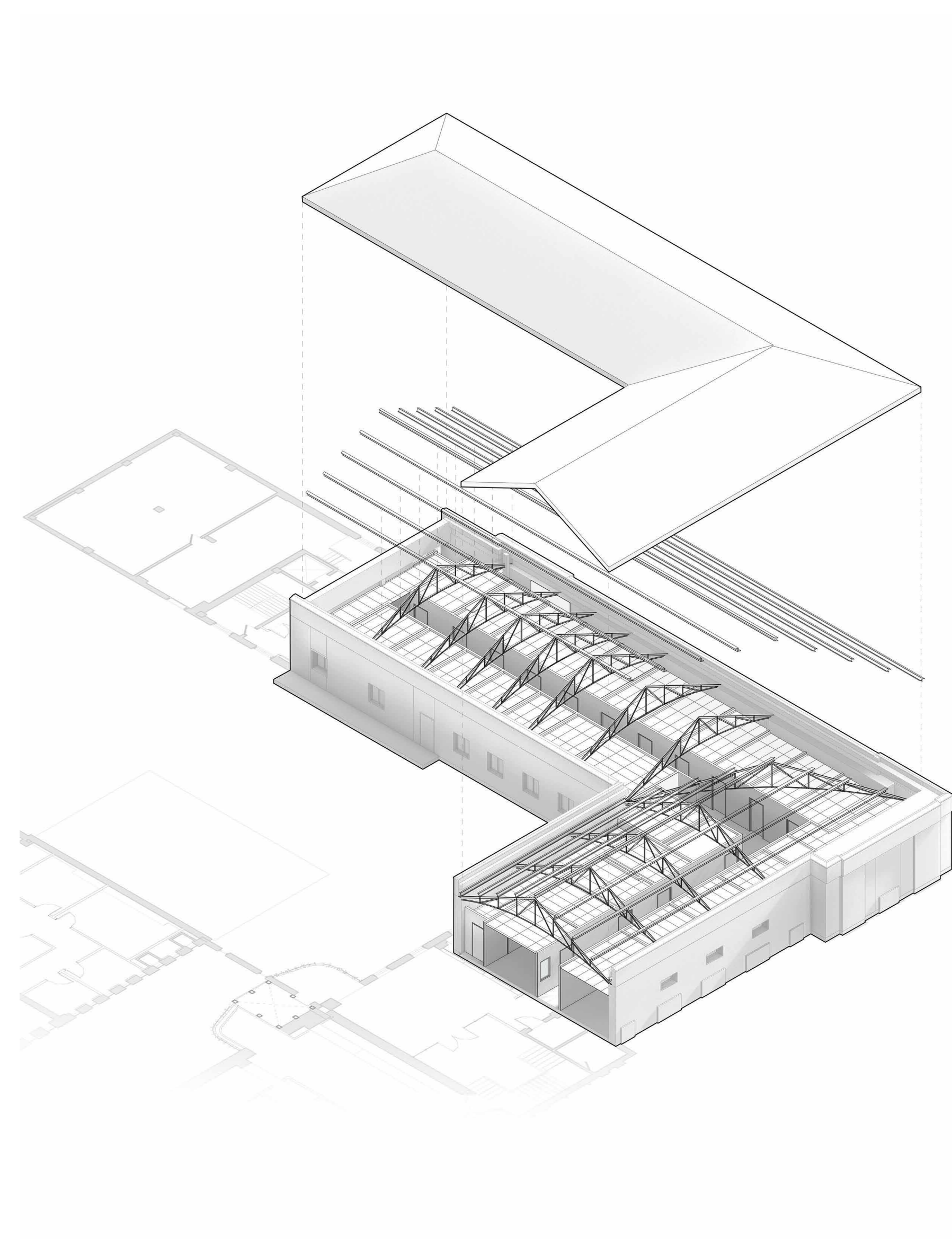
ISSUED FOR CLIENT REVIEW



1 ARTIST EXTERIOR RENDERING - ST. GEORGE ENTRANCE



2 ARTIST INTERIOR RENDERING - ATRIUM ELEVATOR

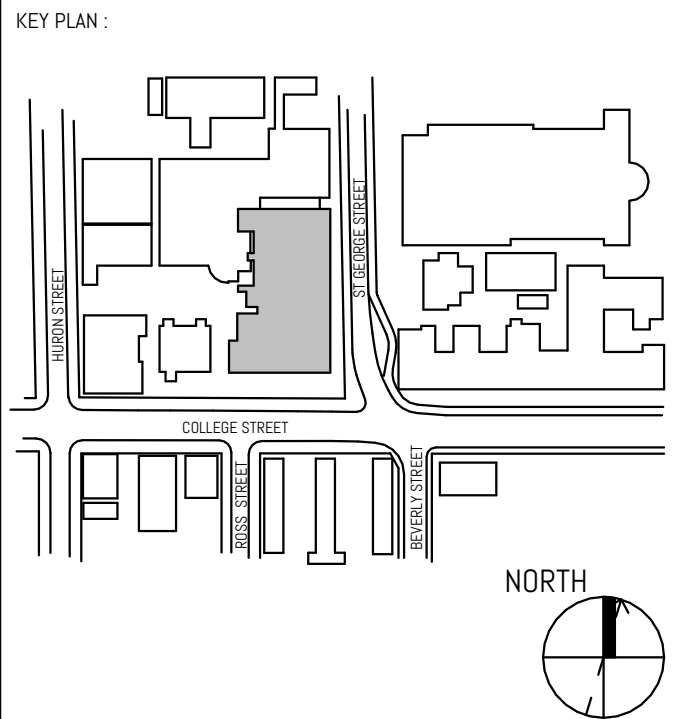


3 ARTIST INTERIOR RENDERING - L3 OPEN CEILING DESIGN

The Health and Wellness Centre (HWC) renovation project at 214 College Street includes renovating approximately 3,647m² of existing interior space, adding 18m² of new circulation space (elevator landings), and upgrading 190m² of exterior circulation space at the St. George entrance for improved barrier-free accessibility. On the second floor, renovated areas will house administrative offices and multipurpose rooms within the East Wing, while the North wing will house counseling spaces and mental health offices. The third floor will house a mix of counseling rooms, examination rooms, and administrative spaces. 510m² of the third floor area is being maintained as shell space for a separate, future occupant. A presence will be maintained on the ground floor for providing reception functions and promoting HWC programming. The project will improve access throughout the building by providing accessible connections between the multiple incongruent floor plates via a central elevator located in the atrium, which acts as a centroidal "spoke" providing access to both the North and East Wings. All floors of the project incorporate spaces for smudging.

Furthermore, as the property is included on the City of Toronto Heritage Register and is designated Part IV under the Ontario Heritage Act, the proposed interventions must conserve the cultural heritage values of the building.

PROJECT DESCRIPTION



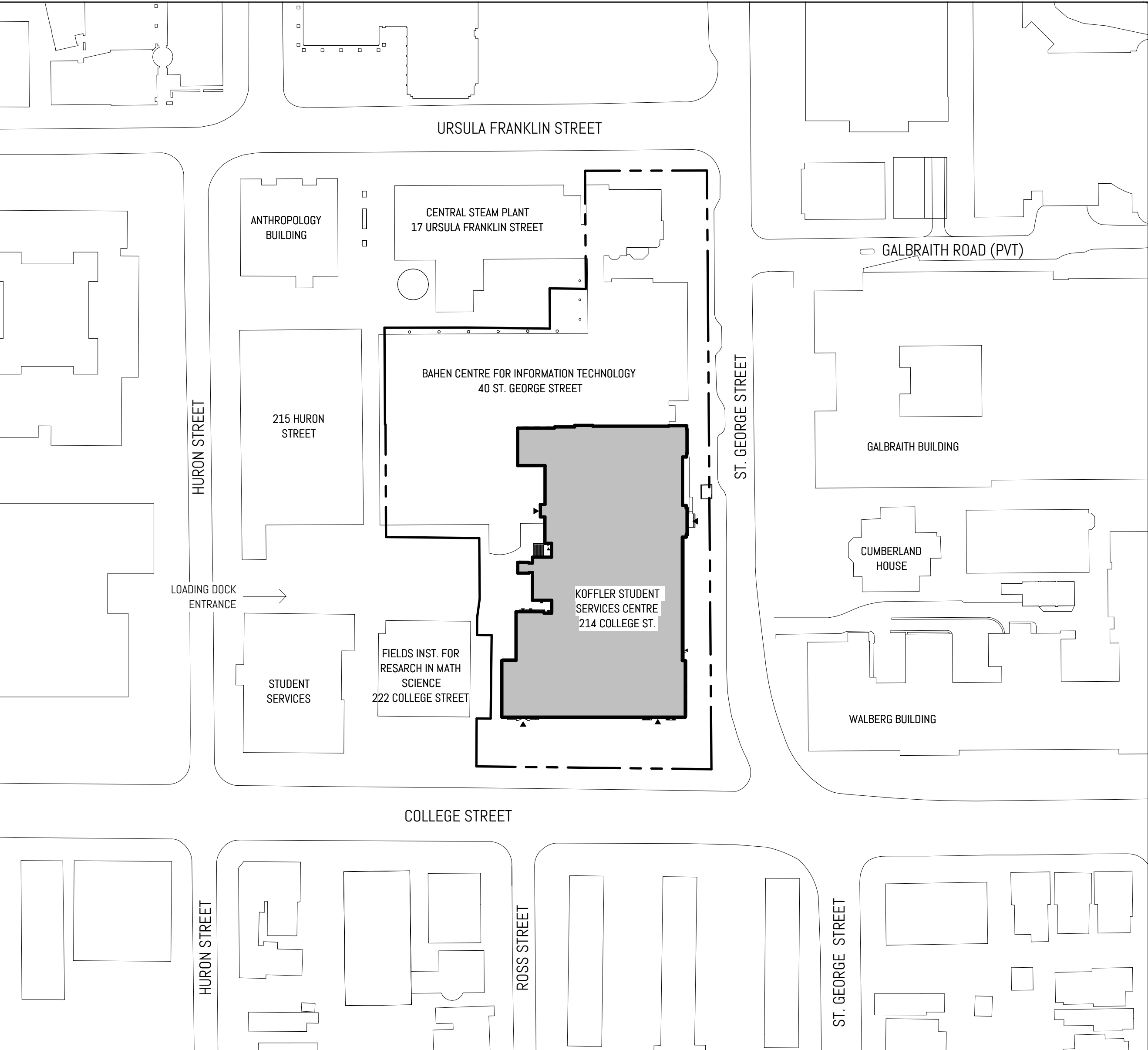
| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 10/20/2024 | CLIENT REVIEW |
| 2 | 10/20/2024 | CUSTOMER SET |

SHEET LIST

| 00. DRAWING LIST | | | |
|------------------|-------------|---------------|----------------------|
| SHEET NUMBER | SHEET TITLE | ISSUANCE DATE | ISSUANCE DESCRIPTION |

| 00. DRAWING LIST | | | |
|------------------|-------------|---------------|----------------------|
| SHEET NUMBER | SHEET TITLE | ISSUANCE DATE | ISSUANCE DESCRIPTION |

CONTEXT PLAN



3 CONTEXT PLAN - ST. GEORGE CAMPUS

PROJECT TEAM

OWNER:

UNIVERSITY OF TORONTO

University of Toronto
University Planning, Design & Construction
Operations & Real Estate Partnerships,
University of Toronto

255 McCaul Street, 4th Floor
Toronto, ON M5T 1W7

ARCHITECTURE:

ENFORM architects

ENFORM Architects Inc.
3008 - 128A Sterling Road,
Toronto, ON M6R 2B7

HERITAGE:

EVOQ Architecture

75 Sherbourne St. Suite 503,
Toronto, ON M5A 2P9

STRUCTURE & BUILDING ENVELOPE:

ENTUITIVE

Entuitive
200 University Avenue, 7th Floor
Toronto, ON M5G 1S5

MECHANICAL:

Smith + Andersen

Smith + Andersen
100 Sheppard Ave. E.
North York, ON M2N 6N6

ELECTRICAL, LIGHTING, IT, DATA, A/V, SECURITY:

Smith + Andersen

Smith + Andersen
100 Sheppard Ave. E.
North York, ON M2N 6N6

BUILDING CODE & ACCESSIBILITY:

LMDG

LMDG Building Code Consultants Ltd
290 N Queen St. Suite 100,
Toronto, ON M5C 5L2

CIVIL:

MTE

MTE Consultants Inc.
10155 Sutton Drive, Unit A,
Burlington, Ontario L7L 6B8

SUSTAINABILITY:

footprint

Footprint
100 Sheppard Avenue East, Suite 1100
Toronto, ON M2N 6N6

LANDSCAPE:

Henry Kortbeek and Associates Inc.

Henry Kortbeek and Associates Inc.
589 Liverpool Road
Pickering, Ontario L1W 1R1

DOOR HARDWARE DESIGN

Upper Canada Specialty Hardware
10 Breckinridge Road, Unit 15
Toronto, Ontario M4G 3Y2

VERTICAL TRANSPORTATION:

KJA

KJA Consultants Inc.
325 Front St. W. Suite 822
Toronto, ON M5Y 2T1

ENFORM architects



UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION

214 College Street, Toronto,
ON M5T 3A1

SHEET CONTENTS:
COVER PAGE + DRAWING LIST

| | | | |
|---|--------------------|---------------------|-----------|
| PROJECT NUMBER: 23-011 (P143-19-100) | | | |
| DRAWING SCALE: AS SHOWN | | | |
| DRAWN BY: NE | CHECKED BY: JAF | DATE: 2024-10-04 | REV: 2 |
| SHEET NO: A000 | | | |

ONTARIO BUILDING CODE DATA MATRIX

| <small>City of Toronto</small> <small>2240 Bloor Street West, Suite 200</small> <small>Toronto, Ontario M6H 1P5</small> <small>416-392-2200</small> <small>www.toronto.ca</small> | | <small>Name of Project:</small> <small>1245 LESLIE STREET & MIDLAND CENTRE OF YOUTH INNOVATION</small> <small>(Location)</small> <small>1245 LESLIE STREET, TORONTO, ONTARIO M6E 1B4</small> <small>Name:</small> <small>204 August 2014</small> | | Building Code Reference ¹ |
|---|---|---|--|--------------------------------------|
| ITEM | ONTARIO'S BUILDING CODE DATA MATRIX PART 3 | | | |
| 3.00 | BUILDING CODE VERSION: | 0 Reg. 332/12 | LAST AMENDMENT: 0 Reg. 89/23 | |
| 3.01 | PROJECT TYPE | <input type="checkbox"/> NEW <input type="checkbox"/> CHANGE OF USE DESCRIPTION: | <input checked="" type="checkbox"/> ADDITION <input type="checkbox"/> ADDITION AND RENOVATION 2 STOREY (HORIZONTAL) ADDITION TO EXISTING BUILDING FOR AN ELEVATOR LANDING | [A] 3.1.2 |
| 3.02 | MAJOR OCCUPANCY CLASSIFICATION | OCCUPANCY GROUP D GROUP A2 GROUP E | USE BUSINESS AND PERSONAL SERVICES ASSEMBLY MERCANTILE (BOOKSTORE) | 3.1.2.1 (1) |
| 3.03 | SUPERIMPOSED MAJOR OCCUPANCIES | <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES DESCRIPTION: | | 3.2.2.7 |
| 3.04 | BUILDING AREA (m ²) | DESCRIPTION BAHEN CENTRE AND KOFFLER CENTRE | EXISTING 9548 NEW 0 TOTAL 9548 | [A] 14.1.2 |
| 3.05 | GROSS AREA (m ²) | DESCRIPTION BAHEN CENTRE AND KOFFLER CENTRE | NEW 39 866 19 TOTAL 39 884 | [A] 14.1.2 |
| 3.06 | MEZZANINE AREA (m ²) | DESCRIPTION NOT APPLICABLE | EXISTING 0 NEW 0 TOTAL 0 | 3.2.1.1 |
| 3.07 | BUILDING HEIGHT | 8 STOREYS ABOVE GRADE 4 STOREYS BELOW GRADE | 41.5 (m) ABOVE GRADE (EXISTING) | [A] 14.1.2 & 3.2.1.1 |
| 3.08 | HIGH BUILDING | <input type="checkbox"/> NO <input checked="" type="checkbox"/> YES | | 3.2.6 |
| 3.09 | NUMBER OF STREETS/ FIRE FIGHTER ACCESS | 2 STREETS(S) | | 3.2.2.10 & 3.2.6 |
| 3.10 | BUILDING CLASSIFICATION <small>2015/2016</small> | 3.2.2.49 GROUP D | | 3.2.2.20 - 83 |
| 3.11 | SPRINKLER SYSTEM | <input checked="" type="checkbox"/> REQUIRED PROPOSED: | <input type="checkbox"/> NOT REQUIRED <input checked="" type="checkbox"/> ENTIRE BUILDING <input type="checkbox"/> SELECTED FLOOR AREAS <input type="checkbox"/> IN LIEU OF ROOF RATING <input type="checkbox"/> SELECTED COMPARTMENTS <input type="checkbox"/> BASEMENT <input type="checkbox"/> NONE | 3.2.1.5 & 3.2.2.17 |
| 3.12 | STANDPIPE SYSTEM | <input checked="" type="checkbox"/> REQUIRED PROPOSED: | <input type="checkbox"/> NOT REQUIRED <input type="checkbox"/> SINGLE STAGE <input type="checkbox"/> TWO STAGE | 3.2.8 |
| 3.13 | FIRE ALARM SYSTEMS | <input checked="" type="checkbox"/> REQUIRED PROPOSED: | <input type="checkbox"/> NOT REQUIRED <input type="checkbox"/> NONE | 3.2.4 |

| | | | | |
|------|-----------------------------------|---|---|----------------------------|
| 3.14 | WATER SERVICE/ SUPPLY IS ADEQUATE | <input type="checkbox"/> NO | <input checked="" type="checkbox"/> YES | |
| 3.15 | CONSTRUCTION TYPE | <u>RESTRICTION</u> <input type="checkbox"/> COMBUSTIBLE PERMITTED <input checked="" type="checkbox"/> NON-COMBUSTIBLE REQUIRED <u>ACTUAL:</u> <input type="checkbox"/> COMBUSTIBLE <input checked="" type="checkbox"/> NON-COMBUSTIBLE <input type="checkbox"/> COMBINATION <u>HEAVY TIMBER CONSTRUCTION</u> <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES | | 3.2.2.20 - 83 & 3.2.1.4. |
| 3.16 | IMPORTANCE CATEGORY | <input type="checkbox"/> LOW <input type="checkbox"/> LOW OCCUPANCY <input type="checkbox"/> POST-DISASTER SHELTER <input checked="" type="checkbox"/> NORMAL <input type="checkbox"/> HIGH <input type="checkbox"/> MINOR STORAGE BUILDING <input type="checkbox"/> EXPLOSIVE OR HAZARDOUS SUBSTANCES <input type="checkbox"/> POST-DISASTER | | 3.1.2.1 (3) & 3.1.2.1.8 |
| 3.17 | SEISMIC HAZARD INDEX | (V _s F _a S _a (0.2)) = _____ 1.0 x 0.244 = 0.244 SEISMIC DESIGN REQUIRED FOR TABLE 4.1.8.18, ITEMS 6 TO 21: (V _s F _a S _a (0.2)) ≥ 0.35 OR POST-DISASTER <input type="checkbox"/> NO <input type="checkbox"/> YES | | 4.1.2.1 (3) & 4.1.8.18 (2) |
| 3.18 | OCCUPANT LOAD | <u>FLOOR LEVEL/AREA</u> <u>OCCUPANCY TYPE</u> <u>BASED ON</u> <u>OCCUPANT LOAD (PERSONS)</u> L2 (NEW ADDITION) 0 (OFFICE) DESIGN 0 L3 (NEW ADDITION) 0 (OFFICE) DESIGN 0 | | 3.1.1.7 |
| 3.19 | BARRIER-FREE DESIGN | <input checked="" type="checkbox"/> YES <u>EXPLANATION</u> _____ <input type="checkbox"/> NO | | 3.8 |
| 3.20 | HAZARDOUS SUBSTANCES | <input type="checkbox"/> YES <u>EXPLANATION</u> _____ <input checked="" type="checkbox"/> NO | | 3.3.1.2 & 3.3.1.1.9 |
| 3.21 | REQUIRED FIRE RESISTANCE RATINGS | <u>HORIZONTAL ASSEMBLY</u> <u>RATING</u> <u>SUPPORTING ASSEMBLY (H)</u> <u>NONCOMBUSTIBLE IN LIEU OF RATING?</u> FLOORS OVER BASEMENT <u>N/A</u> <u>0</u> <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> N/A FLOORS <u>2 HRS</u> <u>2 HRS</u> <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> N/A MEZZANINE <u>N/A</u> <u>0</u> <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> N/A ROOF <u>0 HRS</u> <u>0</u> <input type="checkbox"/> NO <input type="checkbox"/> YES <input type="checkbox"/> N/A | | 3.2.2.20 - 83 & 3.2.1.4. |
| 3.22 | PLUMBING FIXTURE REQUIREMENTS | <u>RATIO:</u> <u>MALE/FEMALE = 50/50 EXCEPT AS NOTED OTHERWISE</u> <u>FLOOR LEVEL/AREA</u> <u>OCCUPANT LOAD</u> <u>80% REFERENCE</u> <u>FIXTURES REQUIRED</u> <u>FIXTURES PROVIDED</u> <u>REFER TO CODE REPORT</u> _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 _____ 0 | | 3.7.4. |
| 3.24 | ENERGY EFFICIENCY | <u>COMPLIANCE PATH:</u> <u>SB-10 & ASHRAE 2013</u> _____ <u>CLIMATIC ZONE:</u> _____ | | SB-10 |
| 3.5 | NOTES | | | |

1 All references are to Division B of the OBC unless preceded by [A] for Division A and [C] for Division C.

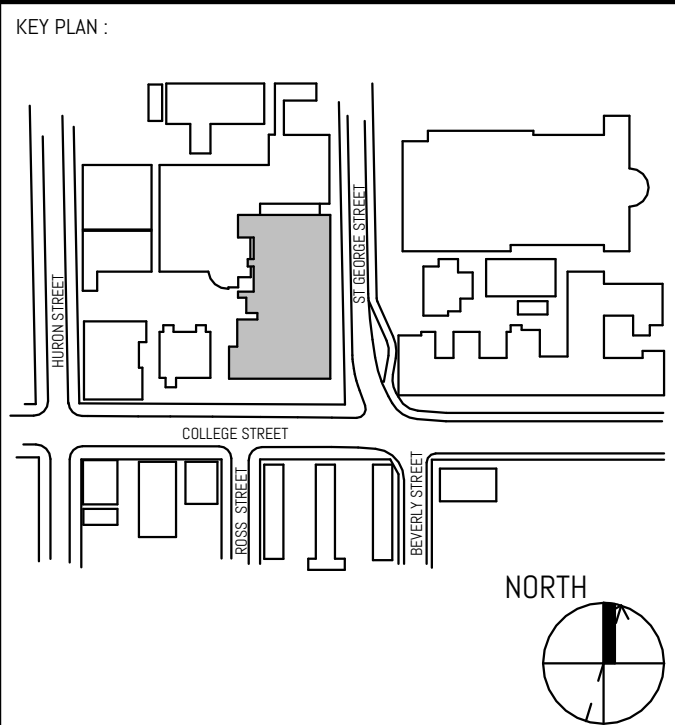
State of Practice
CDR (SRA) Accredited
2300 Highway 401, Suite 100
Toronto, Ontario M2H 3P7
T 416 443 7523

Date of Report
PLS 19-20 (2018 Health & Wellness Centre at Koffler Renovation)
Location
231 College Street, Toronto, Ontario
Date
23rd August 2019

| ITEM | ONTARIO'S BUILDING CODE DATA MATRIX PART 11 - RENOVATION OF EXISTING BUILDING | | | | | Building Code Reference ¹ | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|--|--|-------------------------|--|--|--|---------------------|-------------------|-------------------------|----------------------------------|---------------------|---|------|----------------------|----------|---|-----|----------------------|----------|--|-----|--|--|--|-----|--------|
| 1100 | BUILDING CODE VERSION | 0. Reg. 332/12 LAST AMENDMENT: 0. Reg. 158/24 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1101 | PROJECT TYPE | <input type="checkbox"/> NEW <input type="checkbox"/> CHANGE OF USE <input type="checkbox"/> ADDITION <input type="checkbox"/> ADDITION AND RENOVATION <input checked="" type="checkbox"/> RENOVATION DESCRIPTION: INTERIOR ALTERATIONS AT LEVELS 01, 02 AND 03 WITHIN AN EXISTING 8-STORY BUILDING | | | | [A] 11.2 | | | | | | | | | | | | | | | | | | | | |
| 1102 | MAJOR OCCUPANCY CLASSIFICATION | OCCUPANCY USE GROUP D BUSINESS AND PERSONAL SERVICES GROUP A2 ASSEMBLY GROUP E MERCANTILE (BOOKSTORE) | | | | 3.1.2.1(1) | | | | | | | | | | | | | | | | | | | | |
| 1103 | SUPERIMPOSED MAJOR OCCUPANCIES | <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES DESCRIPTION: | | | | 3.2.2.7 | | | | | | | | | | | | | | | | | | | | |
| 1104 | BUILDING AREA (m ²) | <table><tr><td>DESCRIPTION</td><td>EXISTING</td><td>NEW</td><td>TOTAL</td></tr><tr><td>BAHLEN CENTRE AND KOFFLER CENTRE</td><td>9549</td><td>0</td><td>9549</td></tr></table> | | | | DESCRIPTION | EXISTING | NEW | TOTAL | BAHLEN CENTRE AND KOFFLER CENTRE | 9549 | 0 | 9549 | [A] 14.1.2 | | | | | | | | | | | | |
| DESCRIPTION | EXISTING | NEW | TOTAL | | | | | | | | | | | | | | | | | | | | | | | |
| BAHLEN CENTRE AND KOFFLER CENTRE | 9549 | 0 | 9549 | | | | | | | | | | | | | | | | | | | | | | | |
| 1105 | BUILDING HEIGHT | <table><tr><td>8</td><td>STOREYS ABOVE GRADE</td><td>11.5. (EXISTING)</td><td>(m) ABOVE GRADE</td></tr><tr><td>4</td><td>STOREYS BELOW GRADE</td><td></td><td></td></tr></table> | | | | 8 | STOREYS ABOVE GRADE | 11.5. (EXISTING) | (m) ABOVE GRADE | 4 | STOREYS BELOW GRADE | | | [A] 14.1.2 & 3.2.1.1 | | | | | | | | | | | | |
| 8 | STOREYS ABOVE GRADE | 11.5. (EXISTING) | (m) ABOVE GRADE | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | STOREYS BELOW GRADE | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1106 | NUMBER OF STREETS / FIRE FIGHTER ACCESS | 2 STREET(S) 3.2.2.10 & 3.2.5 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1107 | BUILDING SIZE | <input type="checkbox"/> SMALL <input type="checkbox"/> MEDIUM <input type="checkbox"/> LARGE <input checked="" type="checkbox"/> > LARGE 7.11.2.1.B-N | | | | | | | | | | | | | | | | | | | | | | | | |
| 1108 | EXISTING BUILDING CLASSIFICATION | CHANGE IN MAJOR OCCUPANCY: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NOT APPLICABLE (NO CHANGE OF MAJOR OCCUPANCY) CONSTRUCTION INDEX: 7 (UNRATED ROOF) HAZARD INDEX: 7 IMPORTANCE CATEGORY: <input type="checkbox"/> LOW <input checked="" type="checkbox"/> NORMAL <input type="checkbox"/> HIGH <input type="checkbox"/> POST-DISASTER 7.11.2.1.B to N 4.2.1.(3), 5.2.2.1.(2) | | | | 11.2.1.1 11.2.1.1A 11.2.1.1.B to N | | | | | | | | | | | | | | | | | | | | |
| 1109 | RENOVATION TYPE | <input type="checkbox"/> BASIC RENOVATION <input checked="" type="checkbox"/> EXTENSIVE RENOVATION 11.3.3.1, 11.3.3.2 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1110 | OCCUPANT LOAD | <table><tr><td>FLOOR LEVEL/AREA</td><td>OCCUPANCY TYPE</td><td>BASED ON</td><td>OCCUPANT LOAD (PERSONS)</td></tr><tr><td>LEVEL 1 (RENOVATION)</td><td>EXISTING</td><td></td><td>108</td></tr><tr><td>LEVEL 2 (RENOVATION)</td><td>EXISTING</td><td></td><td>230</td></tr><tr><td>LEVEL 3 (RENOVATION)</td><td>EXISTING</td><td></td><td>329</td></tr><tr><td></td><td></td><td></td><td>667</td></tr></table> | | | | FLOOR LEVEL/AREA | OCCUPANCY TYPE | BASED ON | OCCUPANT LOAD (PERSONS) | LEVEL 1 (RENOVATION) | EXISTING | | 108 | LEVEL 2 (RENOVATION) | EXISTING | | 230 | LEVEL 3 (RENOVATION) | EXISTING | | 329 | | | | 667 | 9.1.17 |
| FLOOR LEVEL/AREA | OCCUPANCY TYPE | BASED ON | OCCUPANT LOAD (PERSONS) | | | | | | | | | | | | | | | | | | | | | | | |
| LEVEL 1 (RENOVATION) | EXISTING | | 108 | | | | | | | | | | | | | | | | | | | | | | | |
| LEVEL 2 (RENOVATION) | EXISTING | | 230 | | | | | | | | | | | | | | | | | | | | | | | |
| LEVEL 3 (RENOVATION) | EXISTING | | 329 | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 667 | | | | | | | | | | | | | | | | | | | | | | | |
| 1111 | PLUMBING FIXTURE REQUIREMENTS | RATIO: MALE/FEMALE = 50/50 EXCEPT AS NOTED OTHERWISE FLOOR LEVEL/AREA REFER TO CODE REPORT <table><tr><td>OCCUPANT LOAD</td><td>DBC REFERENCE</td><td>FIXTURES REQUIRED</td><td>FIXTURES PROVIDED</td></tr><tr><td>0</td><td></td><td>0</td><td>0</td></tr><tr><td>0</td><td></td><td>0</td><td>0</td></tr></table> | | | | OCCUPANT LOAD | DBC REFERENCE | FIXTURES REQUIRED | FIXTURES PROVIDED | 0 | | 0 | 0 | 0 | | 0 | 0 | 3.7.4 | | | | | | | | |
| OCCUPANT LOAD | DBC REFERENCE | FIXTURES REQUIRED | FIXTURES PROVIDED | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | |
|-------|----------------------------------|--|--|-------------|
| 11.12 | BARRIER-FREE DESIGN | <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | EXPLANATION _____ | 11.3.32 (2) |
| 11.13 | REDUCTION IN PERFORMANCE LEVEL | STRUCTURAL: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES BY INCREASE IN OCCUPANT LOAD: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES BY CHANGE OF MAJOR OCCUPANCY: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES PLUMBING: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES SEWAGE SYSTEMS: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES EXTENSION OF COMBUSTIBLE CONSTRUCTION: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES | 11.4.2.1 11.4.2.2 11.4.2.3 11.4.2.4 11.4.2.5 11.4.2.6 | |
| 11.14 | COMPENSATING CONSTRUCTION | <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES _____ STRUCTURAL: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES _____ BY INCREASE IN OCCUPANT LOAD: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES _____ BY CHANGE OF MAJOR OCCUPANCY: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES _____ PLUMBING: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES _____ SEWAGE SYSTEMS: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES _____ EXTENSION OF COMBUSTIBLE CONSTRUCTION: <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES _____ | 11.4.3.1 11.4.3.2 11.4.3.3 11.4.3.4 11.4.3.5 11.4.3.6 11.4.3.7 | |
| 11.15 | COMPLIANCE ALTERNATIVES PROPOSED | <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES (LIST NUMBERS AND DESCRIBE) _____ (LIST NUMBERS AND DESCRIBE) _____ (LIST NUMBERS AND DESCRIBE) _____ | 11.5.1 | |
| 11.16 | NOTES | _____ _____ _____ _____ | 11.5.1 | |

1 All references are to Division B of the OBC unless preceded by [A] for Division A and [C] for Division C



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 08/30/2024 | COSTING SET |

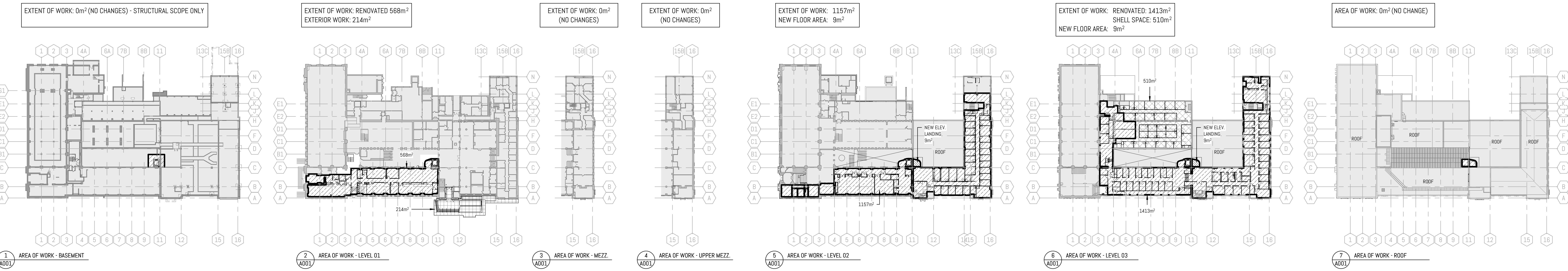
| TABLE 1: APPLICABLE ZONING BYLAW: 438-86 | | LOT DEPTH | 181.87m |
|--|-------------------|---|-----------------------------|
| ZONING DESIGNATION | Q T2.0 H23 | PERMITTED DENSITY | 2.0 (26,002m²) [13,001 X 2] |
| PERMITTED USE | INSTITUTIONAL | EXISTING DENSITY | 3.07 [39,866 + 13,001] |
| DISTRICT | MIXED USE (U) | PROPOSED DENSITY | 3.07 [39,884 + 13,141] |
| PERMITTED HEIGHT | 23.0m | INCREASE IN PROPOSED NRGA OVER JUNE 3, 1997 NRGA (EXISTING CONDITION. INCLUDES 40 ST. GEORGE ST. & 214 COLLEGE ST., 214 COLLEGE STREET ADDITION IS EXCLUDED) | 303.4% [39,866 + 13,141] |
| EXISTING HEIGHT (214 COLLEGE ST.) | 3 STOREYS/ 17.40m | INCREASE IN PROPOSED NRGA OVER JUNE 3, 1997 NRGA (PROPOSED CONDITION. INCLUDES 40 ST. GEORGE ST. & 214 COLLEGE ST. & PROPOSED ADDITION AT 214 COLLEGE STREET. | 303.4% [39,884 + 13,141] |
| PROPOSED HEIGHT (214 COLLEGE ST.) | 3 STOREYS/ 17.40m | | |
| SITE BOUNDARY AREA | 13,001 m² | | |
| LOT FRONTAGE | 71.40m | DELTA OF PROPOSED CONDITION OVER EXISTING CONDITION | 0% [303.4% - 303.4%] |

| FLOOR LEVEL (KOFFLER CENTRE) | EXISTING NRGFA (BEFORE EXCLUSIONS) m ² | EXISTING NRGFA EXCLUSIONS m ² | EXISTING TOTAL NRGFA WITH EXCLUSIONS m ² | PROPOSED NEW NRGFA (ADDITIONS) m ² | PROPOSED NEW NRGFA EXCLUSIONS m ² | PROPOSED NEW NRGFA WITH EXCLUSIONS m ² | TOTAL PROPOSED NRGFA WITH EXCLUSIONS m ² |
|------------------------------|---|---|---|---|--|---|--|
| BASEMENT | 82 | -82 | 0 | 0 | 0 | 0 | 0 |
| GROUND FLOOR | 4272 | -14 | 4258 | 0 | -4 | -4 | 4254 |
| LOWER MEZZANINE | 515 | 0 | 515 | 0 | 0 | 0 | 515 |
| UPPER MEZZANINE | 134 | -134 | 0 | 0 | 0 | 0 | 0 |
| SECOND FLOOR | 3350 | -93 | 3257 | 9 | -4 | 5 | 3262 |
| THIRD FLOOR | 2387 | -51 | 2336 | 9 | -4 | 5 | 2341 |
| KOFFLER CENTRE TOTAL | 10740 | -374 | 10366 | 18 | -12 | 6 | 10372 |

| KÖFFLER CENTRE EXTENT OF WORK BREAKDOWN (m ²) - RENOVATED AND NEW | | |
|---|--------------------|----------------|
| FLOOR LEVEL (KÖFFLER CENTRE) | RENOVATED AREA | NEW FLOOR AREA |
| BASEMENT (NO CHANGES) | 0 | 0 |
| GROUND FLOOR / LEVEL 1 | 568 | 0 |
| LOWER MEZZANINE LEVEL (NO CHANGES) | 0 | 0 |
| UPPER MEZZANINE LEVEL (NO CHANGES) | 0 | 0 |
| LEVEL 2 | 1157 | 9 |
| LEVEL 3 | 1413 / 510 (SHELL) | 9 |
| PROJECT TOTAL | 3138 / 510 (SHELL) | 18 |

| KÖFFLER CENTRE EXTENT OF WORK BREAKDOWN (m ²) - EXTERIOR ACCESSIBILITY UPGRADES | | |
|---|----------------|----------------|
| FLOOR LEVEL (KÖFFLER CENTRE) | RENOVATED AREA | NEW FLOOR AREA |
| GROUND FLOOR / ST. GEORGE ENTRANCE | 214 | 0 |

| PROJECT AREA OF WORK |
|----------------------|
| |



KEY PLAN

SEAL:

OWNER:



PROJECT :
UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION

SHEET CONTENTS :

OBC MATRIX + PROJECT STATISTICS +
AREA OF WORK

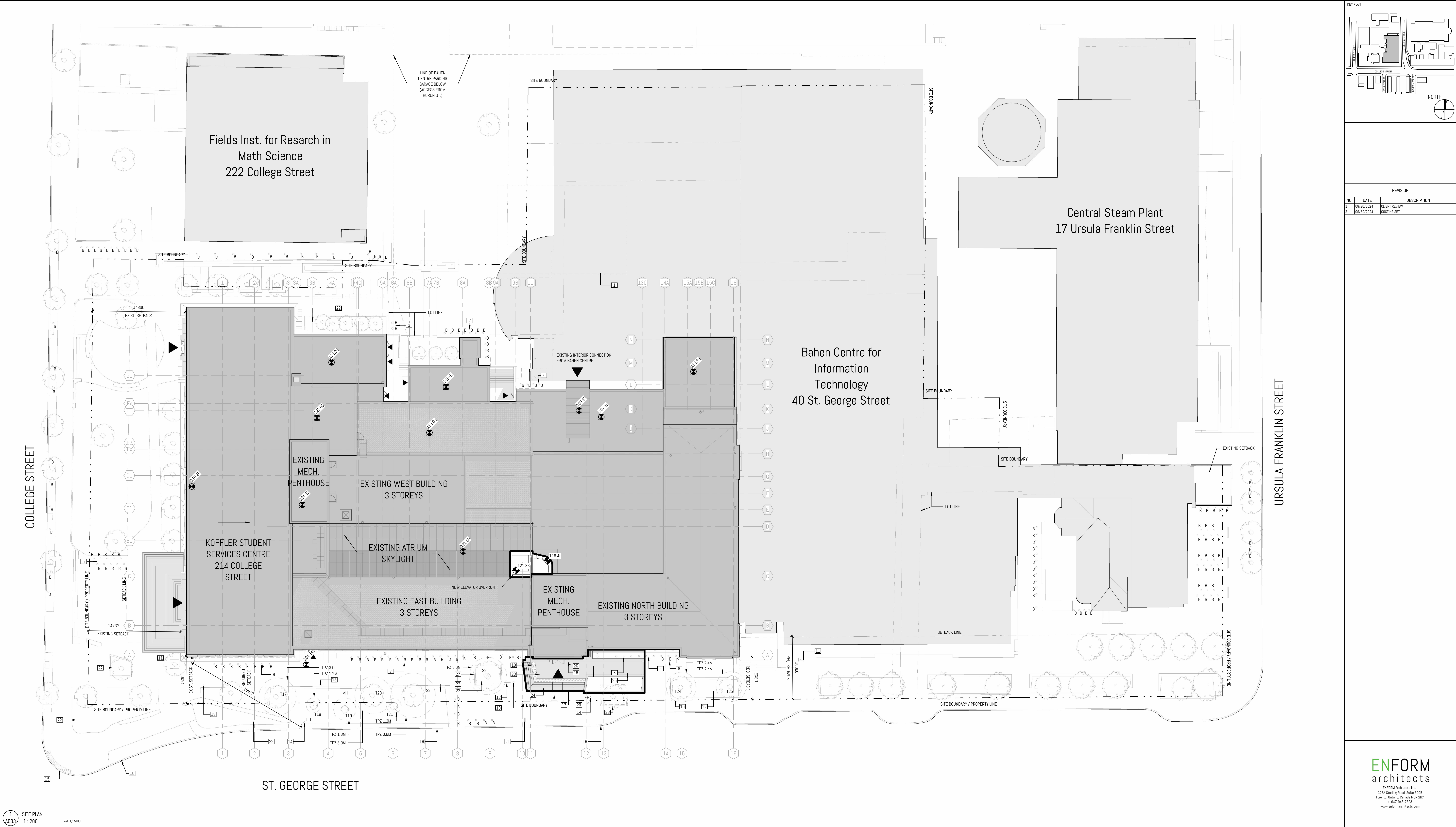
PROJECT NUMBER :
23-011 (P143-19-100)

AS NOTED

| | | |
|------------|--------------|-------|
| DRAWN BY : | CHECKED BY : | DATE: |
|------------|--------------|-------|

| | | |
|--------------------|----|------------|
| NE | AF | 2024-10-04 |
| SHEET NO : 1001 | | REV : 0 |

| | |
|------|---|
| A001 | 2 |
|------|---|



KEY PLAN

REVISION

| NO. | DATE | CLIENT REVIEW | DESCRIPTION |
|-----|------------|---------------|---------------|
| 1 | 08/20/2024 | CLIENT REVIEW | CLIENT REVIEW |
| 2 | 09/20/2024 | CLIENT REVIEW | CLIENT REVIEW |

Central Steam Plant
17 Ursula Franklin Street

Bahen Centre for Information Technology
40 St. George Street

Fields Inst. for Resarch in Math Science
222 College Street

COLEGE STREET

URSULA FRANKLIN STREET

ST. GEORGE STREET

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UNIVERSITY OF TORONTO

UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION

214 College Street, Toronto,
ON M5T 3A2

SHEET NO. A003

2

ARCHITECTURAL SYMBOLS

COLUMB GRID LINE (NEW)

COLUMB GRID LINE (EXISTING)

CENTERLINE

DIMENSION LINE TO FACE OF STUD, FACE OF CONCRETE, COLUMB LINE, OR AS NOTED.

DOOR NUMBER SYMBOL AND MINIMUM CLEARANCES

WALL TYPE TAG

FRAME TYPE - INTERIOR, EXTERIOR & LOUVER

CURTAIN PANEL TYPE

INTERIOR FINISHES TAG

ROOF TYPE TAG

KEYNOTE

NOTE REFERENCE TAG

NORTH ARROW

LEVEL DATUM
LEVEL NAME
LEVEL ELEVATION

DETAIL - SECTION
POSITION ON SHEET
SHEET NUMBER

DETAIL - PLAN/RCP
POSITION ON SHEET
SHEET NUMBER

BUILDING SECTION
POSITION ON SHEET
SHEET NUMBER

WALL SECTION
POSITION ON SHEET
SHEET NUMBER

EXTERIOR ELEVATION
POSITION ON SHEET
SHEET NUMBER

INTERIOR ELEVATION
POSITION ON SHEET
SHEET NUMBER

VIEW TITLE
DRAWING NUMBER
DRAWING SCALE

VIEW TITLE WITH REFERENCE
DRAWING NUMBER
REFERENCE SHEET NUMBER
DRAWING SCALE
SHEET NUMBER

PROPOSED GEODETIC ELEVATION (METERS)

EXISTING GEODETIC ELEVATION (METERS)

SPOT ELEVATION (RELATIVE)

GAS LINE

CEILING TAG
CEILING MATERIAL
HEIGHT ABOVE FINISHED FLOOR

THE FOLLOWING ITEMS ARE CONSIDERED MISCELLANEOUS STEEL OF FERROUS METALS ONLY, FABRICATED FROM 2MM (14 GA.) AND MORE OF METAL, INCLUDING GALVANIZING, CADMIUM AND CHROME PLATING, BUT NOT STAINLESS STEEL AND CAST IRON ITEMS.

- ACCESS DOORS AND FRAMES - EXCEPT TRADE-NAME ITEMS AND THOSE REQUIRED FOR SERVICING MECHANICAL AND ELECTRICAL EQUIPMENT.
- ANGLES AND CHANNEL FRAMES FOR DOORS AND WALL OPENINGS - DRILLING AND TAPPING TO BE SPECIFIED AS BEING DONE BY OTHERS.
- BENCHES AND BRACKETS.
- BOLLARDS, BUMPER POSTS AND RAILS.
- BOLTS - ONLY INCLUDES THOSE BOLTS AND ANCHORS REQUIRED FOR ANCHORING MISCELLANEOUS STEEL SUPPLIED UNDER THIS LIST.
- SECURITY BARS.
- CORNER PROTECTION ANGLES.
- EXPANSION JOINT ANGLES, PLATES CUSTOM-FABRICATED, ETC., INCLUDING TYPES MADE FROM STEEL, OR A COMBINATION OF STEEL AND NON-FERROUS METAL.
- FABRICATED ITEMS WHERE CLEARLY DETAILED OR SPECIFIED AND MADE FROM 2.0MM (14 GA.) AND HEAVIER STEEL, EXCEPT WHERE INCLUDED IN ANOTHER DIVISION.
- FABRICATED STEEL FRAMING FOR CURTAIN WALLS AND STOREFRONTS WHERE NOT DETAILED ON STRUCTURAL DRAWINGS AND NOT ENCLOSED BY ARCHITECTURAL METAL.
- FABRICATED WIRE MESH AND EXPANDED METAL PARTITIONS AND SCREENS.
- (CUSTOM-FABRICATED) FOOTSCRAPERS, MUD AND FOOT GRILLES, INCLUDING PANS, BUT LESS DRAINS.
- FRAMES, GRATING AND PLATE COVERS FOR MANHOLES, CATCH BASINS, SUMPS, TRENCHES, HATCHES, PITS, ETC., EXCEPT WHERE CAST IRON, FRAMES AND COVERS AND TRADE-NAME FLOOR AND ROOF DRAINS.
- GATES, GRILLES, DRILLWORK AND LOUVRES, EXCLUDING BAKED ENAMEL OR WHEN FORMING PART OF MECHANICAL SYSTEM.
- GRATING-TYPE FLOORS AND CATWALKS - EXCLUDING THOSE FORMING PART OF MECHANICAL SYSTEM.
- HANDRAILS, BALUSTERS AND ANY METAL BRACKETS ATTACHED TO STEEL RAIL, INCLUDING PLASTIC COVER, EXCLUDING STEEL HANDRAILS FORMING PART OF STRUCTURAL STEEL FRAMING.
- INTELS, UNLESS SHOWN ON STRUCTURAL DRAWINGS.
- MAT RECESS FRAMES, CUSTOM-FABRICATED TYPES ONLY.
- MOBILE CHALK AND TACKBOARD FRAMES, CUSTOM-FABRICATED TYPES ONLY.
- MONORAIL BEAMS OF STANDARD SHAPES, EXCLUDING TRADE-NAME ITEMS, UNLESS SHOWN ON STRUCTURAL DRAWINGS.
- SHOP DRAWINGS AND/OR ERECTION DIAGRAMS.
- SHOP PREPARATION AND/OR PRIMING.
- SLEEVES IF SPECIFIED, EXCEPT FOR MECHANICAL AND ELECTRICAL DIVISION.
- STAR NOSINGS, CUSTOM-FABRICATED TYPES ONLY.
- STEEL LADDERS AND LADDER RUNGS NOT FORMING PART OF STRUCTURAL STEEL OR MECHANICAL WORK.
- STEEL STAIRS AND LANDINGS NOT FORMING PART OF STRUCTURAL STEEL.
- TABLE AND COUNTER LEGS, FRAMES AND BRACKETS, CUSTOM-FABRICATED TYPES ONLY.
- THRESHOLDS AND SILLS, CUSTOM-FABRICATED TYPES ONLY.
- VANITY AND VALANCE BRACKETS, CUSTOM-FABRICATED TYPES ONLY.
- WEATHERBARS - STEEL.

- MISCELLANEOUS STEEL ITEMS EXCLUDED
- BASES AND SUPPORTS FOR MECHANICAL AND ELECTRICAL EQUIPMENT WHERE DETAILED ON MECHANICAL OR ELECTRICAL DRAWINGS.
 - BOLTS OTHER THAN FOR ANCHORING ITEMS OF MISCELLANEOUS STEEL.
 - CAST IRON FRAMES AND COVERS FOR MANHOLES AND CATCH BASINS.
 - CHAIN LINK AND WOVEN WIRE MESH.
 - METAL CLADDING AND COVERING, LESS THAN 2MM (14 GA.).
 - PRECAST CONCRETE CONNECTIONS AND ANCHORAGES IN BUILDING STRUCTURE.
 - REINFORCING STEEL OR MESH.
 - ROOF AND FLOOR HATCHES WHEN TRADE-NAME ITEMS.
 - SHEET METAL ITEMS, STEEL DECKING AND SIDING AND THEIR ATTACHMENTS, CLOSURES, ETC., LESS THAN 2.0MM (14 GA.).
 - STEEL REINFORCEMENT FOR ARCHITECTURAL METAL STOREFRONTS, CURTAINWALLS AND WINDOWS.
 - STEEL STACKS.
 - STONE ANCHORS.
 - STUD SHEAR CONNECTORS WHEN USED WITH STEEL DECK.
 - TEMPORARY BRACING FOR OTHER TRADES.
 - THIMBLES AND BREECHING, ALSO MECHANICAL FIRE DAMPERS.
 - WINDOW AND AREA WELLS.

WHEN MISCELLANEOUS STEEL FABRICATOR ERCTS MISCELLANEOUS STEEL, ALL MATERIAL REQUIRED FOR TEMPORARY AND/OR PERMANENT CONNECTIONS OF THE COMPONENT PARTS OF THE MISCELLANEOUS STEEL SHALL BE SUPPLIED.



GENERAL NOTES PERTAINING TO ALL DRAWINGS:

- DO NOT SCALE THE DRAWINGS. VERIFY ALL CONDITIONS AND ALL DIMENSIONS IN THE FIELD AND NOTIFY ARCHITECT IMMEDIATELY OF ANY DISCREPANCY BETWEEN DRAWINGS AND EXISTING CONDITIONS.
- AREA OF WORK DENOTED ON THE DRAWING IS PROVIDED FOR GENERAL GUIDANCE PURPOSES ONLY. WORK MAY BE REQUIRED OUTSIDE OF THE AREA DENOTED TO CONNECT WITH EXISTING SYSTEMS, SERVICES ETC. CONTRACTOR TO COMPLETE DEMOLITION IN ACCORDANCE WITH CURRENT REGULATIONS, CODES, LAWS AND AUTHORITIES HAVING JURISDICTION.
- PRIOR TO TENDER CALL, CONTRACTOR TO VISIT THE SITE AND ASCERTAIN TO THEIR OWN SATISFACTION ALL EXISTING CONDITIONS PERTAINING TO THIS CONTRACT.
- CONTRACTOR TO MAINTAIN EXISTING ACCESS TO EXITS WIDTH TO MEET MINIMUM CODE REQUIREMENTS.
- CONTRACTOR IS RESPONSIBLE FOR DEMOLITION TO COMPLETE THE PROJECT AND FOR COORDINATING AND SCHEDULING DEMOLITION WITH DESIGNATED SUBSTANCES REMOVALS TO SUIT THE PROJECT SCHEDULE. REFER TO DESIGNATED SUBSTANCES REPORTS.
- CONTRACTOR TO PREVENT MOVEMENT OR SETTLEMENT OF EXISTING/ADJACENT STRUCTURAL ELEMENTS. CONTRACTOR TO PROVIDE BRACING/SHORING AS REQUIRED TO MAINTAIN THE STRUCTURAL INTEGRITY OF ALL BUILDING ELEMENTS.
- CONTRACTOR TO COORDINATE DEMOLITION WORK WITH ALL DISCIPLINES. CONTRACTOR TO CONSULT WITH ARCHITECT, PRIOR TO DEMOLITION, IF SCOPE OF WORK IS UNCLEAR OR IN DOUBT. REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR FURTHER INFORMATION.
- GENERAL TRADES CONTRACTOR SHALL CHASE, BORE, DRILL OR SAW CUT WALLS AND FLOORS FOR OPENINGS, TRENCHING AND MAKING GOOD AS REQUIRED BY MECHANICAL AND ELECTRICAL TRADES. ALSO REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR RELATED GENERAL TRADES WORK.
- CONTRACTOR TO ASCERTAIN THE LOCATION OF ANY SERVICES BURIED IN FLOOR SLABS PRIOR TO CUTTING AND OBTAIN CONSULTANT'S APPROVAL BEFORE WORK COMMENCES.
- CONTRACTOR TO MAKE ALL NECESSARY INQUIRIES TO DETERMINE LOCATION OF ANY EXISTING SERVICES INCLUDING BUT NOT LIMITED TO HYDRO, TELEPHONE, WATER, GAS, SEWER AND CABLE.
- CONTRACTOR TO OPEN UP EXISTING WALLS OR CEILINGS AS REQUIRED TO COMPLETE MECHANICAL AND ELECTRICAL WORKS. CONTRACTOR TO MAKE GOOD EXISTING FINISHES ON COMPLETION OF THE WORK UNLESS NOTED OTHERWISE ON THE DRAWINGS. FOR DIMENSIONS OF OPENINGS FOR NEW MECHANICAL AND ELECTRICAL WORKS, REFER TO MECHANICAL AND ELECTRICAL DRAWINGS.
- CONTRACTOR TO REMOVE ALL AFFECTED ITEMS OF FURNITURE, MILLWORK & EXISTING WALL MOUNTED ITEMS AS NOTED ON THE DRAWINGS. CONTRACTOR SHALL ASK APPROVAL FROM U. OF T. REPRESENTATIVE BEFORE DISPOSING OF REMOVED ITEMS. MATERIAL & ITEMS THAT WILL NOT BE DISPOSSED OF SHALL BE TAKEN BY CONTRACTOR TO THE STORAGE AREA DESIGNATED BY THE U. OF T. REPRESENTATIVE.
- CONTRACTOR IS RESPONSIBLE FOR DISPOSAL OF DEMOLISHED MATERIAL, EXCEPT WHERE NOTED OTHERWISE. CONTRACTOR TO PROVIDE NEW OPENINGS IN WALLS AS NOTED. REFER TO DOOR SCHEDULE.
- CONTRACTOR TO PROTECT EXISTING FINISHES, LANDINGS, STAIRS, HANDRAILS & GUARDRAILS TO REMAIN AND ADJACENT AREAS DURING CONSTRUCTION.
- CONTRACTOR TO INFILL ANY OPENINGS REMAINING AFTER MECHANICAL, ELECTRICAL OR OTHER ELEMENTS ARE DEMOLISHED. MATERIALS AND FINISH OF INFILL TO MATCH EXISTING. INFILL TO PROVIDE FIRE RESISTANCE RATING TO MATCH THE EXISTING SEPARATION.
- LOCATION OF MECHANICAL AND ELECTRICAL ROUTING IS APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAKE SURE THE ABOVE MENTIONED DOES NOT INTERFERE WITH EXISTING CONDITIONS BEFORE CONSTRUCTION COMMENCES. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR EXACT LOCATION OF FIXTURES, GRILLES, ACCESS HATCHES ETC.
- CONTRACTOR TO VERIFY ON SITE THAT ALL MECHANICAL AND ELECTRICAL WORKS SHOWN CAN BE INSTALLED BEFORE CONSTRUCTION COMMENCES.
- WHERE STRUCTURAL/MECHANICAL WORK IMPACTS EXISTING ROOF, MAKE GOOD ROOF AS REQUIRED.
- CONTRACTOR TO PATCH, REPAIR AND MAKE GOOD ALL AREAS DISTURBED BY THE OPERATION OF THE WORK AND DISTURBED BY THE WORK OF OTHER TRADES, MATERIALS AND FINISHES TO MATCH EXISTING UNLESS NOTED OTHERWISE.
- CONTRACTOR TO PROVIDE ACCESS HATCHES AS REQUIRED TO ACCESS AND/OR SERVICE MECHANICAL/ELECTRICAL EQUIPMENT. FINAL LOCATION OF ALL ACCESS HATCHES IN DRYWALL OR PLASTER CEILINGS TO BE REVIEWED ON SITE WITH ARCHITECT PRIOR TO INSTALLATION.
- UNLESS NOTED OTHERWISE, CONTRACTOR TO PAINT NEW MECHANICAL DUCTS, PIPES, PIPE SUPPORTS, ELECTRICAL CONDUIT, MOUNTING BRACKETS, AND ACCESS DOORS WHERE EXPOSED TO VIEW.
- UNLESS NOTED OTHERWISE, CONTRACTOR TO PAINT NEW STRUCTURAL STEEL NOT RECEIVING SPRAY-APPLIED FIRE PROOFING, METAL STAIRS, LADDERS, GUARDS, AND HANDRAILS, WALLS AND DRYWALL/PLASTER CEILINGS WITHIN CONSTRUCTION AREA, ALL NEW DRYWALL, (UNLESS OTHERWISE NOTED), WALLS AND DRYWALL/PLASTER CEILINGS IN AREAS AFFECTED BY CONSTRUCTION. REFER TO ROOM FINISH SCHEDULE.
- CONTRACTOR TO PROVIDE FIRE RATED PLYWOOD SUPPORTS FOR WALL MOUNTED MECHANICAL AND ELECTRICAL WORKS. COORDINATE WITH MECHANICAL AND ELECTRICAL DRAWINGS AND SPECIFICATIONS.
- CONTRACTOR TO PROVIDE ADEQUATE BLOCKING AND NECESSARY SUPPORT INSIDE WALLS AND CEILING BULKHEADS FOR ALL WALL-MOUNTED MILLWORK ITEMS, DOORS, EQUIPMENT AND ACCESSORIES ETC.
- ALL MATERIALS SPECIFIED ARE TO BE INSTALLED, FINISHED AND SEALED IN ACCORDANCE WITH THE MANUFACTURER'S APPROVED RECOMMENDATIONS AND SPECIFICATIONS.
- CONTRACTOR IS RESPONSIBLE FOR THE SUPPLY AND INSTALLATION OF ANY MATERIALS NOT SPECIFICALLY DRAWN OR DESCRIBED BUT REASONABLY IMPLIED AND NECESSARY FOR COMPLETION OF THE WORK WITHOUT ADDITIONAL COSTS UNDER THIS CONTRACT.
- CONTRACTOR TO REPLACE ALL DAMAGED ACOUSTICAL CEILING SYSTEMS DISTURBED BY THE WORK OF THIS CONTRACT. REPAIR AND ADJUST ACOUSTICAL CEILING SYSTEM AS REQUIRED TO ACCOMMODATE CHANGES INCLUDING BUT NOT LIMITED TO WALL LOCATION (EXISTING AND NEW), MECHANICAL AND ELECTRICAL ITEMS AND WORK STATION POWER POLES. REFER TO MECHANICAL AND ELECTRICAL DRAWINGS.
- DUST PROOF TEMPORARY HOARDINGS MUST BE IN PLACE PRIOR TO ANY REMOVALS WORK. TEMPORARY HOARDING TO BE FACED ON PUBLIC SIDE BY IMPACT RESISTANT DRYWALL, TAPED, FILLED, PAINTED TO COMPLETELY SEPARATE THE WORK AREA FROM THE PUBLIC AREA. UPON COMPLETION OF THE WORK, REMOVE HOARDING, PATCH AND MAKE GOOD ALL DISTURBED AREAS TO MATCH EXISTING. HOARDING MUST MAINTAIN ACCESS TO EXISTS AND MUST NOT REDUCE THE CORRIDOR WIDTH TO LESS THAN THAT PERMITTED BY THE OBC.
- IN PARTITIONS REQUIRING SOUND INSULATION, SOUND ABSORPTIVE MATERIAL MUST FILL AT LEAST 90% OF THE CAVITY DEPTH. THE CAVITY SHOULD NOT BE OVER-FILLED TO THE POINT OF PRODUCING OUTWARD PRESSURE ON THE FINISHES. BATTS MUST BE WIDE ENOUGH TO FILL THE CAVITY FROM THE WEB OF STUD TO THE WEB OF THE NEXT.
- IN PARTITIONS REQUIRING SOUND INSULATION, ACOUSTICAL SEALANT SHOULD BE APPLIED AROUND ELECTRICAL BOXES AND OTHER OPENINGS. AS WELL AS AT THE JUNCTION OF INTERSECTING WALLS AND FLOORS. ALL CRACKS/PENETRATIONS/HOLES/ETC. ARE TO BE FILLED WITH ACOUSTIC MATERIAL AND SEALED WITH ACOUSTIC CAULK. ALL WALL/FLOOR JOINTS ARE TO BE SEALED WITH ACOUSTIC CAULK.
- ALL DIMENSIONS SHOWN ARE TAKEN TO FINISHED FACE OF WALL UNLESS OTHERWISE NOTED.
- ENSURE CONTINUITY OF AIR, MOISTURE AND VAPOUR TRANSITIONS TO ADJACENT ENVELOPE COMPONENTS (TYP)

ABBREVIATIONS

| # | NUMBER (BEFORE NUMERALS) |
|------------|---|
| (F/C) | FOOT |
| (M/C) | INCH |
| < | ANGLE |
| A | AMPERE |
| A/C | AIR CONDITIONING |
| AB | AIR BARRIER |
| AC | ALTERNATING CURRENT |
| AC/NC | ARCHITECTURAL CONCRETE |
| ACP | ACOUSTIC PANEL |
| ACT | ACOUSTIC CEILING TILE |
| ADCS | ADULT CHANGING STATION |
| ADJ | ADJUSTABLE |
| AF | ABOVE FINISHED FLOOR |
| AL or ALUM | ALUMINUM |
| ANOD | ANODIZED |
| APPROX | APPROXIMATE |
| ARCH | ARCHITECTURAL |
| AB | AIR VAPOUR BARRIER |
| B.M | BENCH MARK |
| BCS | BABY CHANGING STATION |
| BH | BORE HOLE |
| BLDG | BUILDING |
| BLKG | BLOCKING |
| BN | BULL NOSE |
| BOL | BOLLARD |
| C.C | CLEAR COAT |
| C/W | COMPLETE WITH |
| CB | CATCH BASIN |
| CBK | CONCRETE BLOCK |
| cfs | CUBIC FEET PER SECOND |
| CS | CORNER GUARD |
| CLG | CLEAR GLASS |
| CH | COAT HOOK |
| CH | CLOTHING HOOK |
| CHK PL | CHECKED PLATE |
| CHS | CLOTHING HOOK (SAFETY) |
| CJ | CONTROL JOINT |
| CL | CENTER LINE |
| CMB | CEMENT BOARD |
| CD | CLEAN-UP |
| COL | COLUMN |
| CONC | CONCRETE |
| CONSTR | CONSTRUCTION |
| CONT | CONTINUOUS |
| CPT | CARPET |
| CR | CHAIR RAIL |
| CT | CERAMIC TILE |
| cu ft | CUBIC FEET |
| cu yd | CUBIC YARD |
| CWP | CRYSTALLINE WATERPROOFING |
| DB | DECEBEL |
| DCS | DIAPER CHANGING STATION |
| deg C | DEGREE CELSIUS |
| deg F | DEGREE FAHRENHEIT |
| DET | DETAIL |
| DFT | DRY FILM THICKNESS |
| dia | DIAMETER |
| DN | DOWN |
| DWG | DRAWING |
| EF | EPOXY FLOORING |
| EIFS | EXTERIOR INSULATION FINISHING SYSTEM |
| EJ | EXPANSION JOINT |
| EL | ELEVATION |
| ELEC | ELECTRIC |
| EMT | ELECTRO METALLIC TUBING |
| ENCL | ENCLOSURE |
| EQUIP | EQUIPMENT |
| EXIST | EXISTING |
| EXP | EXPOSED |
| EXT | EXTERIOR |
| FA | FIRE ALARM |
| FBB | FIBREBOARD |
| FBR | FACE BRICK |
| FD | FLOOR DRAIN |
| FHC | FIRE HOSE CABINET |
| FIN | FINISHED |
| FL | FLOOR |
| FDB | FREE ON BOARD |
| fpm | FEET PER MINUTE |
| FTG | FOOTING |
| PWC | FABRIC WALL COVERING |
| PWP | FIBREGLASS WALL PANEL |
| g | GRAM |
| ga | GAUGE |
| gal | GALLON (IMPERIAL MEASURE) |
| sq ft | SQUARE FEET |
| sq yd | SQUARE YARD |
| SS | STAINLESS STEEL |
| SSM | SOLID SURFACE MATERIAL/SOLID POLYMER MATERIAL |
| ST | STONE OR STONE TILE |
| STL | STEEL |
| STRUCT | STRUCTURAL |
| SUSP | SUSPENDED |
| 1 | TONNE |
| T&G | TONGUE & GROOVE |
| TB | TACK BOARD |
| TBR | TO BE REMOVED |
| TC | TRAFFIC COATING |
| TDD | TOWEL DISPENSER/DISPOSAL |
| TDL | TOWEL DISPOSAL |
| TFL | TELEPHONE |
| TEMP | TEMPORARY |
| TENANT | FINISHED BY TENANT |
| TERR | TERRAZZO |
| TGL | TEMPERED GLASS |
| TTD | TOILET TISSUE DISPENSER |
| TTD-S | TOILET TISSUE DISPENSER (SAFETY) |
| TWB | TOWEL BAR |
| TYP | TYPICAL |
| U/C | UNDER CUT |
| U/G | UNDERGROUND |
| U/S | UNDERSIDE |
| UNO | UNLESS NOTED OTHERWISE |
| UPHOLSTERY | UPHOLSTERY |
| UPL | GALLONS PER MINUTE (United States Measure) |
| USdim | US DIMENSION |
| V | VOLT |
| VB | VAPOUR BARRIER |
| VCT | VINYL COMPOSITE TILE |
| VERT | VERTICAL |
| VEST | VESTIBULE |
| VT | VINYL TILE |
| v-ft | VERTICAL FOOT |
| VWC | VINYL WALL COVERING |
| VWP | VINYL WALL PROTECTION |
| W | WATT |
| WB | WHITE BOARD |
| WC | WATER CLOSET |
| WD | WOOD |
| WF | WIDE FLANGE |
| WGL | WIRED GLASS |
| WM | WIRE MESH |
| WPM | WATERPROOF MEMBRANE |
| WPS | WALL PROTECTION STRIP |
| WVP | WOOD VENEER PANELING |
| WWF | WELDED WIDE FLANGE |
| WWM | WELDED WIRE MESH |
| YARD | YARD |
| Z | ZINC |
| ° | DEGREE (ANGLES) |
| µm | MICROMETRE |

ABBREVIATIONS

| # | NUMBER (BEFORE NUMERALS) |
|------------|---|
| MCC | MOTOR CONTROL CENTRE |
| MECH | MECHANICAL |
| MEZZ | MEZZANINE |
| min | MINIMUM |
| MIR | MIRROR |
| MIR/S | MIRROR (SAFETY) |
| MIR/S | MIRROR WITH SHELF |
| misc | MISCELLANEOUS |
| mm | MILLIMETRE |
| MPS | MEGAPASCAL |
| MPH | MOP HOLDERS |
| MRSB | MOISTURE RESISTANT GYPSUM BOARD |
| MRSB | MOISTURE RESISTANT SHEATHING BOARD |
| MW | MECHANICAL ROOM WATERPROOFING |
| MTL | METAL |
| N | NEWTON |
| N/A | NOT APPLICABLE |
| ND | NAPKIN AND TAMPON DISPOSAL |
| NC | NOT IN CONTRACT |
| NO | NUMBER |
| NOM | NOMINAL |
| NTS | NOT TO SCALE |
| NW | NAPKIN AND TAMPON VENDING UNIT |
| O.A | OVERALL |
| OC | ON CENTRE |
| OD | OUTSIDE DIAMETER |
| OVERHEAD | OVERHEAD |
| OWS | OPEN WEB STEEL JOIST |
| oz | OUNCE |
| PA | PUBLIC ADDRESS SYSTEM |
| Pn | PASCAL |
| PC | PRECAST CONCRETE |
| PC | PORCELAIN TILE |
| PERP | PERPENDICULAR |
| PL | PLATE |
| PLM | PLASTIC LAMINATE |
| PLS | PLASTER |
| PLC | POLISHED CONCRETE |
| PLYWD | PLYWOOD |
| PM | PRESSED METAL |
| PREFAB | PREFABRICATED |
| PREFIN | PREFINISHED |
| PS | PRESSED STEEL |
| psi | POLYMS PER SQUARE INCH |
| PI | PIANT |
| PTD | PAPER TOWEL DISPENSER |
| PVC | POLYVINYL CHLORIDE |
| Q | QUARTY TILE |
| R | RESER |
| RB | RESILIENT BASE |
| RD | ROOF DRAIN |
| REINF | REINFORCED |
| RETO | REQUIRED |
| REV | REVISION |
| RFL | RESINOUS FLOORING |
| RH | RIGHT HAND |
| RHR | RIGHT HAND REVERSE |
| RM | ROOM |
| rpm | REVOLUTIONS PER MINUTE |
| RS | REDUCING STRIP |
| RWL | RAIN WATER LEADER |
| RWP | ROOF WALL PROTECTION |
| S | SALT LOCK |
| s | SECOND |
| SAN | SANITARY |
| SC | SOLID CORE |
| SCWV | SOLID CORE WOOD VENEER |
| SD | SOAP DISPENSER |
| SG | SECURITY GLAZING |
| SH ROD | SHOWER ROD |
| SH ROD/C | SHOWER ROD WITH CURTAIN |
| SHST | SHOWER SEAT |
| SHV | SHEET VINYL |
| SM | SIMILAR |
| SINK | SINK |
| SLC | SEALED CONCRETE |
| SEALR | SEALER |
| SN | STAR NOSING |
| SND | SANITARY NAPKIN DISPOSAL |
| SOAP DISH | SOAP DISH |
| SPD | SPECIFICATION |
| SPR | SPRINKLER |
| SQ | SQUARE |
| sq ft | SQUARE FEET |
| sq yd | SQUARE YARD |
| SS | STAINLESS STEEL |
| SSM | SOLID SURFACE MATERIAL/SOLID POLYMER MATERIAL |
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| U/C | UNDER CUT |
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| UPL | GALLONS PER MINUTE (United States Measure) |
| USdim | US DIMENSION |
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| VB | VAPOUR BARRIER |
| VCT | VINYL COMPOSITE TILE |
| VERT | VERTICAL |
| VEST | VESTIBULE |
| VT | VINYL TILE |
| v-ft | VERTICAL FOOT |
| VWC | VINYL WALL COVERING |
| VWP | VINYL WALL PROTECTION |
| W | WATT |
| WB | WHITE BOARD |
| WC | WATER CLOSET |
| WD | WOOD |
| WF | WIDE FLANGE |
| WGL | WIRED GLASS |
| WM | WIRE MESH |
| WPM | WATERPROOF MEMBRANE |
| WPS | WALL PROTECTION STRIP |
| WVP | WOOD VENEER PANELING |
| WWF | WELDED WIDE FLANGE |
| WWM | WELDED WIRE MESH |
| YARD | YARD |
| Z | ZINC |
| ° | DEGREE (ANGLES) |
| µm | MICROMETRE |

KEY PLAN

| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/20/2024 | CLIENT SET |

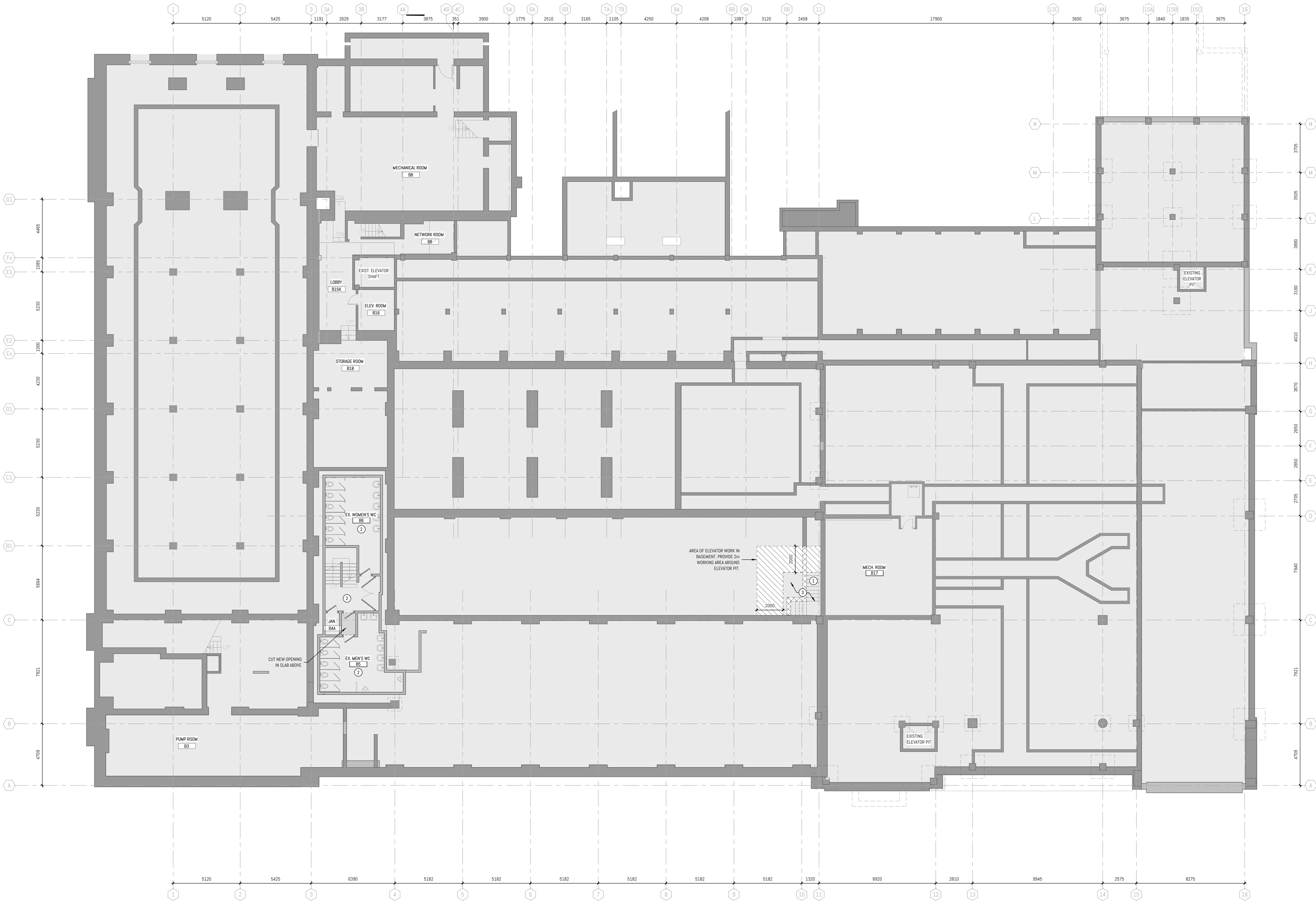


PROJECT
UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION

214 College Street, Toronto,
ON M5T 3A2.

SHEET CONTENTS
ABBREVIATIONS, SYMBOLS &
MISCELLANEOUS METALS

| | | | |
|--|------------------|--------------------|------|
| PROJECT NUMBER 23-011 (P143-19-100) | | | |
| DRAWING SCALE AS SHOWN | | | |
| DRAWN BY CC | CHECKED BY AF | DATE 2024-10-04 | REV. |
| SHEET NO A004 | | | |



2 LEVEL 00 DEMOLITION PLAN
A0200 1:100

DEMOLITION BASEMENT PLAN NOTES

| NOTE | DESCRIPTION |
|------|--|
| 1 | EXIST. ABANDONED STAIRCASE TO BE DEMOLISHED |
| 2 | ACT. TILES IN WASHROOMS AND VESTIBULE TO BE REMOVED AS REQ'D TO FACILITATE NEW CONDUIT RUNS ABOVE. |
| 3 | EXCAVATE AREA AND PREPARE TO ACCEPT NEW ELEVATOR PIT. REFER TO STRUCTURAL DRAWINGS FOR DETAILS. |

GENERAL NOTES: DEMOLITION

A. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE STRUCTURAL, MECHANICAL AND ELECTRICAL DRAWINGS.

B. ROOM NUMBERS SHOWN ARE EXISTING ROOM NUMBERS. REFER TO NEW WORK DRAWING FOR NEW ROOM NUMBERS.

C. FOR ALL DESIGNATED SUBSTANCES MATERIALS REMOVAL PROCEDURES. REFER TO GENERAL SPECIFICATION FOR DESIGNATED SUBSTANCES MATERIALS REPORT AND SCOPE OF WORK. IF NOTED IN THE SCOPE OF WORK, CONSTRUCTION MANAGER IS RESPONSIBLE FOR DEMOLITION OF DESIGNATED SUBSTANCES AND FOR MATERIALS NOTED IN THE DESIGNATED SUBSTANCES MATERIALS REPORT WHERE AFFECTED BY CONSTRUCTION INCLUDING BUT NOT LIMITED TO MECHANICAL AND ELECTRICAL WORK.

D. TEMPORARY HEADING MUST BE IN PLACE PRIOR TO ANY REMOVALS WORK. MAINTAIN ALL ACCESS TO EXIT REQUIREMENTS OF THE OBC.

E. PROTECT ALL EXISTING FINISHES, LANDINGS, STAIRS, HANDRAILS & GUARDRAILS DURING CONSTRUCTION.

F. MAKE GOOD ALL EXPOSED WALL AND CEILING SURFACES. REMOVE ALL NAILS, SCREWS, WALL PLUGS, WALL CLIPS, STAPLES FROM EXISTING WALLS. PATCH, REPAIR AND MAKE GOOD WALL SURFACES.

G. REMOVE ALL AFFECTED MILLWORK & OTHER EXISTING WALL MOUNTED ITEMS SUCH AS BULLETIN BOARDS, PEGBOARDS, CHALKBOARDS AND ACCESSORIES AS NOTED ON THE DRAWINGS. CONSTRUCTION MANAGER SHALL ASK APPROVAL FROM CONSULTANT AND U OF T REPRESENTATIVE BEFORE DISPOSING OF REMOVED ITEMS. MATERIALS & ITEMS THAT WILL NOT BE DISPOSED OF SHALL BE TAKEN BY THE CONSTRUCTION MANAGER TO A STORAGE AREA DESIGNATED BY THE U OF T REPRESENTATIVE.

H. REMOVE AND RETAIN ALL LOCKSETS / CYLINDERS AND ELECTRIC STRIKES, CLOSERS AND DOOR OPERATORS FROM DOORS TO BE SALVAGED AS NOTED ON THE DRAWINGS AND HAND OVER TO U OF T.

I. REMOVE EXISTING DOORS AND FRAMES AS NOTED ON THE DRAWINGS.

J. REMOVE ALL EXISTING FLOOR FINISH WITHIN THE CONSTRUCTION AREA BACK TO CONCRETE SUBSURFACE UNLESS NOTED OTHERWISE. REMOVE ALL ADHESIVE AND PATCH AND REPAIR SUBSURFACE TO RECEIVE NEW FLOOR FINISH TO PROVIDE SMOOTH FINISH.

K. REMOVE UNUSED EXPOSED ANCHORS. SEAL GROUT, FILL HOLES ON THE EXISTING SLAB AND WALLS AS PER SPEC.

L. REFER TO GENERAL NOTES FOR ADDITIONAL DEMOLITION INFORMATION.

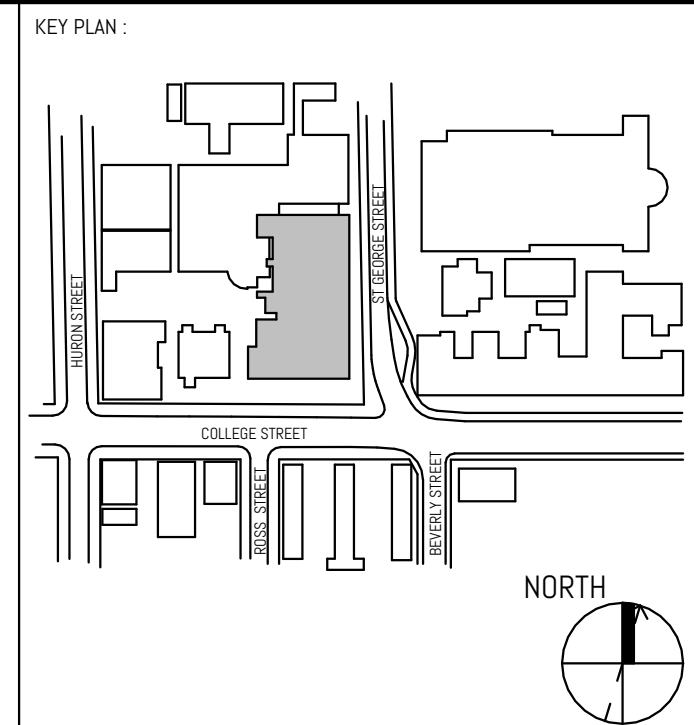
MAKE GOOD, MAKE GOOD, MAKING GOOD

MAKE GOOD, MAKE GOOD, MAKING GOOD MEANS REPAIRING, RESTORING, REFURBISHING, REHABILITATING OR PERFORMING FILLING OPERATION ON ANY EXISTING COMPONENTS DISTURBED DUE TO WORK OF THIS CONTRACT TO AT LEAST THE CONDITION EXISTING AT THE COMMENCEMENT OF THE WORK IN TERMS OF CONSTRUCTION INTEGRITY, FINISHES, ALIGNMENT WITH EXISTING ADJOINING SURFACES, COMPATIBILITY OF MATERIALS, SOUND, ATTENUATION CRITERIA, EXFILTRATION/INFILTRATION REQUIREMENTS, AIR/VAPOUR BARRIER AND THERMAL CONTINUITY.

CONSTRUCTION MANAGER TO SITE VERIFY ALL DIMENSIONS.

DEMOLITION LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE DEMOLISHED
- EXISTING ELEMENT TO BE DEMOLISHED
- INDICATIVE NEW OPENING IN EXISTING FLOOR
REFER TO STRUCTURAL DRAWINGS. CM TO SUBMIT EXCAVATION WORKS PLAN
- EXISTING FLOOR DATUM
- N.I.C. PRIMARY SCOPE OF WORK
- EXISTING DOOR AND DOOR FRAME TO BE DEMOLISHED. HARDWARE TO BE RETURNED TO THE UNIVERSITY.
- DEMOLITION NOTE REFERENCE



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/20/2024 | CLIENT REVIEW |

ENFORM
architects

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1304 Sheppard Avenue East, Suite 2010
Toronto, Ontario, Canada M4B 2B7
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SEAL



PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2.

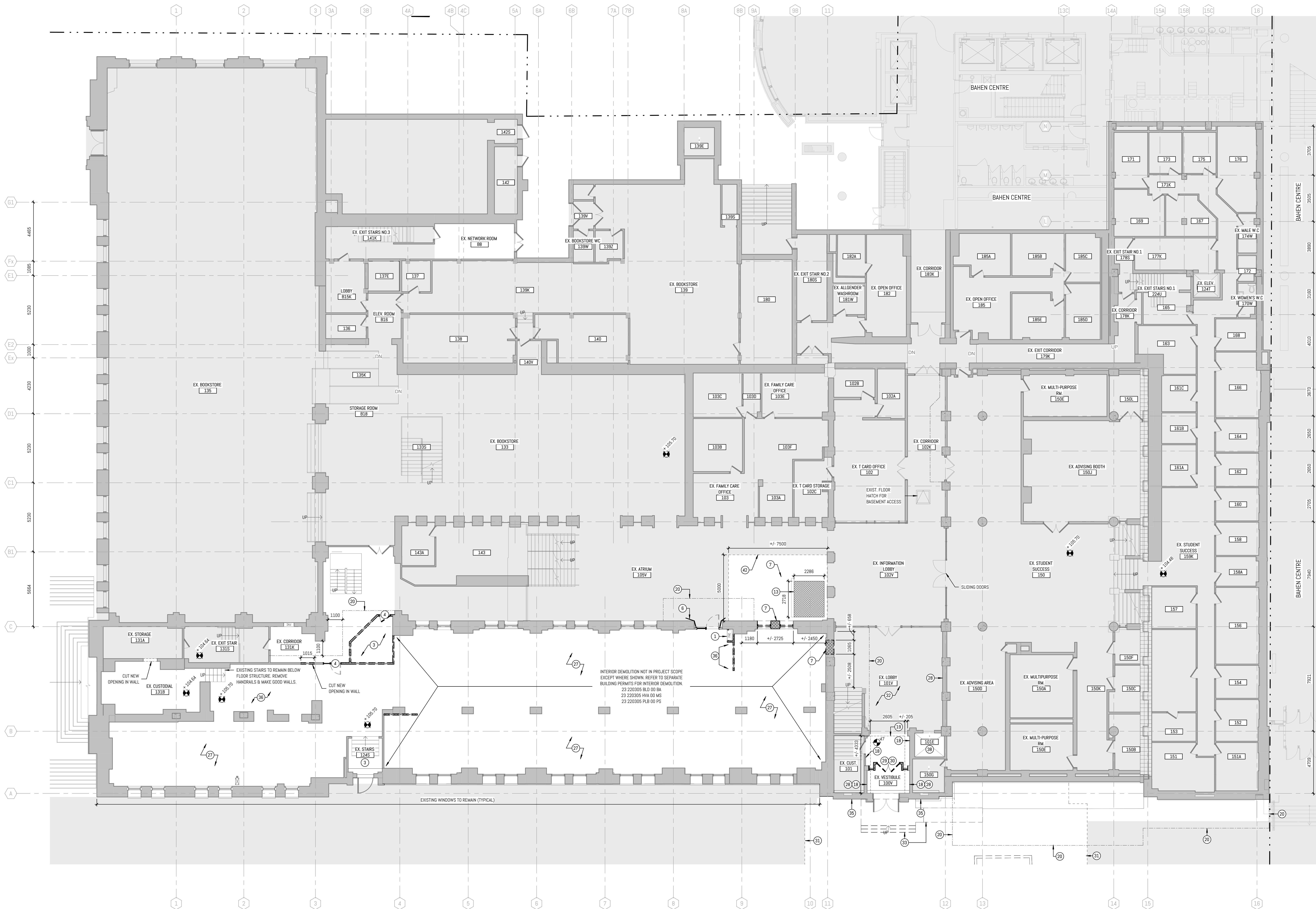
SHEET CONTENTS:
BASEMENT DEMOLITION PLAN

PROJECT NUMBER:
23-011 (P143-19-100)

DRAWING SCALE:
1:100

DRAWN BY: CC CHECKED BY: AF DATE: 2024-10-04

SHEET NO:
A0200



1 LEVEL 01 DEMOLITION PLAN
1:100 REF 3/4400

| DEMOLITION FLOOR PLAN NOTES | |
|-----------------------------|---|
| NOTE | DESCRIPTION |
| 1 | EXISTING FIRE HOSE CABINET TO BE REMOVED. REFER TO MECHANICAL. |
| 2 | REMOVE EXISTING PARTITIONS D/W B & FRAMING AS REQUIRED PATCH REPAIR AND MAKE GOOD REMAINING WALLS TO RECEIVE NEW FINISHES. |
| 3 | REMOVE EXISTING FLOORING AND BASEBOARD. MAKE GOOD EXISTING FLOOR TO ACCEPT NEW FLOORING. |
| 4 | REMOVE EXISTING DOOR AND DOOR FRAME. SALVAGE LOCKSET CYLINDERS AND CLOSER. ITEMS TO BE HANDED TO U OF T REPRESENTATIVE. |
| 5 | CONTRACTOR TO MAINTAIN EXISTING FIRE AROUND EXISTING ELEVATOR, STAIRWAY, AND MECHANICAL SHAFTS. |
| 6 | REMOVE EXISTING MILLWORK ENTRY. MAKE GOOD WALLS TO ACCEPT NEW FINISHES. |
| 7 | CUT OPENING IN EXISTING MASONRY WALL. MAKE GOOD TO ACCEPT NEW PARTITIONS. REFER TO STRUCTURAL. |
| 7.1 | CUT OPENING IN EXISTING MASONRY WALL. SALVAGE FACE BRICK FOR FUTURE INCORPORATION. |
| 8 | REMOVE EXISTING MASONRY WALL BELOW EXISTING WINDOW OPENING. MAKE GOOD TO ACCEPT NEW INTERIOR FINISH. REFER TO STRUCTURAL. |
| 9 | REMOVE BLOCKING FROM EXISTING WINDOW OPENINGS. MAKE GOOD TO ACCEPT NEW WINDOWS AND ROOM FINISHES. |
| 10 | EXISTING WINDOW IN EXISTING OPENING TO REMAIN. EXISTING BRICK OR STONE RETURN TO REMAIN. |
| 11 | REMOVE ALL EXISTING WINDOW COMPONENTS FROM EXISTING OPENINGS. |
| 12 | CUT NEW OPENING STRUCTURAL MASONRY WALL. REFER TO STRUCTURAL. |
| 13 | CUT NEW OPENING IN EXISTING FLOOR. REFER TO STRUCTURAL, MECHANICAL, AND ELECTRICAL. |
| 14 | REMOVE AND SALVAGE EXISTING LIFT. ITEMS TO BE HANDED TO U OF T REPRESENTATIVE. REFER TO ELECTRICAL AND STRUCTURAL. |
| 15 | REMOVE EXISTING STAIRS AND PLATFORM C/W HANDRAIL AND GUARDRAIL. |
| 16 | REMOVE EXISTING STAIRS AND PLATFORM C/W HANDRAIL AND GUARDRAIL. |
| 17 | REMOVE RAMP C/W HANDRAIL. |
| 18 | REMOVE & SALVAGE EXISTING TILE (BY HERITAGE CONTRACTOR). SET ASIDE TO USE IN OTHER LOCATIONS. MAKE GOOD EXISTING FLOORING TO ACCEPT NEW FLOORING & FOOT GRILLE. |
| 19 | CHIP EXISTING CONCRETE AS REQUIRED TO INSTALL NEW RECESSED FLOOR GRILLE. TO BE COORDINATED ON SITE. |
| 20 | PROPOSED LINE OF CONSTRUCTION HEADING BY CONTRACTOR. MAINTAIN MIN. 100mm CLEARANCE IN CORRIDORS. |
| 21 | REMOVE EXISTING RADIATOR COVER. EXISTING RADIATOR TO REMAIN. REFER TO MECHANICAL. |
| 22 | REMOVE EXISTING RADIATOR. MAKE GOOD EXISTING WALL PANEL. REFER TO MECHANICAL. |

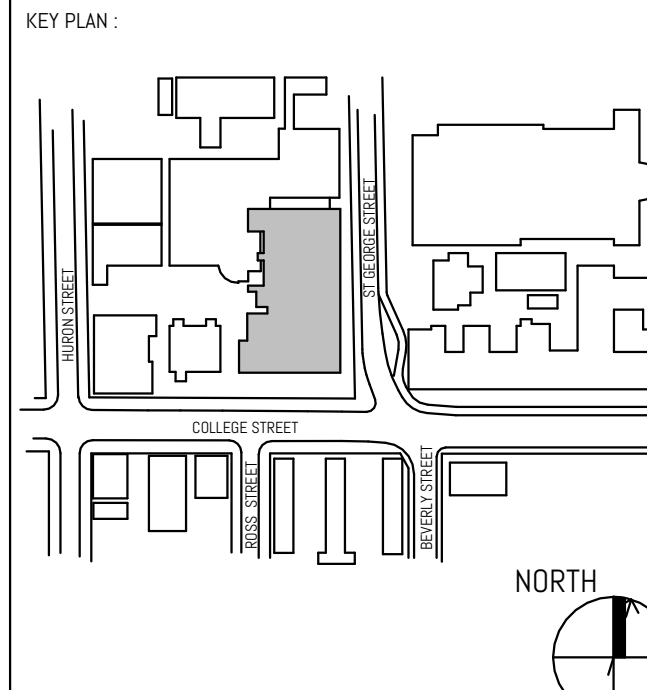
| DEMOLITION FLOOR PLAN NOTES | |
|-----------------------------|--|
| NOTE | DESCRIPTION |
| 27 | REFER TO BACK-TO-BASE DEMOLITION SCOPE OF WORK, BUILDING PERMIT 22 220305 BLD 00 BA. |
| 28 | REMOVE WALL BASE. PATCH AND MAKE GOOD WALL TO RECEIVE NEW WALL BASE, TYP. |
| 29 | REMOVE GLASS ABOVE DOORS. FILL REVEAL FOR NEW GLASS, SAND AND PAINT. |
| 30 | REMOVE DOORS AND GLASS SILL LIGHTS. |
| 31 | LINE OF PAVING DEMOLITION - REFER TO ARCH AND LANDSCAPE DRAWINGS. |
| 32 | REMOVE EXISTING CARPET AND MAKE GOOD TO RECEIVE NEW FLOOR FINISH. |
| 33 | DEMOLISH EXISTING STAIRS AND RAMP. |
| 34 | REFER TO HERITAGE DRAWINGS 14-03 FOR MASONRY REPAIR WORKS. |
| 35 | FILL ABANDONED PENETRATIONS IN FLOOR SLAB WITH MIN. 150mm CONCRETE. |
| 36 | DECOMMISSION EXISTING ELEVATOR AND DISMANTLE ALL COMPONENTS. REFER TO MECHANICAL AND ELECTRICAL. |
| 37 | DEMOLISH EXISTING ORNAMENTAL ARCH AND EXPOSE ENCASED STRUCTURE. |
| 40 | SELECTIVE DEMOLITION OF ROOFING MEMBRANES. CUT BACK EXISTING MEMBRANES AND PREPARE TO RECEIVE NEW WATERPROOFING AND INSULATION TO NEW STRUCTURAL CURB. |
| 41 | DEMOLISH EXISTING WALL FINISH AND MAKE GOOD SUBSTRATE TO RECEIVE NEW FINISH. |
| 42 | APPROXIMATE EXTENT OF FLOOR FINISH REMOVAL. SALVAGE FLOOR TILES WHERE APPROPRIATE. |

| GENERAL NOTES: DEMOLITION | |
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| | EXISTING DOOR AND DOOR FRAME TO BE DEMOLISHED. HARDWARE TO BE RETURNED TO THE UNIVERSITY. |
| | DEMOLITION NOTE REFERENCE |



THE ISSUANCE OF THIS RECORD DRAWING IS A REPRESENTATION BY THE ARCHITECT THAT THE CONSTRUCTION, ENLARGEMENT OR ALTERATION OF THE BUILDING IS IN GENERAL, AS OPPOSED TO PRECISE, CONFORMITY WITH THE DESIGN PREPARED AND PROVIDED BY THE ARCHITECT, BUT IS NOT A REPRESENTATION THAT THE CONSTRUCTION, ENLARGEMENT OR ALTERATION OF THE BUILDING IS IN CONFORMITY WITH A DESIGN THAT HAS BEEN REQUESTED OR PROVIDED BY OTHERS.

THE REVISIONS TO THESE CONTRACT DOCUMENTS, REFLECTING THE SIGNIFICANT CHANGES IN THE WORK MADE DURING CONSTRUCTION, ARE BASED ON DATA FURNISHED BY THE CONTRACTOR TO THE ARCHITECT. THE ARCHITECT SHALL NOT BE HELD RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED BY THE CONTRACTOR.

| REVISION | |
|----------|------------|
| NO. | DATE |
| 1 | 08/20/2024 |
| 2 | 09/20/2024 |

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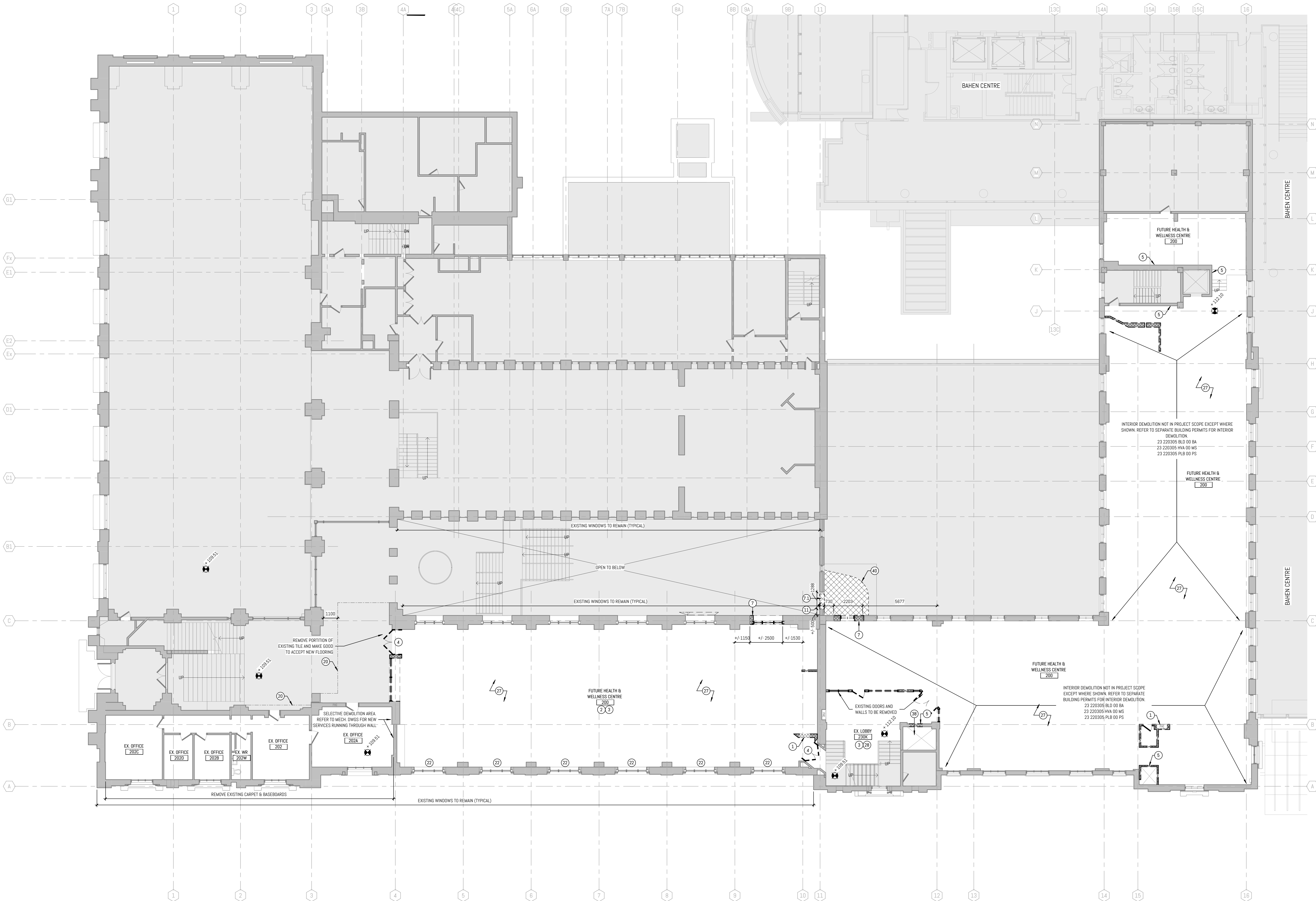
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1 DEMO - LEVEL 02 - OVERALL
AD202 1:100 Rev 1/4/00

| DEMOLITION FLOOR PLAN NOTES | |
|-----------------------------|---|
| NOTE | DESCRIPTION |
| 1 | EXISTING FIRE HOSE CABINET TO BE REMOVED. REFER TO MECHANICAL. |
| 2 | REMOVE EXISTING PARTITIONS DMB & FRAMING AS REQUIRED PATCH REPAIR AND MAKE GOOD REMAINING WALLS TO RECEIVE NEW FINISHES. |
| 3 | REMOVE EXISTING FLOORING AND BASEBOARD. MAKE GOOD EXISTING FLOOR TO ACCEPT NEW FLOORING. |
| 4 | REMOVE EXISTING DOOR AND DOOR FRAME. SALVAGE LOCKSET/CYLINDERS AND CLOSER. ITEMS TO BE HANDED TO U OF T REPRESENTATIVE. |
| 5 | CONTRACTOR TO MAINTAIN EXISTING FIRE AROUND EXISTING ELEVATOR, STAIRWAY, AND MECHANICAL SHAFTS. |
| 6 | REMOVE EXISTING MILLWORK ENTRY. MAKE GOOD WALLS TO ACCEPT NEW FINISHES. |
| 7 | CUT OPENING IN EXISTING MASONRY WALL. MAKE GOOD TO ACCEPT NEW PARTITIONS. REFER TO STRUCTURAL. |
| 7.1 | CUT OPENING IN EXISTING MASONRY WALL. SALVAGE FACE BRICK FOR FUTURE INCORPORATION. |
| 8 | REMOVE EXISTING MASONRY WALL BELOW EXISTING WINDOW OPENING. MAKE GOOD TO ACCEPT NEW INTERIOR FINISH. REFER TO STRUCTURAL. |
| 9 | REMOVE BLOCKING FROM EXISTING WINDOW OPENINGS. MAKE GOOD TO ACCEPT NEW WINDOWS AND ROOM FINISHES. |
| 10 | EXISTING WINDOW IN EXISTING OPENING TO REMAIN. EXISTING BRICK OR STONE RETURN TO REMAIN. |
| 11 | REMOVE ALL EXISTING WINDOW COMPONENTS FROM EXISTING OPENING. |
| 12 | CUT NEW OPENING STRUCTURAL MASONRY WALL. REFER TO STRUCTURAL. |
| 13 | CUT NEW OPENING IN EXISTING FLOOR. REFER TO STRUCTURAL, MECHANICAL, AND ELECTRICAL. |
| 15 | REMOVE AND SALVAGE EXISTING LIFT. ITEMS TO BE HANDED TO U OF T REPRESENTATIVE. REFER TO ELECTRICAL AND STRUCTURAL. |
| 16 | REMOVE EXISTING STAIRS AND PLATFORM C/W HANDRAIL AND GUARDRAIL. |
| 17 | REMOVE RAMP C/W HANDRAIL. |
| 18 | REMOVE & SALVAGE EXISTING TILE (BY HERITAGE CONTRACTOR). SET ASIDE TO USE IN OTHER LOCATIONS. MAKE GOOD EXISTING FLOORING TO ACCEPT NEW FLOORING & FOOT GRILLE. |
| 19 | CHIP EXISTING CONCRETE AS REQUIRED TO INSTALL NEW RECESSED FLOOR GRILLE. TO BE COORDINATED ON SITE. |
| 20 | PROPOSED LINE OF CONSTRUCTION HEADING BY CONTRACTOR. MAINTAIN MIN. 100mm CLEARANCE IN CORRIDORS. |
| 21 | REMOVE EXISTING RADIATOR COVERS. EXISTING RADIATOR TO REMAIN. REFER TO MECHANICAL. |
| 22 | REMOVE EXISTING RADIATOR. MAKE GOOD EXISTING WALL PANEL. REFER TO MECHANICAL. |

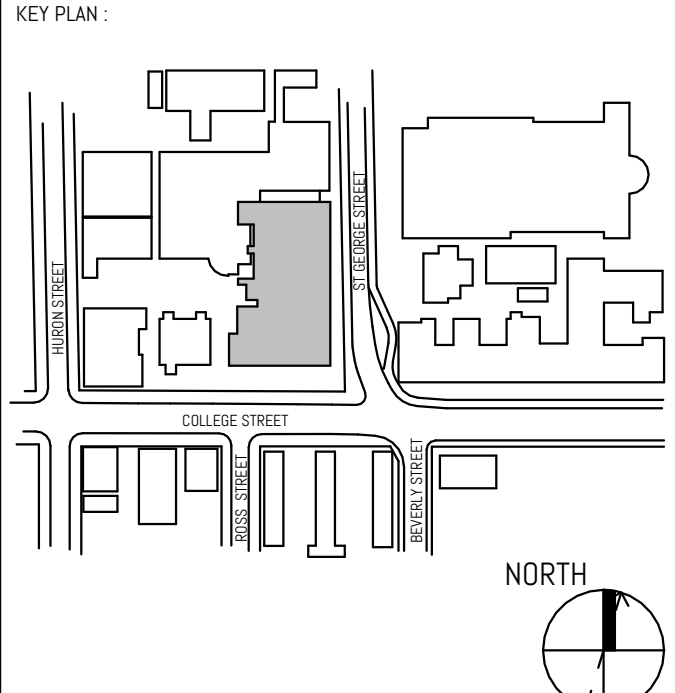
| DEMOLITION FLOOR PLAN NOTES | |
|-----------------------------|--|
| NOTE | DESCRIPTION |
| 27 | REFER TO BACK-TO-BASE DEMOLITION SCOPE OF WORK, BUILDING PERMIT 23 220305 BLD 00 BA. |
| 28 | REMOVE WALL BASE. PATCH AND MAKE GOOD WALL TO RECEIVE NEW WALL BASE, TYP. |
| 29 | REMOVE GLASS ABOVE DOORS. FILL REVEAL FOR NEW GLASS, SAND AND PAINT. |
| 30 | REMOVE DOORS AND GLASS SIDE LIGHTS. |
| 31 | LINE OF PAVING DEMOLITION. REFER TO ARCH AND LANDSCAPE DRAWINGS. |
| 32 | REMOVE EXISTING CARPET AND MAKE GOOD TO RECEIVE NEW FLOOR FINISH. |
| 33 | DEMOLISH EXISTING STAIRS AND RAMP. |
| 35 | REFER TO HERITAGE DRAWINGS 11-13 FOR MASONRY REPAIR WORKS. |
| 36 | INFILL ABANDONED PENETRATIONS IN FLOOR SLAB WITH MIN. 100mm CONCRETE. |
| 38 | DECOMMISSION EXISTING ELEVATOR AND DISMANTLE ALL COMPONENTS. REFER TO MECHANICAL AND ELECTRICAL. |
| 39 | DEMOLISH EXISTING ORNAMENTAL ARCH AND EXPOSE ENCASED STRUCTURE. |
| 40 | SELECTIVE DEMOLITION OF ROOFING MEMBRANES. CUT BACK EXISTING MEMBRANES AND PREPARE TO RECEIVE NEW WATERPROOFING AND INSULATION TO NEW STRUCTURAL CURB. |
| 41 | DEMOLISH EXISTING WALL FINISH AND MAKE GOOD SUBSTRATE TO RECEIVE NEW FINISH. |
| 42 | APPROXIMATE EXTENT OF FLOOR FINISH REMOVAL. SALVAGE FLOOR TILES WHERE APPROPRIATE. |

| GENERAL NOTES: DEMOLITION | |
|---------------------------|---|
| A. | THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE STRUCTURAL, MECHANICAL AND ELECTRICAL DRAWINGS. |
| B. | ROOM NUMBERS SHOWN ARE EXISTING ROOM NUMBERS. REFER TO NEW WORK DRAWING FOR NEW ROOM NUMBERS. |
| C. | FOR ALL DESIGNATED SUBSTANCES MATERIALS REMOVAL PROCEDURES. REFER TO GENERAL SPECIFICATION FOR DESIGNATED SUBSTANCES MATERIALS REPORT AND SCOPE OF WORK. IF NOTED IN THE SCOPE OF WORK, CONSTRUCTION MANAGER IS RESPONSIBLE FOR DEMOLITION OF DESIGNATED SUBSTANCES AND FOR MATERIALS NOTED IN THE DESIGNATED SUBSTANCES MATERIALS REPORT WHERE AFFECTED BY CONSTRUCTION INCLUDING BUT NOT LIMITED TO MECHANICAL AND ELECTRICAL WORK. |
| D. | TEMPORARY HEADING MUST BE IN PLACE PRIOR TO ANY REMOVALS WORK. MAINTAIN ALL ACCESS TO EXIT REQUIREMENTS OF THE OBC. |
| E. | PROTECT ALL EXISTING FINISHES, LANDINGS, STAIRS, HANDRAILS & GUARDRAILS DURING CONSTRUCTION. |
| F. | MAKE GOOD ALL EXPOSED WALL AND CEILING SURFACES. REMOVE ALL NAILS, SCREWS, WALL PLUGS, WALL CLIPS, STAPLES FROM EXISTING WALLS. PATCH, REPAIR AND MAKE GOOD WALL SURFACES. |
| G. | REMOVE ALL AFFECTED MILLWORK & OTHER EXISTING WALL MOUNTED ITEMS SUCH AS BULLETIN BOARDS, PEGBOARDS, CHALKBOARDS AND ACCESSORIES AS NOTED ON THE DRAWINGS. CONSTRUCTION MANAGER SHALL ASK APPROVAL FROM CONSULTANT AND U OF T REPRESENTATIVE BEFORE DISPOSING OF REMOVED ITEMS. MATERIALS & ITEMS THAT WILL NOT BE DISPOSED OF SHALL BE TAKEN BY THE CONSTRUCTION MANAGER TO A STORAGE AREA DESIGNATED BY THE U OF T REPRESENTATIVE. |
| H. | REMOVE AND RETAIN ALL LOCKSETS / CYLINDERS AND ELECTRIC STRIKES, CLOSERS AND DOOR OPERATORS FROM DOORS TO BE SALVAGED AS NOTED ON THE DRAWINGS AND HAND OVER TO U OF T. |
| I. | REMOVE EXISTING DOORS AND FRAMES AS NOTED ON THE DRAWINGS. |
| J. | REMOVE ALL EXISTING FLOOR FINISH WITHIN THE CONSTRUCTION AREA BACK TO CONCRETE SUBSURFACE UNLESS NOTED OTHERWISE. REMOVE ALL ADHESIVE AND PATCH AND REPAIR SUBSURFACE TO RECEIVE NEW FLOOR FINISH TO PROVIDE SMOOTH FINISH. |
| K. | REMOVE UNUSED EXPOSED ANCHORS. SEAL GROUT, FILL HOLES ON THE EXISTING SLAB AND WALLS AS PER SPEC. |
| L. | REFER TO GENERAL NOTES FOR ADDITIONAL DEMOLITION INFORMATION. |

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MAKE GOOD, MAKE GOOD, MAKING GOOD MEANS REPAIRING, RESTORING, REFURBISHING, REHABILITATING OR PERFORMING FILLING OPERATION ON ANY EXISTING COMPONENTS DISTURBED DUE TO WORK OF THIS CONTRACT, TO AT LEAST THE CONDITION EXISTING AT THE COMMENCEMENT OF THE WORK IN TERMS OF CONSTRUCTION INTEGRITY, FINISHES, ALIGNMENT WITH EXISTING ADJOINING SURFACES, COMPATIBILITY OF MATERIALS, SOUND, ATTENUATION CRITERIA, EXFILTRATION/FILTRATION REQUIREMENTS, AIR/VAPOUR BARRIER AND THERMAL CONTINUITY.

CONSTRUCTION MANAGER TO SITE VERIFY ALL DIMENSIONS.

| DEMOLITION LEGEND | |
|-------------------|--|
| | EXISTING WALL TO REMAIN |
| | EXISTING WALL TO BE DEMOLISHED |
| | EXISTING ELEMENT TO BE DEMOLISHED |
| | INDICATIVE NEW OPENING IN EXISTING FLOOR. REFER TO STRUCTURAL DRAWINGS. CM TO SUBMIT EXCAVATION WORKS PLAN |
| | EXISTING FLOOR DATUM |
| | N.I.C. PRIMARY SCOPE OF WORK |
| | EXISTING DOOR AND DOOR FRAME TO BE DEMOLISHED. HARDWARE TO BE RETURNED TO THE UNIVERSITY. |
| | DEMOLITION NOTE REFERENCE |



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| 2 | 09/20/2024 | CUSTOMER SET |

ENFORM
architects
ENFORM Architects Inc.
1304 Bloor Street West, Suite 2000
Toronto, Ontario, Canada M6H 2B7
Tel: 416-948-7523
www.enformarchitects.com

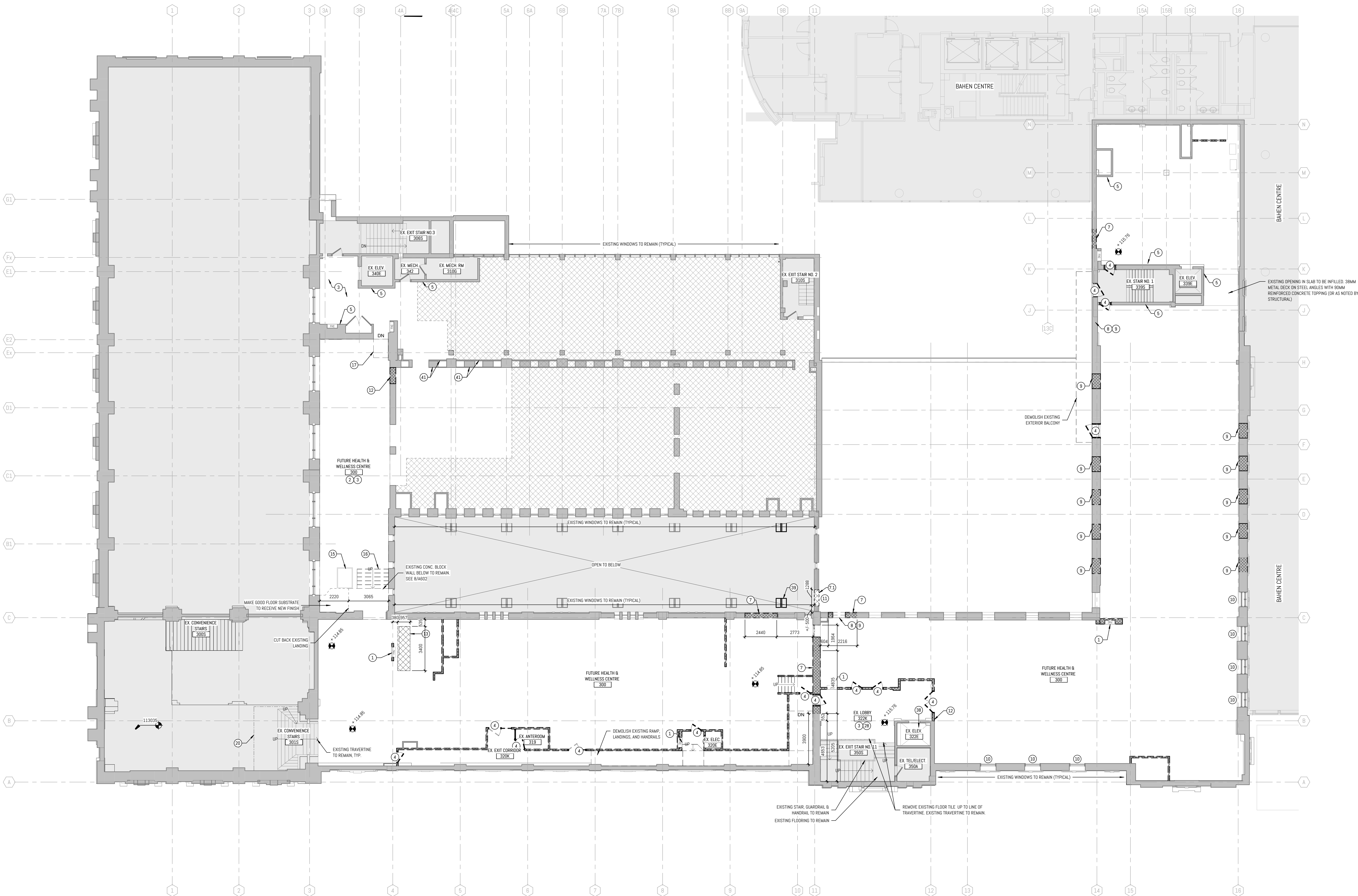


PROJECT
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2.

SHEET CONTENTS
LEVEL 2 DEMOLITION PLAN

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| DRAWING SCALE 1:100 | |
| DRAWN BY CC | CHECKED BY AF |
| DATE 2024-10-04 | DATE 2024-10-04 |
| SHEET NO. AD202 | REV. 2 |



1 DEMO LEVEL 03 - OVERALL
AD203 1:100 Rev. 1/4/04

| DEMOLITION FLOOR PLAN NOTES | |
|-----------------------------|---|
| NOTE | DESCRIPTION |
| 1 | EXISTING FIRE HOSE CABINET TO BE REMOVED. REFER TO MECHANICAL. |
| 2 | REMOVE EXISTING PARTITIONS D/W B FRAMINGS AS REQUIRED PATCH REPAIR AND MAKE GOOD REMAINING WALLS TO RECEIVE NEW FINISHES. |
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| 5 | CONTRACTOR TO MAINTAIN EXISTING FIRE AROUND EXISTING ELEVATOR, STAIRWAY, AND MECHANICAL SHAFTS. |
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| 20 | PROPOSED LINE OF CONSTRUCTION HEADING BY CONTRACTOR. MAINTAIN MIN. 1100mm CLEARANCE IN CORRIDORS. |
| 21 | REMOVE EXISTING RADIATOR COVER. EXISTING RADIATOR TO REMAIN. REFER TO MECHANICAL. |
| 22 | REMOVE EXISTING RADIATOR. MAKE GOOD EXISTING WALL PANEL. REFER TO MECHANICAL. |

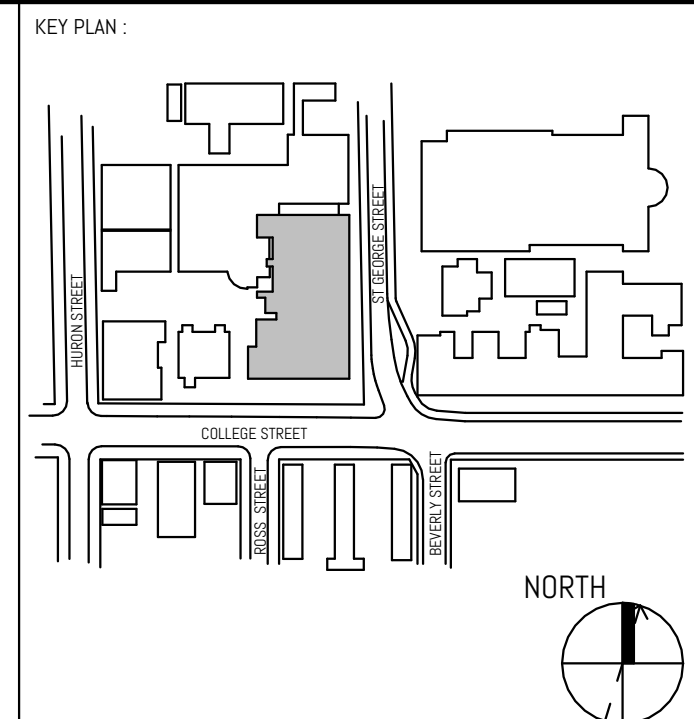
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| NOTE | DESCRIPTION |
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| 30 | REMOVE DOORS AND GLASS SIDE LIGHTS. |
| 31 | LINE OF PAVING DEMOLITION. REFER TO ARCH AND LANDSCAPE DRAWINGS. |
| 32 | REMOVE EXISTING CARPET AND MAKE GOOD TO RECEIVE NEW FLOOR FINISH. |
| 33 | DEMOLISH EXISTING STAIRS AND RAMP. |
| 35 | REFER TO HERITAGE DRAWINGS 14-03 FOR MASONRY REPAIR WORKS. |
| 36 | INFILL ABANDONED PENETRATIONS IN FLOOR SLAB WITH MIN. 150mm CONCRETE. |
| 38 | DECOMMISSION EXISTING ELEVATOR AND DISMANTLE ALL COMPONENTS. REFER TO MECHANICAL AND ELECTRICAL. |
| 39 | DEMOLISH EXISTING ORNAMENTAL ARCH AND EXPOSE ENCASED STRUCTURE. |
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| E. | PROTECT ALL EXISTING FINISHES, LANDINGS, STAIRS, HANDRAILS & GUARDRAILS DURING CONSTRUCTION. |
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| G. | REMOVE ALL AFFECTED MILLWORK & OTHER EXISTING WALL MOUNTED ITEMS SUCH AS BULLETIN BOARDS, PEGBOARDS, CHALKBOARDS AND ACCESSORIES AS NOTED ON THE DRAWINGS. CONSTRUCTION MANAGER SHALL ASK APPROVAL FROM CONSULTANT AND U OF T REPRESENTATIVE BEFORE DISPOSING OF REMOVED ITEMS. MATERIALS & ITEMS THAT WILL NOT BE DISPOSED OF SHALL BE TAKEN BY THE CONSTRUCTION MANAGER TO A STORAGE AREA DESIGNATED BY THE U OF T REPRESENTATIVE. |
| H. | REMOVE AND RETAIN ALL LOCKSETS/CYLINDERS AND ELECTRIC STRIKES, CLOSERS AND DOOR OPERATORS FROM DOORS TO BE SALVAGED AS NOTED ON THE DRAWINGS AND HAND OVER TO U OF T. |
| I. | REMOVE EXISTING DOORS AND FRAMES AS NOTED ON THE DRAWINGS. |
| J. | REMOVE ALL EXISTING FLOOR FINISH WITHIN THE CONSTRUCTION AREA BACK TO CONCRETE SUBSURFACE UNLESS NOTED OTHERWISE. REMOVE ALL ADHESIVE AND PATCH AND REPAIR SUBSURFACE TO RECEIVE NEW FLOOR FINISH TO PROVIDE SMOOTH FINISH. |
| K. | REMOVE UNUSED EXPOSED ANCHORS. SEAL GROUT, FILL HOLES ON THE EXISTING SLAB AND WALLS AS PER SPEC. |
| L. | REFER TO GENERAL NOTES FOR ADDITIONAL DEMOLITION INFORMATION. |

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CONSTRUCTION MANAGER TO SITE VERIFY ALL DIMENSIONS.

| DEMOLITION LEGEND | |
|-------------------|--|
| | EXISTING WALL TO REMAIN |
| | EXISTING WALL TO BE DEMOLISHED |
| | EXISTING ELEMENT TO BE DEMOLISHED |
| | INDICATIVE NEW OPENING IN EXISTING FLOOR REFER TO STRUCTURAL DRAWINGS. CM TO SUBMIT EXCAVATION WORKS PLAN |
| | EXISTING FLOOR DATUM |
| | N.I.C. PRIMARY SCOPE OF WORK |
| | EXISTING DOOR AND DOOR FRAME TO BE DEMOLISHED. HARDWARE TO BE RETURNED TO THE UNIVERSITY. |
| | DEMOLITION NOTE REFERENCE |



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| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/20/2024 | CUSTOMER SET |

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SEAL



PROJECT
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2.

SHEET CONTENTS
LEVEL 3 DEMOLITION PLAN

PROJECT NUMBER
23-011 (P143-19-100)

DRAWING SCALE
1:100

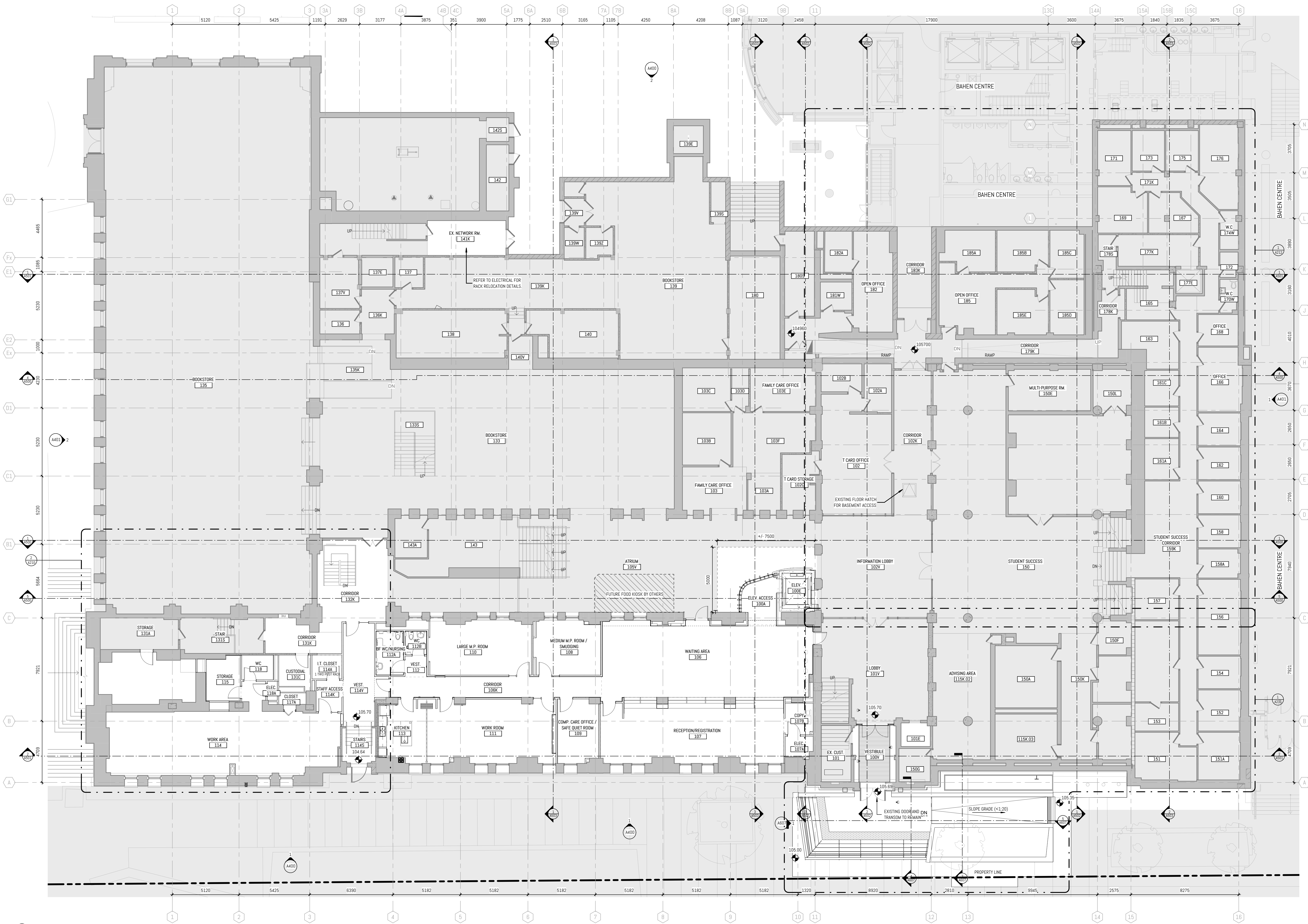
DRAWN BY
CC

CHECKED BY
AF

DATE
2024-10-04

SHEET NO.
AD203

REV.
2



1 LEVEL 01 - NEW WORK
A201 1:100 Ref. 1/ A400

GENERAL NOTES: NEW WORK

A. MAKE GOOD ALL EXISTING WALL SURFACES DAMAGED DURING REMOVALS AND CONSTRUCTION

B. NEW FLOOR FINISHES. REFER TO FINISH SCHEDULE

C. NEW DOOR & DOOR FRAME. REFER TO DOOR SCHEDULES

D. PAINT ALL EXISTING DOORS AND DOOR FRAMES

E. PROVIDE FIRESTOPPING TO ALL NEW FLOOR SERVICE PENETRATIONS. REFER TO MECH AND ELEC DWGS FOR LOCATIONS OF PENETRATIONS

F. PROTECT ALL EXISTING FINISHES, LANDINGS, STAIRS, HANDRAILS & GUARDRAILS DURING CONSTRUCTION

G. CLEAN AND PAINT EXISTING PIPE & MECH DUCTS AS REQUIRED

H. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE MECHANICAL & ELECTRICAL DRAWINGS

I. WHERE DISSIMILAR COMPONENTS SUCH AS PUSH BUTTON AND KEY SWITCH ARE INTO FIRE-RATED ASSEMBLIES, ENSURE CONTINUITY OF FIRE SEPARATIONS BY BOXING IN ELEMENTS WITH GYPSUM BOARD AND FRAMING TO SUIT AUTHORITIES JURISDICTION

J. CONTRACTOR TO PATCH, REPAIR AND MAKE GOOD ALL AREAS DISTURBED BY THE OPERATION OF THE WORK AND DISTURBED BY THE WORK OF OTHER TRADES (MECH, ELEC, W. & ETC.) MATERIALS AND FINISHES TO MATCH EXISTING UNLESS NOTED OTHERWISE

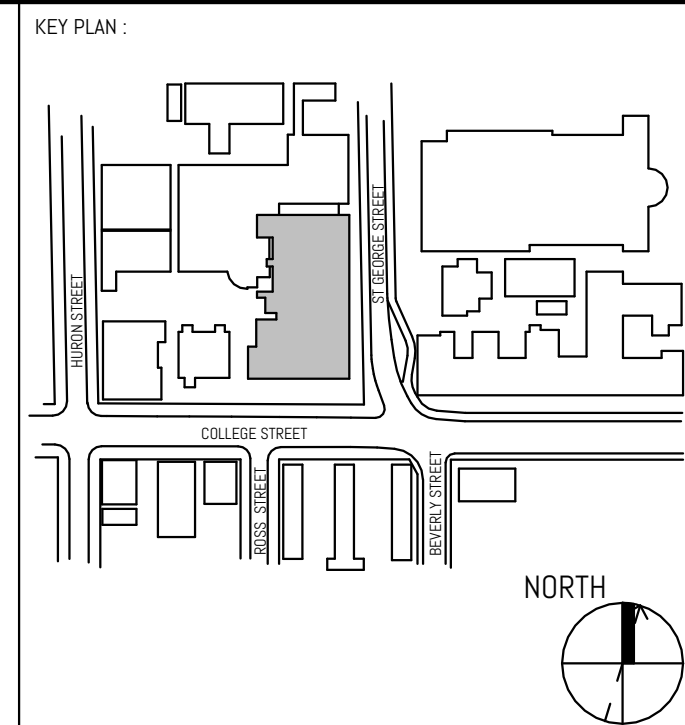
K. FILL NEW FLOOR OPENINGS WITH NON SHRINKING GROUT. REFER TO MECH AND ELEC DWGS

L. NEW DRYWALL PARTITIONS AND EXISTING PARTITIONS WITHIN PROJECT C/W NEW BASE. NEW BASE TO BE ONE PIECE ON EACH SEGMENT OF WALL, BOTH SIDES OF THE WALL. WALL TO SIT DIRECTLY ON FLOOR. REFER TO FINISH SCHEDULE

M. PAINT WALLS AND BULKHEADS IN AND CORRIDORS WITHIN PROJECT SCOPE. REFER TO FINISH SCHEDULE

FLOOR PLAN LEGEND & SYMBOLS

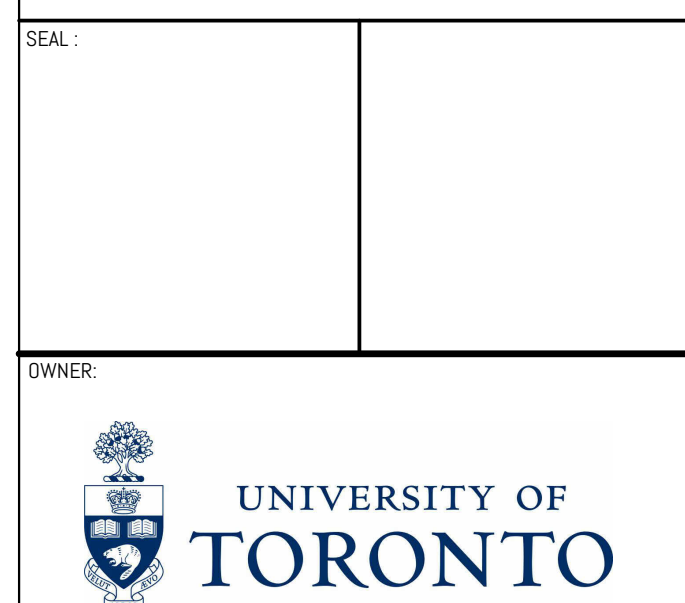
| | | | |
|--|---|--|---------------------------------|
| | GLAZING TYPE TAG | | NEW NOTE REFERENCE TAG |
| | WALL TYPE TAG | | NIC PRIMARY SCOPE OF WORK |
| | WALL TYPE TAG (TO BE VIF BY CONTRACTOR) | | SCOPE OF WORK |
| | SPOT ELEVATION (PROPOSED FLOOR ELEVATION DATUM) | | SHELL SPACE - FIT OUT BY OTHERS |
| | SPOT ELEVATION (EXISTING FLOOR ELEVATION DATUM) | | MAKE GOOD EXISTING FLOOR |
| | EXISTING WALL TO REMAIN | | EXIST UNEXCAVATED SPACE |
| | NEW PARTITION | | DOOR TAG |
| | NEW OR EXISTING RATED WALL TO BE MAINTAINED | | SPECIALTY EQUIPMENT TAG |



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/20/2024 | CONTRACT SET |

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PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2

SHEET CONTENTS:
GROUND FLOOR PLAN

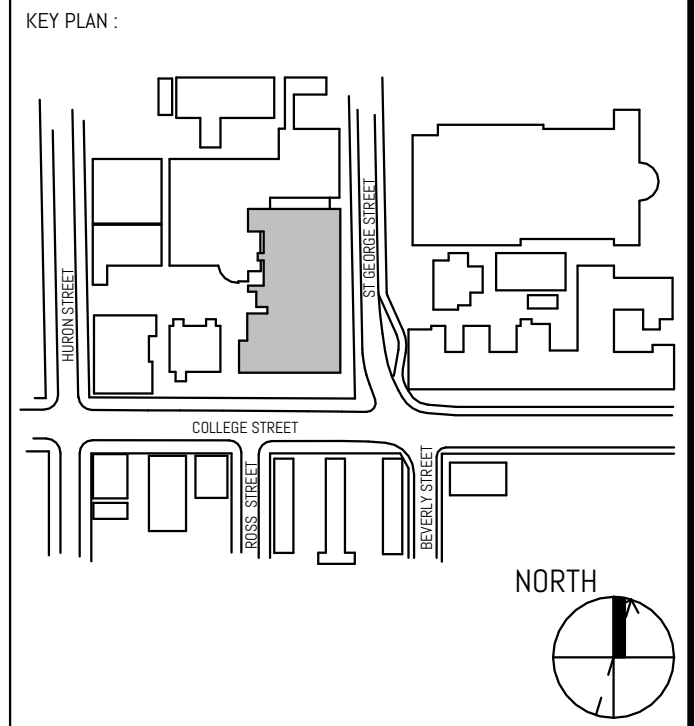
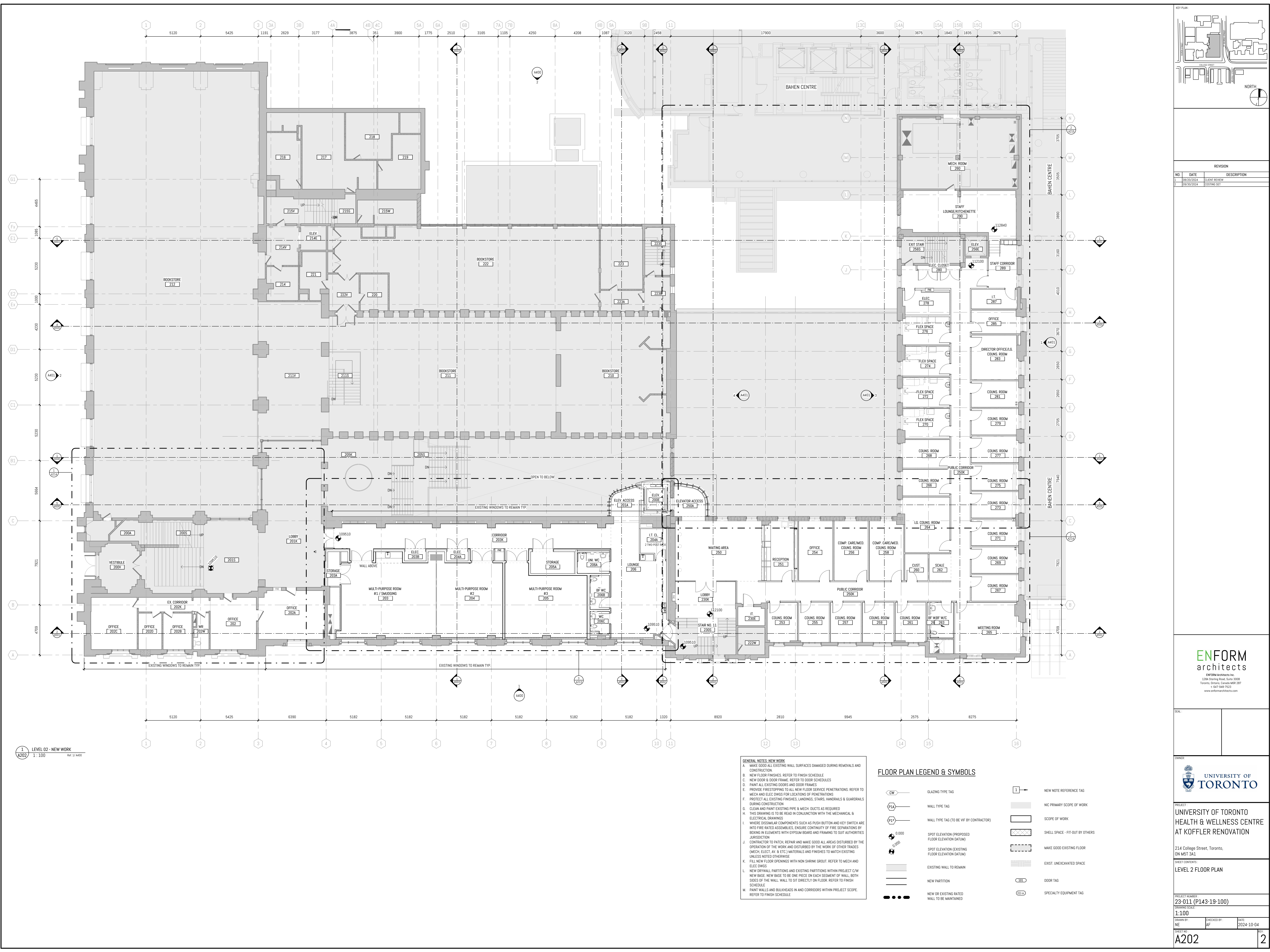
PROJECT NUMBER:
23-011 (P143-19-100)

DRAWING SCALE:
1:100

DRAWN BY: NE
CHECKED BY: AF
DATE: 2024-10-04

SHEET NO:
A201

2



| REVISION | | |
|----------|------------|----------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/10/2024 | CORRECTING SET |

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PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2

SHEET CONTENTS:
LEVEL 2 FLOOR PLAN

PROJECT NUMBER:
23-011 (P143-19-100)

DRAWING SCALE:
1:100

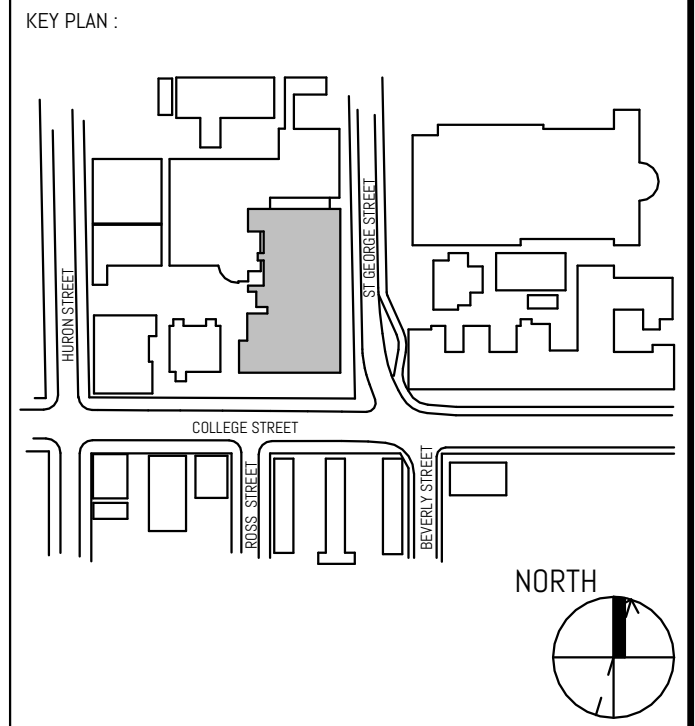
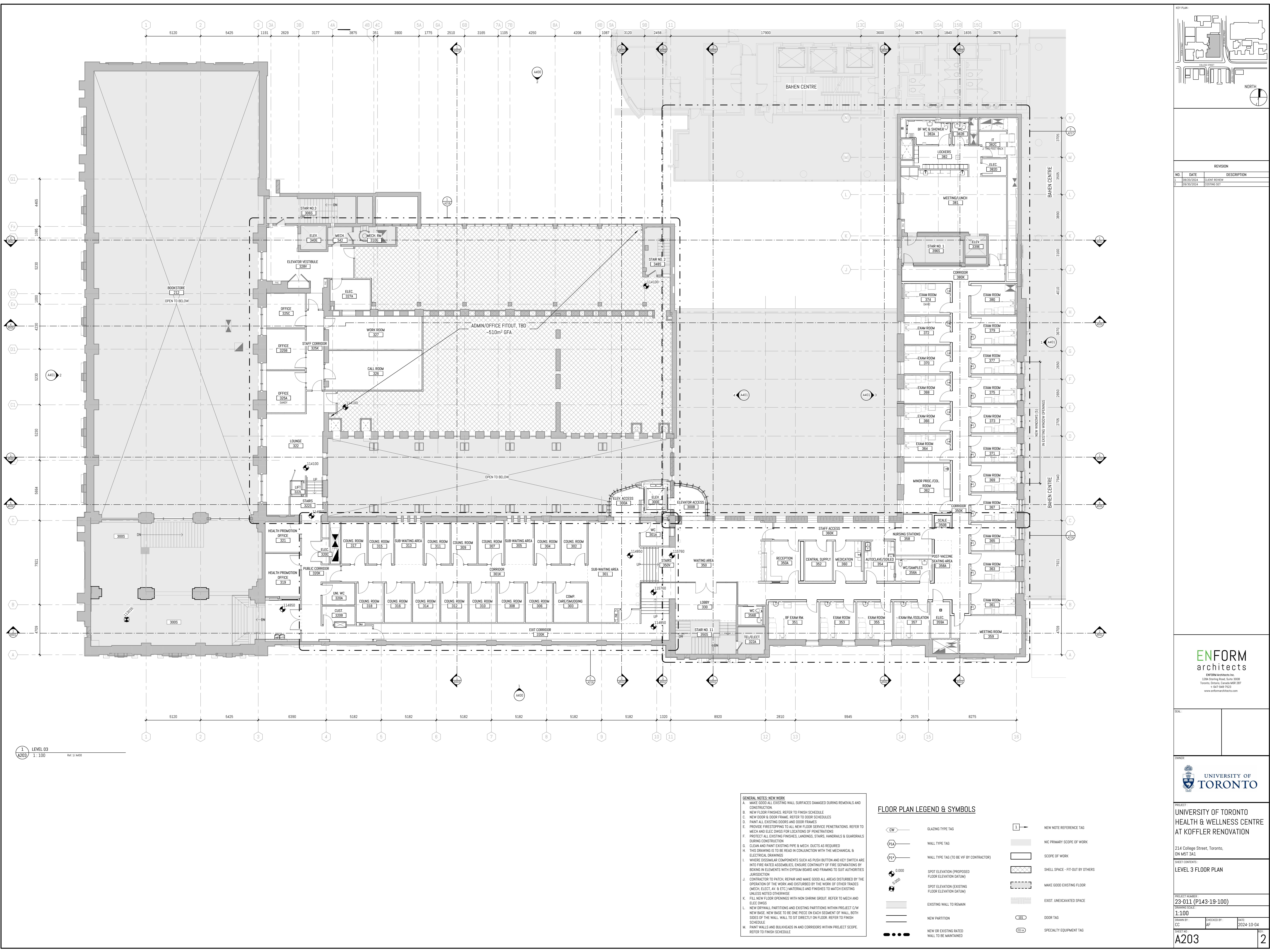
DRAWN BY:
NE

CHECKED BY:
AF

DATE:
2024-10-04

SHEET NO:
A202

REV:
2



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 10/20/2024 | CLIENT REVIEW |
| 2 | 10/20/2024 | CLIENT REVIEW |

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PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A1

SHEET CONTENTS:
LEVEL 3 FLOOR PLAN

PROJECT NUMBER:
23-011 (P143-19-100)

DRAWING SCALE:
1:100

DRAWN BY:
CZ

CHECKED BY:
AF

DATE:
2024-10-04

SHEET NO:
A203

REV:
2

GENERAL NOTES: NEW WORK

A. MAKE GOOD ALL EXISTING WALL SURFACES DAMAGED DURING REMOVALS AND CONSTRUCTION.

B. NEW FLOOR FINISHES. REFER TO FINISH SCHEDULE.

C. NEW DOOR & DOOR FRAME. REFER TO DOOR SCHEDULES.

D. PAINT ALL EXISTING DOORS AND DOOR FRAMES.

E. PROVIDE FIRESTOPPING TO ALL NEW FLOOR SERVICE PENETRATIONS. REFER TO MECH AND ELEC DWGS FOR LOCATIONS OF PENETRATIONS.

F. PROTECT ALL EXISTING FINISHES, LANDINGS, STAIRS, HANDRAILS & GUARDRAILS DURING CONSTRUCTION.

G. CLEAN AND PAINT EXISTING PIPE & MECH DUCTS AS REQUIRED.

H. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE MECHANICAL & ELECTRICAL DRAWINGS.

I. WHERE DISSIMILAR COMPONENTS SUCH AS PUSH BUTTON AND KEY SWITCH ARE INTO FIRE-RATED ASSEMBLIES, ENSURE CONTINUITY OF FIRE SEPARATIONS BY BOXING IN ELEMENTS WITH GYPSUM BOARD AND FRAMING TO SUIT AUTHORITIES JURISDICTION.

J. CONTRACTOR TO PATCH, REPAIR AND MAKE GOOD ALL AREAS DISTURBED BY THE OPERATION OF THE WORK AND DISTURBED BY THE WORK OF OTHER TRADES (MECH, ELEC, MV, & ETC.) MATERIALS AND FINISHES TO MATCH EXISTING UNLESS NOTED OTHERWISE.

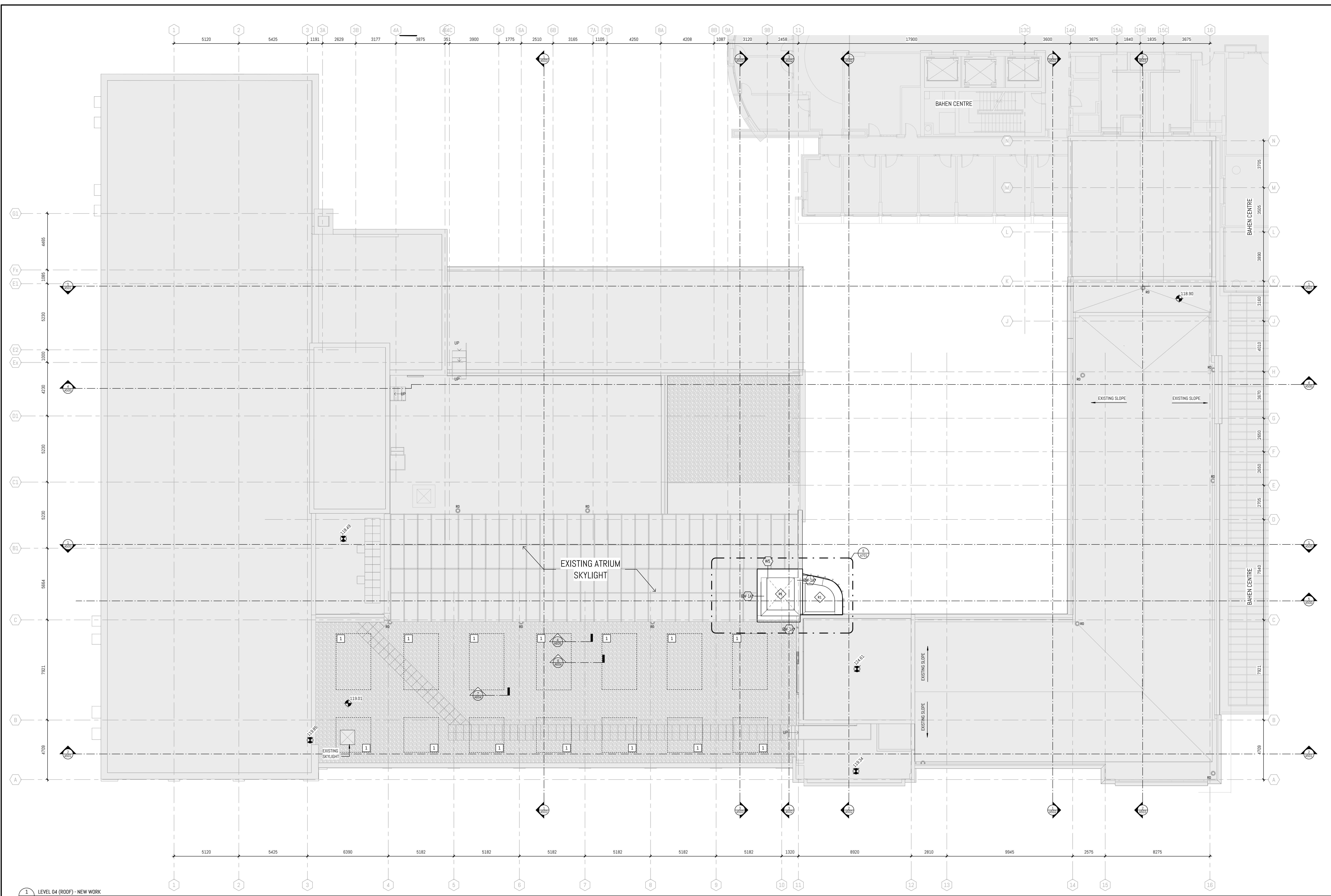
K. FILL NEW FLOOR OPENINGS WITH NON SHRINK GROUT. REFER TO MECH AND ELEC DWGS.

L. NEW DRYWALL PARTITIONS AND EXISTING PARTITIONS WITHIN PROJECT C/W NEW BASE. NEW BASE TO BE ONE PIECE ON EACH SEGMENT OF WALL, BOTH SIDES OF THE WALL. WALL TO SIT DIRECTLY ON FLOOR. REFER TO FINISH SCHEDULE.

M. PAINT WALLS AND BULKHEADS IN AND CORRIDORS WITHIN PROJECT SCOPE. REFER TO FINISH SCHEDULE.

FLOOR PLAN LEGEND & SYMBOLS

| | | | |
|--|---|--|---------------------------------|
| | GLAZING TYPE TAG | | NEW NOTE REFERENCE TAG |
| | WALL TYPE TAG | | NIC PRIMARY SCOPE OF WORK |
| | WALL TYPE TAG (TO BE VIF BY CONTRACTOR) | | SCOPE OF WORK |
| | SPOT ELEVATION (PROPOSED FLOOR ELEVATION DATUM) | | SHELL SPACE - FIT OUT BY OTHERS |
| | SPOT ELEVATION (EXISTING FLOOR ELEVATION DATUM) | | MAKE GOOD EXISTING FLOOR |
| | EXISTING WALL TO REMAIN | | EXIST UNEXCAVATED SPACE |
| | NEW PARTITION | | DOOR TAG |
| | NEW OR EXISTING RATED WALL TO BE MAINTAINED | | SPECIALTY EQUIPMENT TAG |



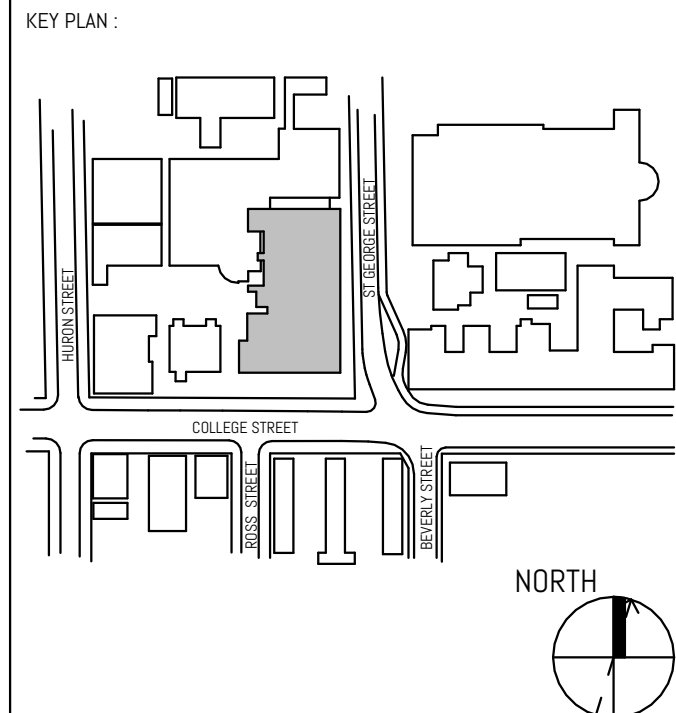
1 LEVEL 04 (ROOF) - NEW WORK
A204 1:100 Ref. 17/440

| NEW WORK - ROOF PLAN NOTES | |
|----------------------------|---|
| NOTE | DESCRIPTION |
| 1 | EXISTING SKYLIGHT INFILL WITH STEEL BRACKETS AT PERIMETER |

GENERAL NOTES: NEW WORK
A. MAKE GOOD ALL EXISTING WALL SURFACES DAMAGED DURING REMOVALS AND CONSTRUCTION
B. NEW FLOOR FINISHES. REFER TO FINISH SCHEDULE
C. NEW DOOR & DOOR FRAME. REFER TO DOOR SCHEDULES
D. PAINT ALL EXISTING DOORS AND DOOR FRAMES
E. PROVIDE FIRESTOPPING TO ALL NEW FLOOR SERVICE PENETRATIONS. REFER TO MECH AND ELEC DWGS FOR LOCATIONS OF PENETRATIONS
F. PROTECT ALL EXISTING FINISHES, LANDINGS, STAIRS, HANDRAILS & GUARDRAILS DURING CONSTRUCTION
G. CLEAN AND PAINT EXISTING PIPE & MECH. DUCTS AS REQUIRED
H. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE MECHANICAL & ELECTRICAL DRAWINGS
I. WHERE DISSIMILAR COMPONENTS SUCH AS PUSH BUTTON AND KEY SWITCH ARE INTO FIRE-RATED ASSEMBLIES, ENSURE CONTINUITY OF FIRE SEPARATIONS BY BOXING IN ELEMENTS WITH GYPSUM BOARD AND FRAMING TO SUIT AUTHORITIES JURISDICTION
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K. FILL NEW FLOOR OPENINGS WITH NON SHRINK GROUT. REFER TO MECH AND ELEC DWGS
L. NEW DRYWALL PARTITIONS AND EXISTING PARTITIONS WITHIN PROJECT C/W NEW BASE. NEW BASE TO BE ONE PIECE ON EACH SEGMENT OF WALL, BOTH SIDES OF THE WALL. WALL TO SET DIRECTLY ON FLOOR. REFER TO FINISH SCHEDULE
M. PAINT WALLS AND BULKHEADS IN AND CORRIDORS WITHIN PROJECT SCOPE. REFER TO FINISH SCHEDULE

ROOF PLAN LEGEND & SYMBOLS

| | | | |
|--|---|--|---------------------------|
| | WALL TYPE TAG | | NEW NOTE REFERENCE TAG |
| | WALL TYPE TAG (TO BE VIF BY CONTRACTOR) | | NIC PRIMARY SCOPE OF WORK |
| | ROOF TYPE TAG | | SCOPE OF WORK |
| | SPOT ELEVATION (PROPOSED FLOOR ELEVATION DATUM) | | DOOR TAG |
| | SPOT ELEVATION (EXISTING FLOOR ELEVATION DATUM) | | ROOF ANCHOR |
| | EXISTING WALL TO REMAIN | | ROOF DRAIN |
| | NEW PARTITION | | |
| | NEW OR EXISTING RATED WALL TO BE MAINTAINED | | |



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/30/2024 | COSTING SET |

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PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A1

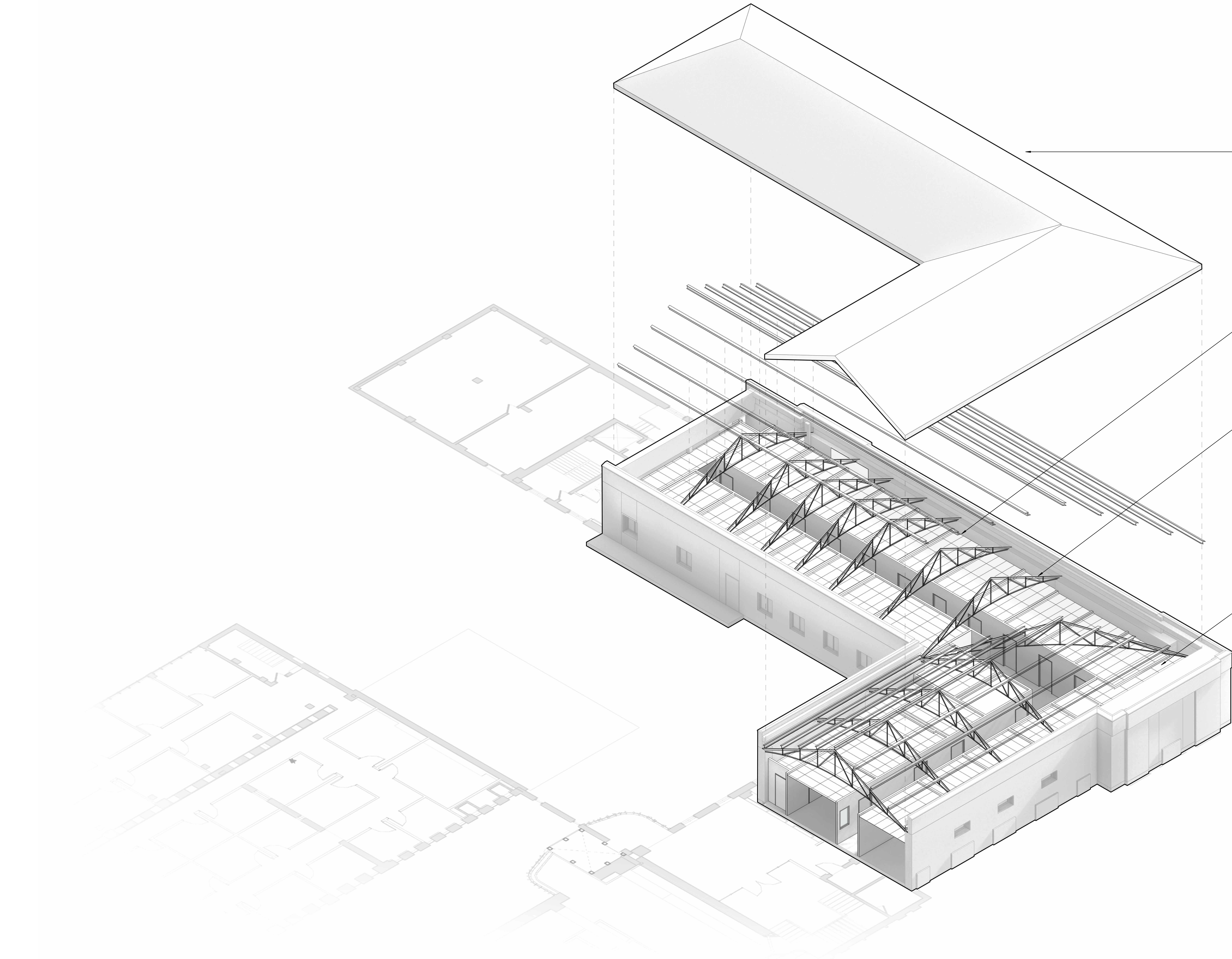
SHEET CONTENTS:
ROOF PLAN

PROJECT NUMBER:
23-011 (P143-19-100)

DRAWING SCALE:
1:100

DRAWN BY: CC CHECKED BY: AF DATE: 2024-10-04

SHEET NO: A204 REV: 2



EXISTING UNOCCUPIED ROOF

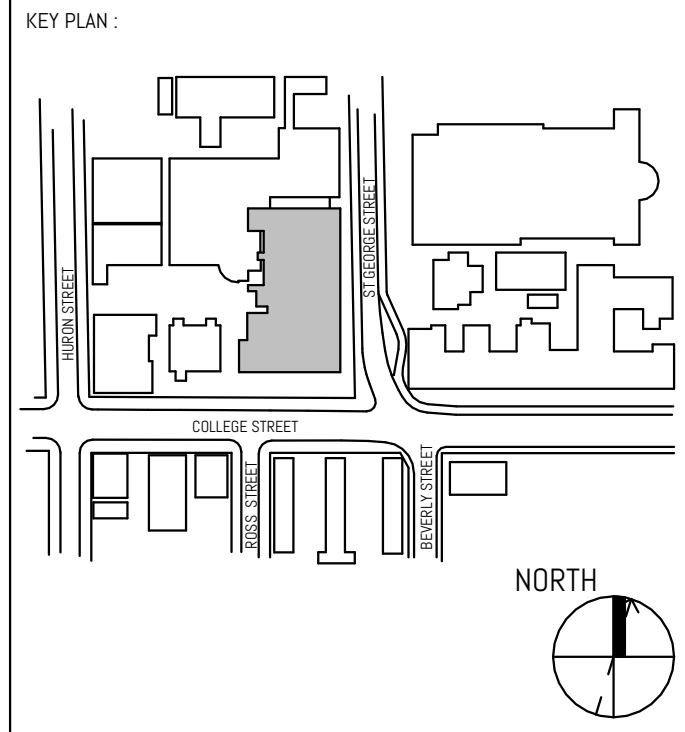
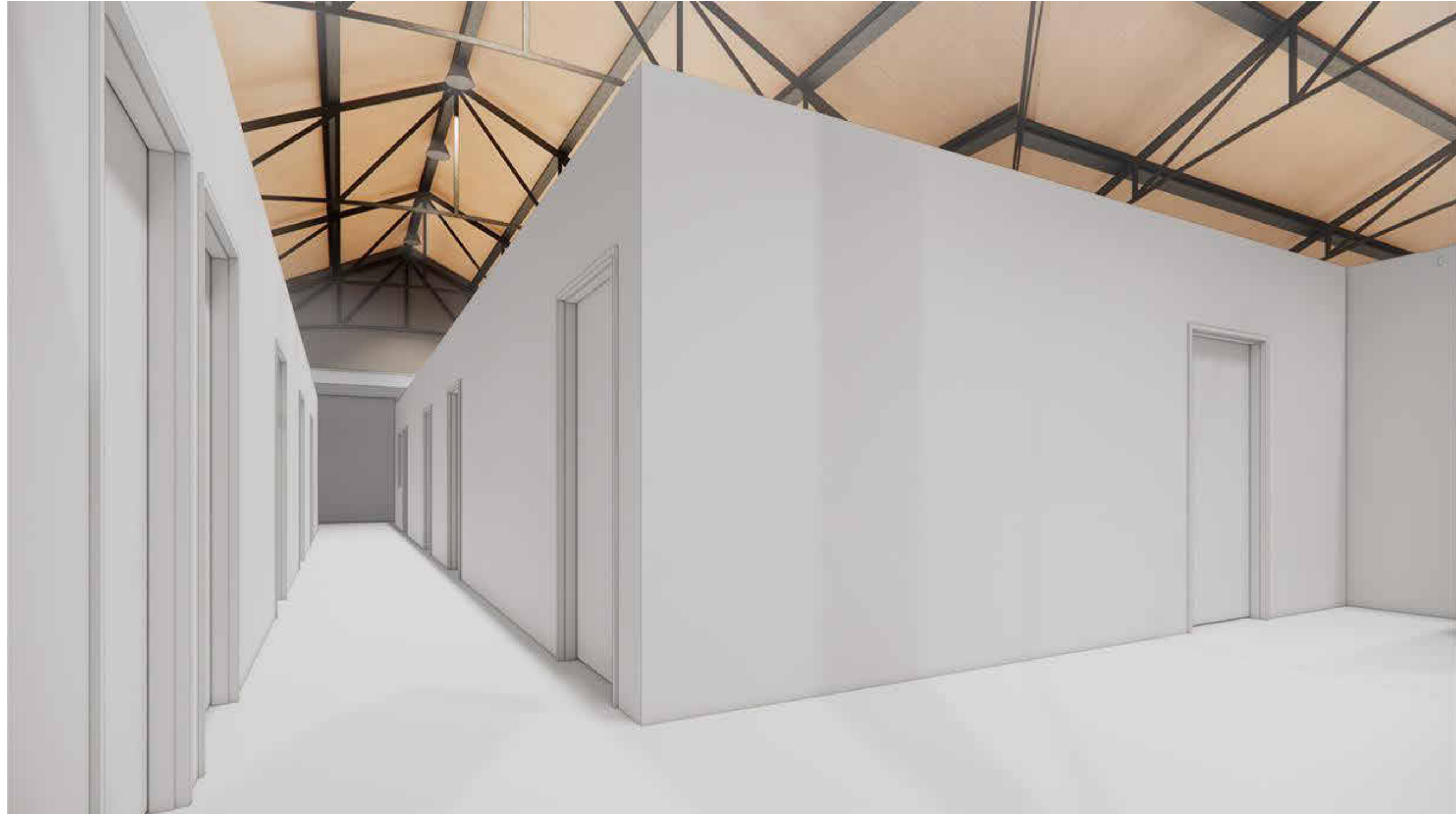
EXISTING EXPOSED SHEATHING BOARD (APPROX. 4" THK. PAPER GFACED PLASTER SHEETS)
- MAKE GOOD SURFACE TO RECEIVE PAINT FINISH

EXISTING EXPOSED ROOF STRUCTURE
- MAKE GOOD EXISTING SURFACE TO RECEIVE NEW PAINT FINISH.

3RD LEVEL ROOMS
CEILING SYSTEM:
- ACOUSTIC CEILING TILE
- FURRING CHANNEL / 20 GAUGE STRAPPING @ 410 O.C.
- 100MM ACOUSTIC INSULATION
- C-JOISTS @ 410 (16") O.C., PRODUCT: BAILEY LIGHTWEIGHT STEEL FRAMING (LSF) JOISTS, 800S250-97
- 19MM FIRE RETARDENT PLYWOOD FASTENED TO THE TOP FLANGE OF THE C-JOISTS (SERVICE / MAINTENANCE LOCATIONS ONLY).

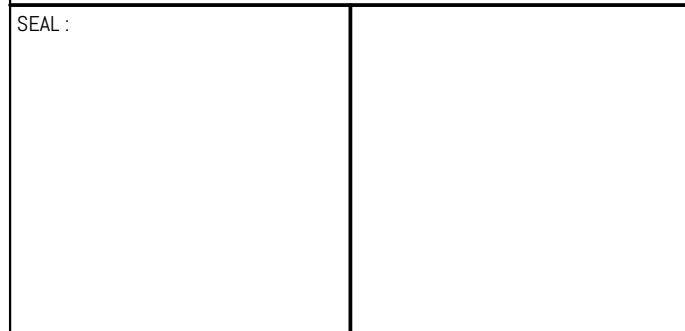
WALLS:
- 16MM GYPSUM WALL BOARD
- 154MM STEEL STUD FRAMING @ 410 O.C., 16 GAUGE, PRODUCT: BAILEY LIGHTWEIGHT STEEL FRAMING 600S162-54
- 100MM ACOUSTIC INSULATION
- 16 GAUGE STEEL SHREET CROSS BRACING
- 2 LAYERS OF 16MM GYPSUM WALL BOARD

NOTE:
MECHANICAL AND ELECTRICAL SYSTEMS (DUCTWORK, SPRINKLER SYSTEM, UPLIGHTING, ETC.) TO BE EXPOSED ABOVE 3RD LEVEL ROOMS AND CONCEALED FROM COMMON CORRIDOR.



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/25/2024 | CLIENT REVIEW |
| 2 | 09/10/2024 | COSTING SET |

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UNIVERSITY OF TORONTO

PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2

SHEET CONTENTS:
AXO & RENDERED VIEWS- LEVEL 03

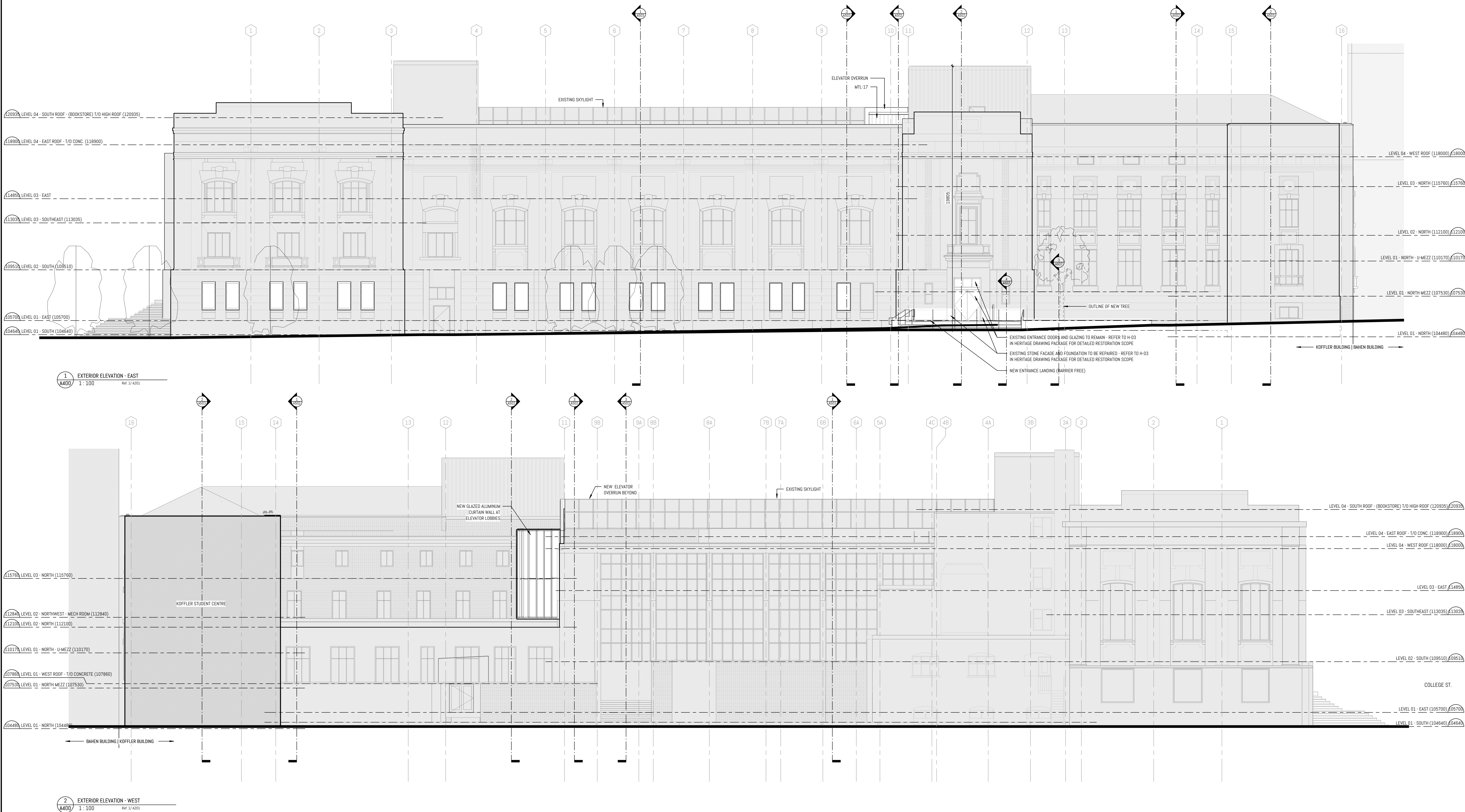
PROJECT NUMBER:
23-011 (P143-19-100)
DRAWING SCALE:
1:50
DRAWN BY: NE
CHECKED BY: AF
DATE: 2024-10-04

SHEET NO. **A316B** REV. **2**

| LEGEND & SYMBOLS | |
|---------------------------|---------------------------------|
| <div></div> | SCOPE OF WORK |
| <div></div> | N.I.C. PRIMARY SCOPE OF WORK |
| <div>+</div> <div>+</div> | GLASS W/ VISUAL MARKERS (100m²) |

| KEY PLAN | |
|----------|--|
| | |
| | |
| | |

| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/30/2024 | CONSULT SET |



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OWNER:
UNIVERSITY OF TORONTO

PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2

SHEET CONTENTS:
EXTERIOR ELEVATIONS

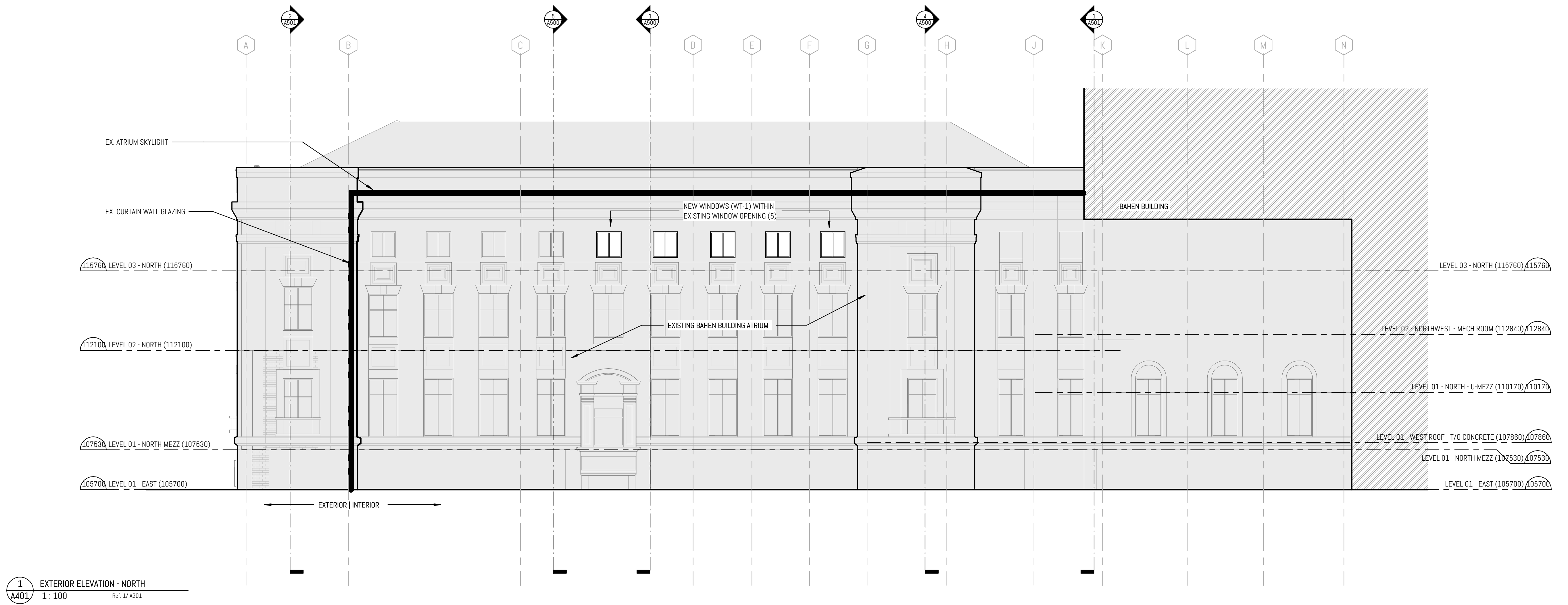
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23-011 (P143-19-100)

DRAWING SCALE:
1:100

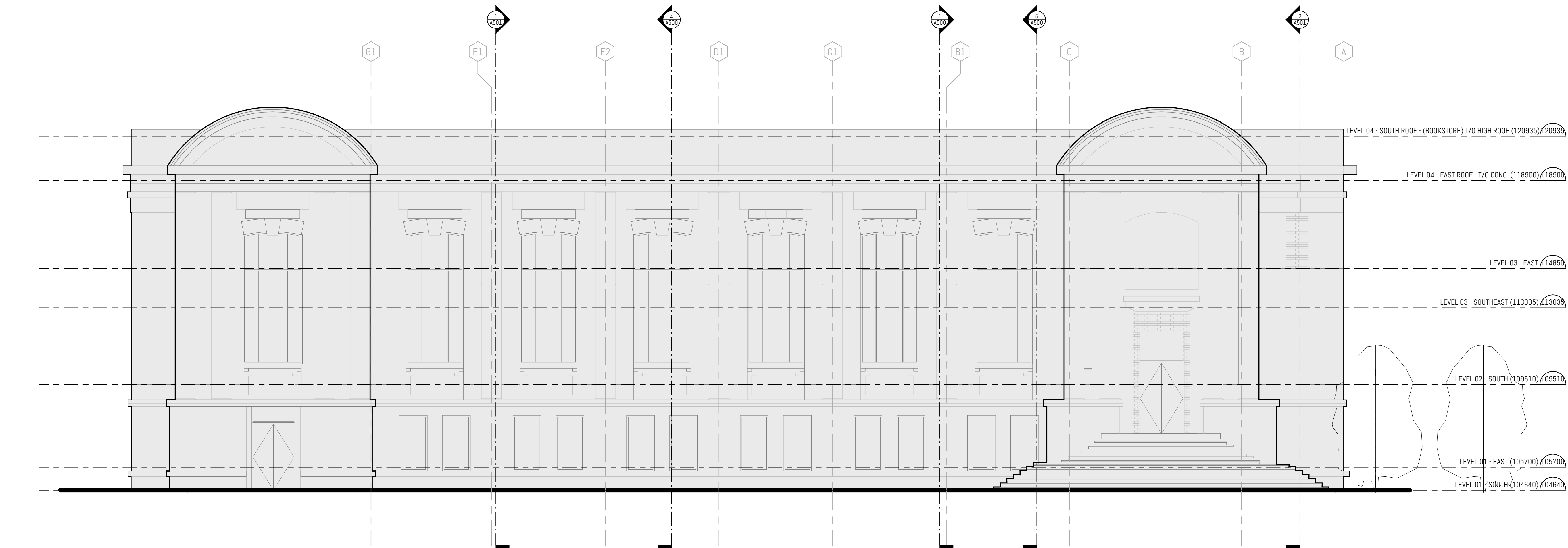
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SHEET NO: **A400** REV: **2**

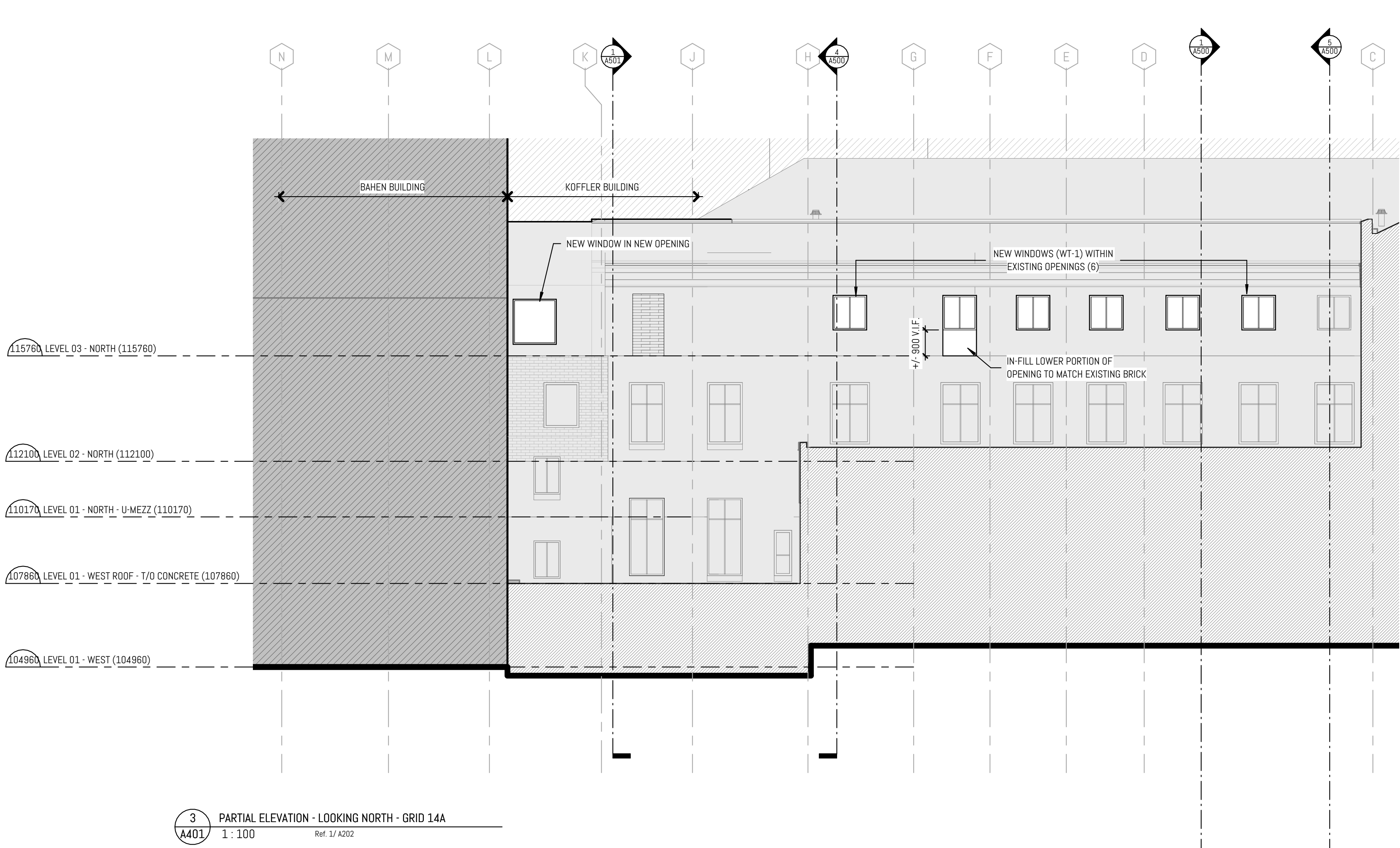
| LEGEND & SYMBOLS | |
|------------------|---------------------------------|
| | SCOPE OF WORK |
| | N.I.C. PRIMARY SCOPE OF WORK |
| | GLASS W/ VISUAL MARKERS (100m²) |



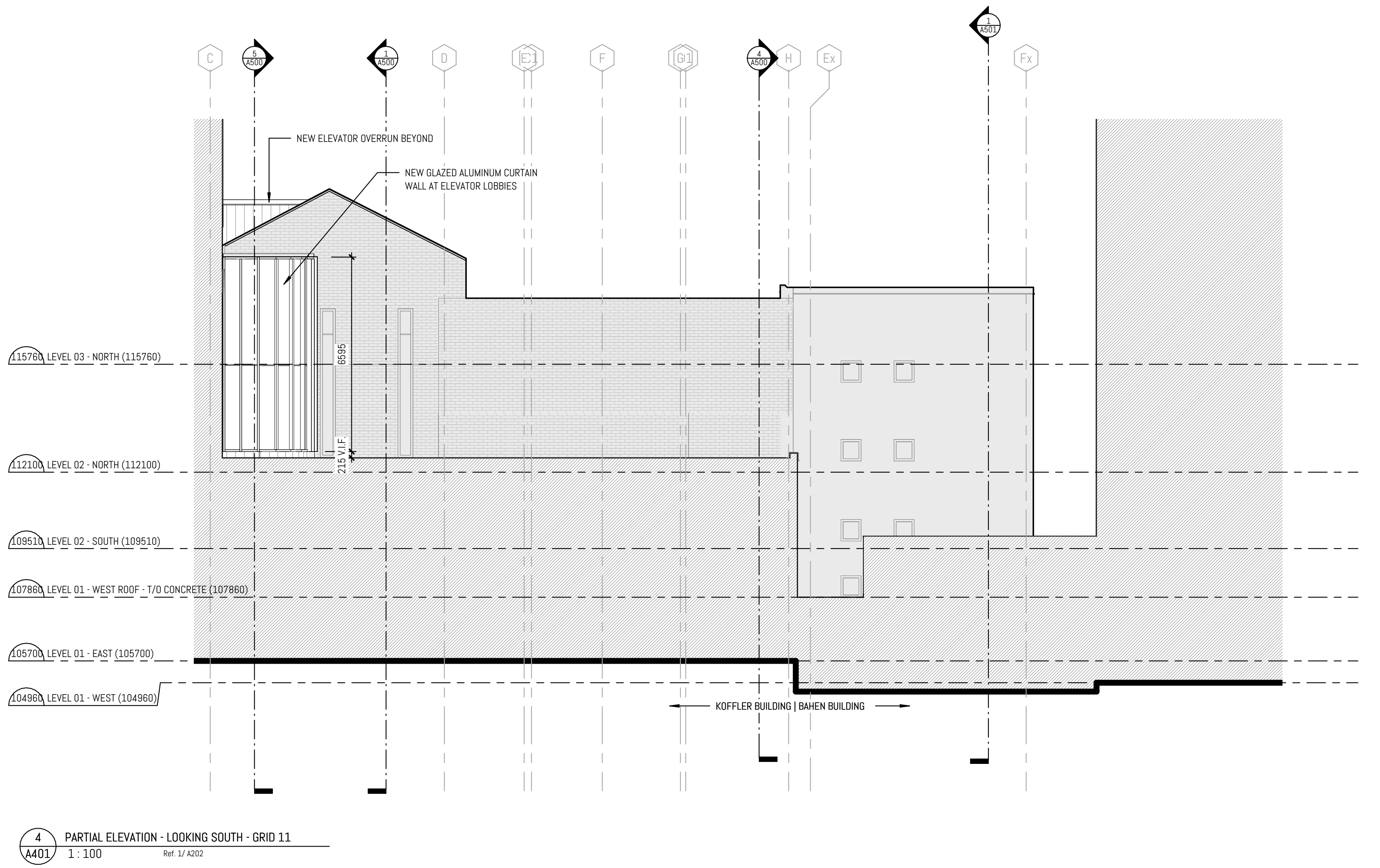
1 EXTERIOR ELEVATION - NORTH
A401 1:100 REF. 17 A201



2 EXTERIOR ELEVATION - SOUTH
A401 1:100 REF. 17 A201



3 PARTIAL ELEVATION - LOOKING NORTH - GRID 14A
A401 1:100 REF. 17 A201



4 PARTIAL ELEVATION - LOOKING SOUTH - GRID 11
A401 1:100 REF. 17 A201

KEY PLAN

| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/30/2024 | CLIENT REVIEW |

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**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
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214 College Street, Toronto,
ON M5T 3A1

SHEET CONTENTS

EXTERIOR ELEVATIONS

PROJECT NUMBER

23-011 (P143-19-100)

DRAWING SCALE

1:100

DRAWN BY

CC

CHECKED BY

AF

DATE

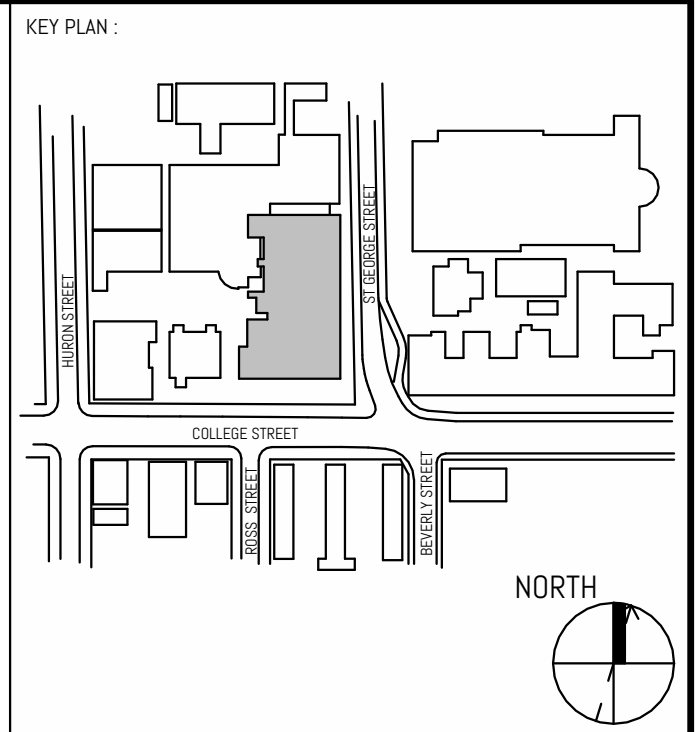
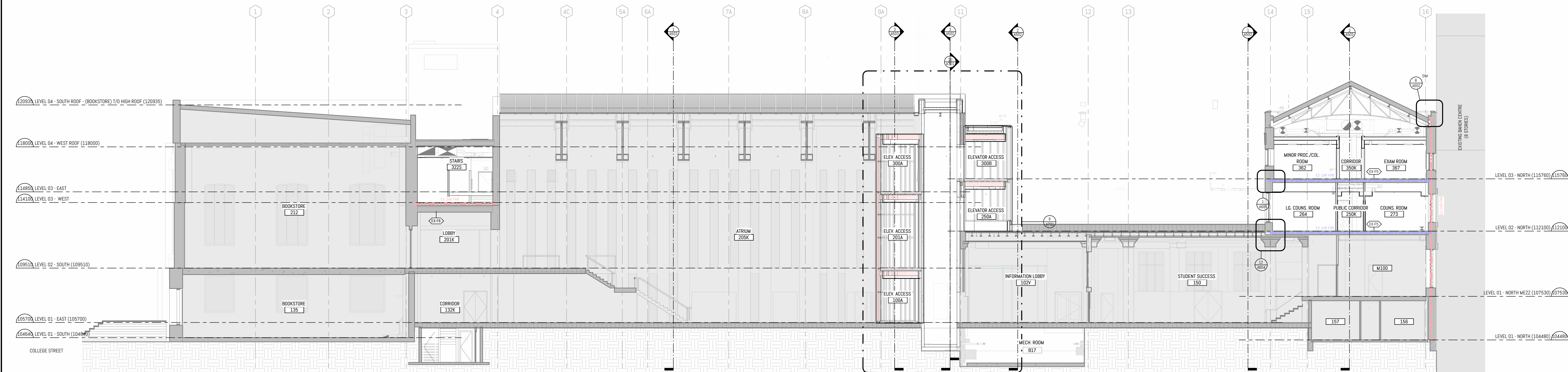
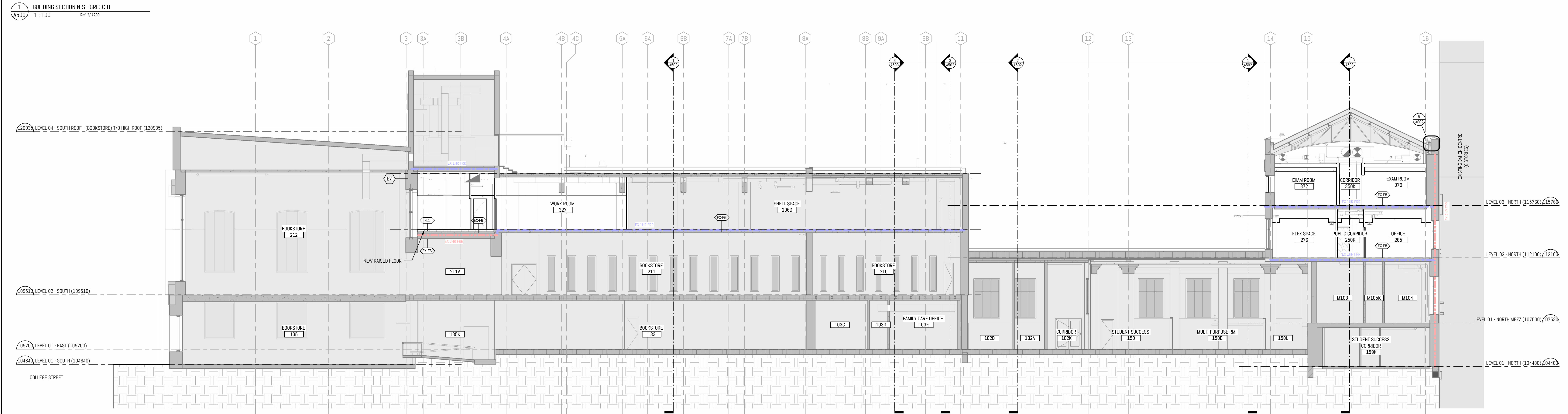
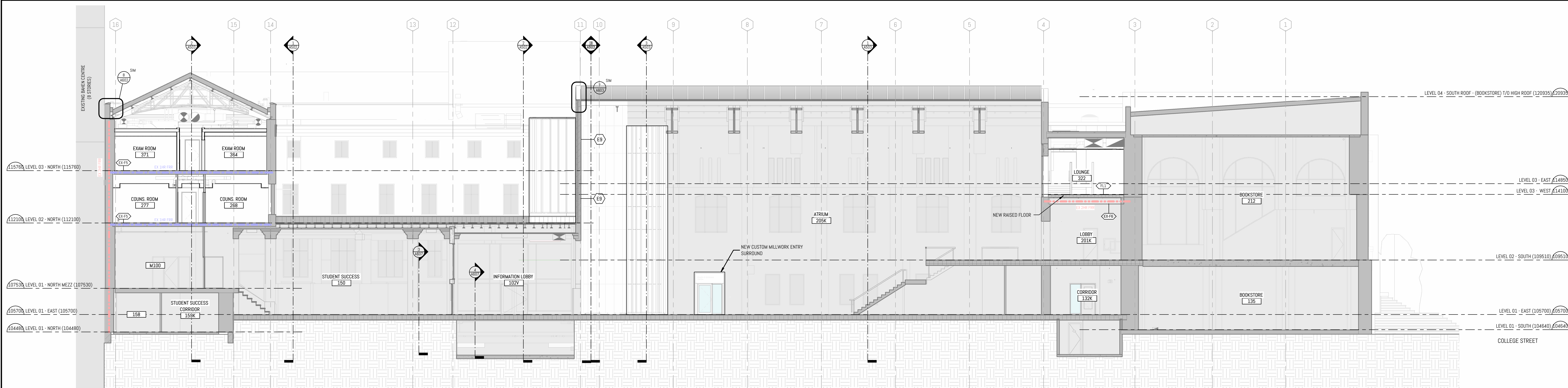
2024-10-04

SHEET NO.

A401

REV.

2



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 10/20/2024 | CLIENT REVIEW |
| 2 | 10/20/2024 | CUSTOMER SET |

| FIRE LIFE SAFETY LEGEND | |
|--|------------------------|
| --- | 0 HR FIRE-RATED WALL |
| --- | 3/4HR FIRE-RATED WALL |
| --- | 1 HR FIRE-RATED WALL |
| --- | 1.5 HR FIRE-RATED WALL |
| --- | 2 HR FIRE-RATED WALL |

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PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2.

SHEET CONTENTS:
BUILDING SECTIONS

PROJECT NUMBER:
23-011 (P143-19-100)

DRAWING SCALE:
1 : 100

DRAWN BY:
NE

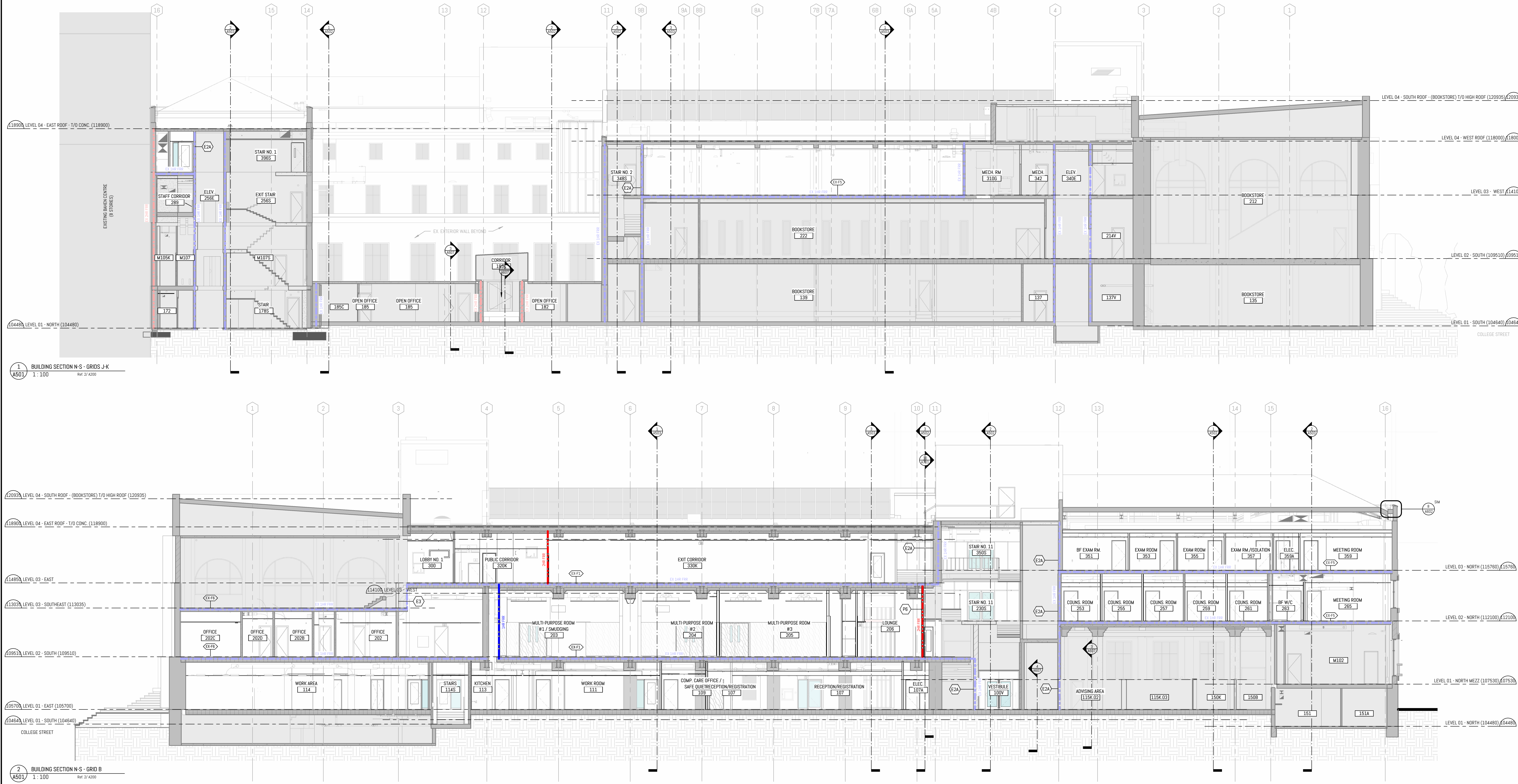
CHECKED BY:
AF

DATE:
2024-10-04

SHEET NO:
A500

2

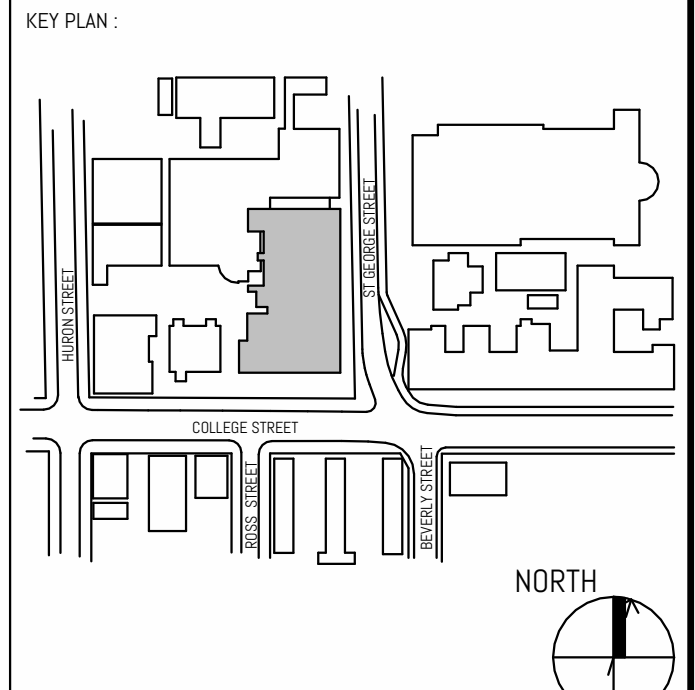
NOTE: EXISTING FIRE RATED ASSEMBLIES WILL BE SITE VERIFIED IF REPAIR AND/OR ALTERATION WORK IS REQUIRED FOLLOWING DEMOLITION WORK.



1 BUILDING SECTION N-S - GRIDS J-K
A501 1:100 Ref: 22-A200

2 BUILDING SECTION N-S - GRID B
A501 1:100 Ref: 22-A200

NOTE: EXISTING FIRE RATED ASSEMBLIES
WILL BE SITE VERIFIED IF REPAIR AND/OR
ALTERATION WORK IS REQUIRED
FOLLOWING DEMOLITION WORK.



| REVISION | | | |
|----------|------------|---------------|--------------|
| NO. | DATE | CLIENT REVIEW | DESCRIPTION |
| 1 | 08/20/2024 | | CLINT REVIEW |
| 2 | 09/30/2024 | | CLINT REVIEW |

| FIRE LIFE SAFETY LEGEND | |
|--|------------------------|
| --- | 0 HR FIRE RATED WALL |
| --- | 3/4 HR FIRE RATED WALL |
| --- | 1 HR FIRE RATED WALL |
| --- | 1.5 HR FIRE RATED WALL |
| --- | 2 HR FIRE RATED WALL |

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SEAL:



PROJECT:
**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2

SHEET CONTENTS:
BUILDING SECTIONS

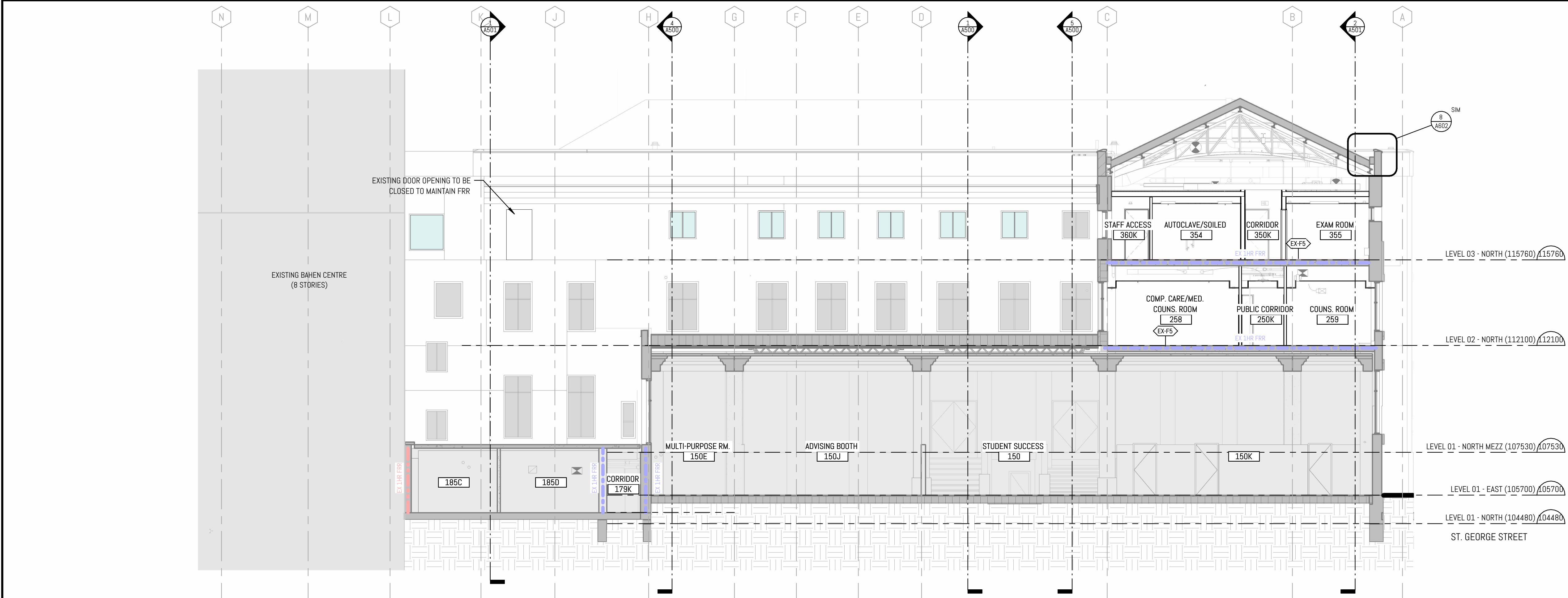
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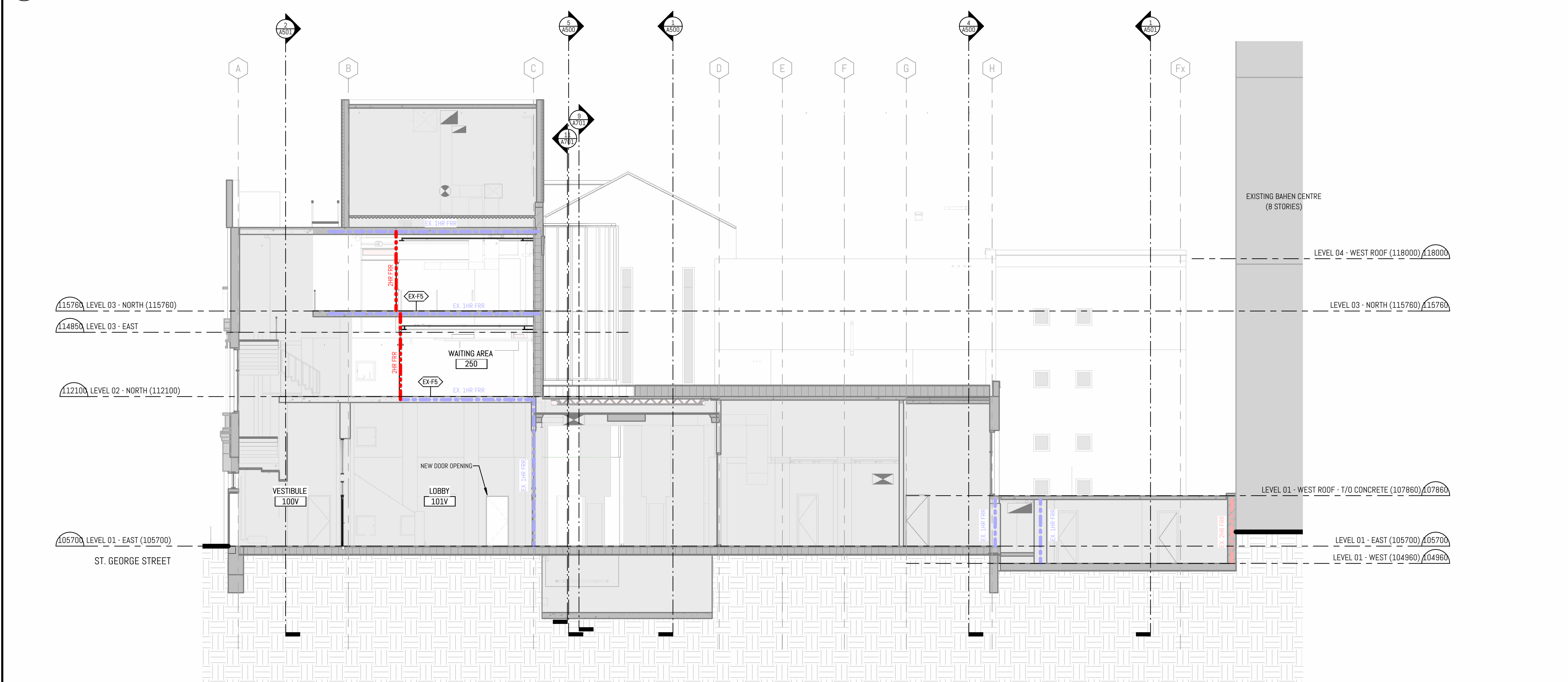
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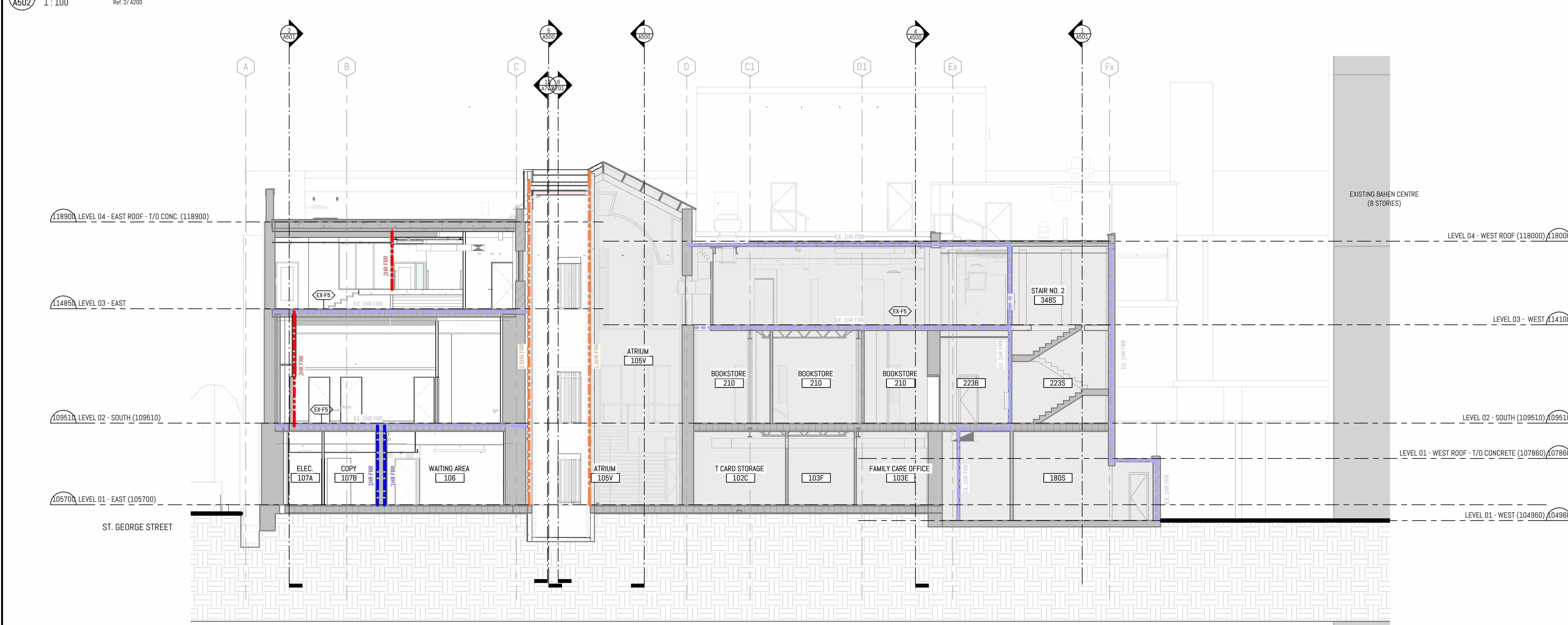
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2



1 BUILDING SECTION E-W - GRID 13C
1:100 Ref: 2/1 A500

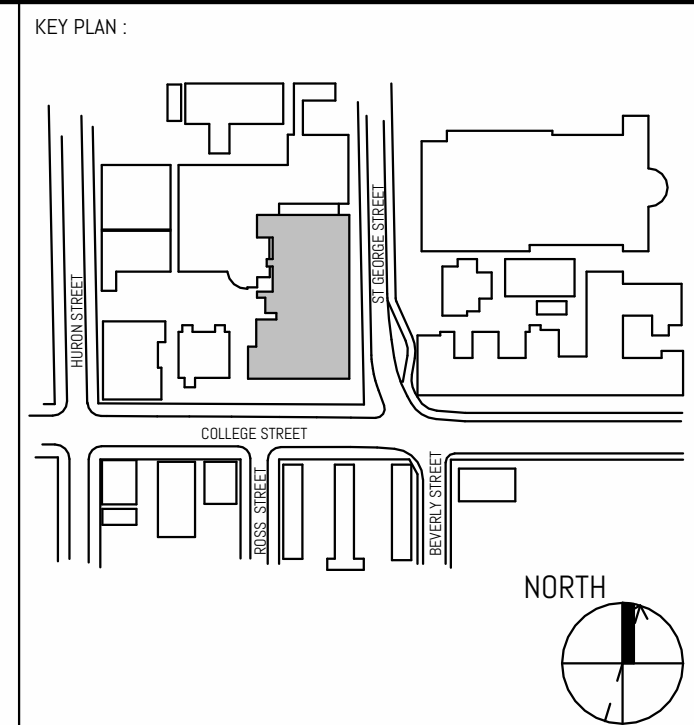


2 BUILDING SECTION E-W - GRID 11
1:100 Ref: 2/1 A500



3 BUILDING SECTION E-W - GRID 10-11
1:100 Ref: 2/1 A500

NOTE: EXISTING FIRE RATED ASSEMBLIES
WILL BE SITE VERIFIED IF REPAIR AND/OR
ALTERATION WORK IS REQUIRED
FOLLOWING DEMOLITION WORK.



| REVISION | | |
|----------|------------|---------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLIENT REVIEW |
| 2 | 09/20/2024 | CLIENT REVIEW |

| FIRE LIFE SAFETY LEGEND | |
|-------------------------|------------------------|
| | 0 HR FIRE-RATED WALL |
| | 3/4 HR FIRE-RATED WALL |
| | 1 HR FIRE-RATED WALL |
| | 1.5 HR FIRE-RATED WALL |
| | 2 HR FIRE-RATED WALL |

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ON M5T 3A2

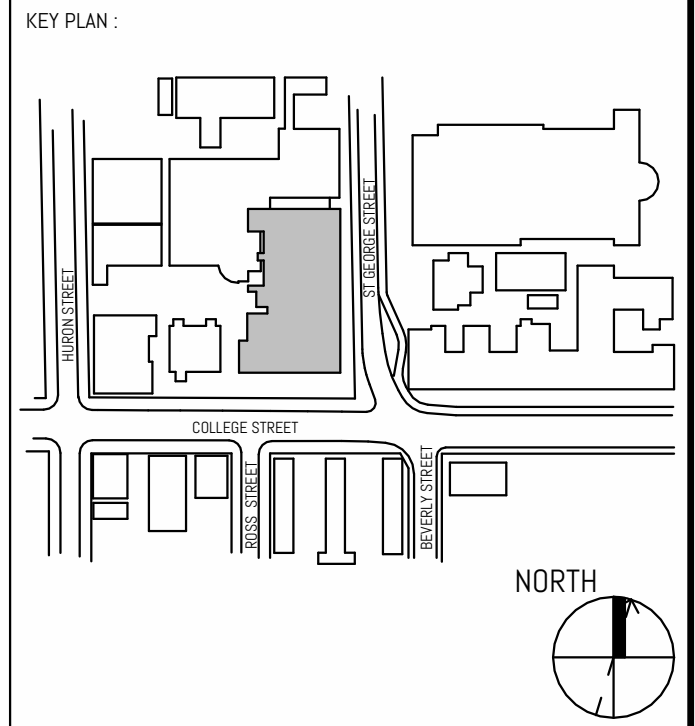
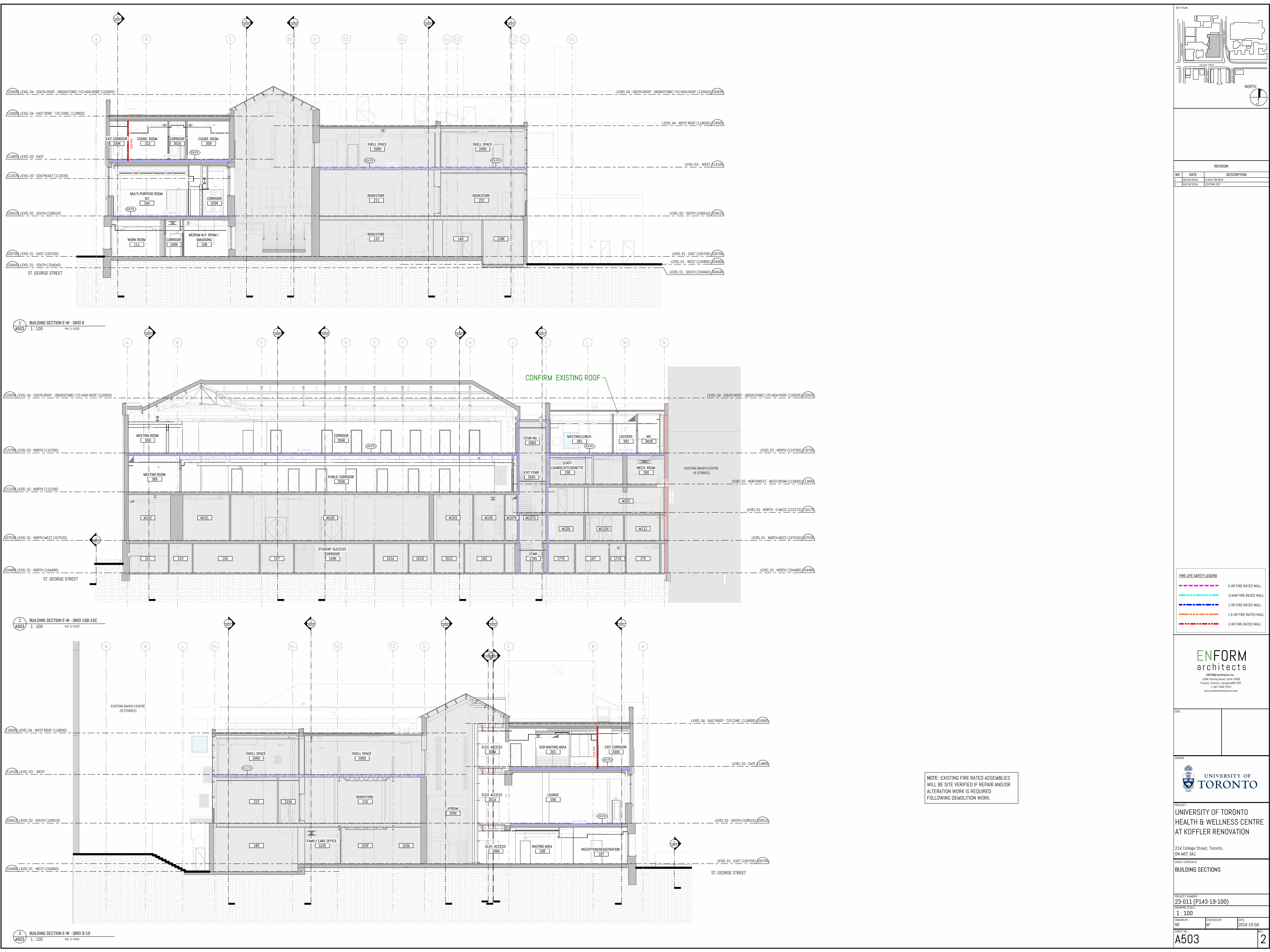
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PROJECT NUMBER:
23-011 (P143-19-100)

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DRAWN BY: NE CHECKED BY: AF DATE: 2024-10-04

SHEET NO:
A502



| REVISION | | |
|----------|------------|--------------|
| NO. | DATE | DESCRIPTION |
| 1 | 08/20/2024 | CLINT REVIEW |
| 2 | 09/30/2024 | CLINT REVIEW |

| FIRE LIFE SAFETY LEGEND | |
|-------------------------|------------------------|
| | 0 HR FIRE-RATED WALL |
| | 3/4 HR FIRE-RATED WALL |
| | 1 HR FIRE-RATED WALL |
| | 1.5 HR FIRE-RATED WALL |
| | 2 HR FIRE-RATED WALL |

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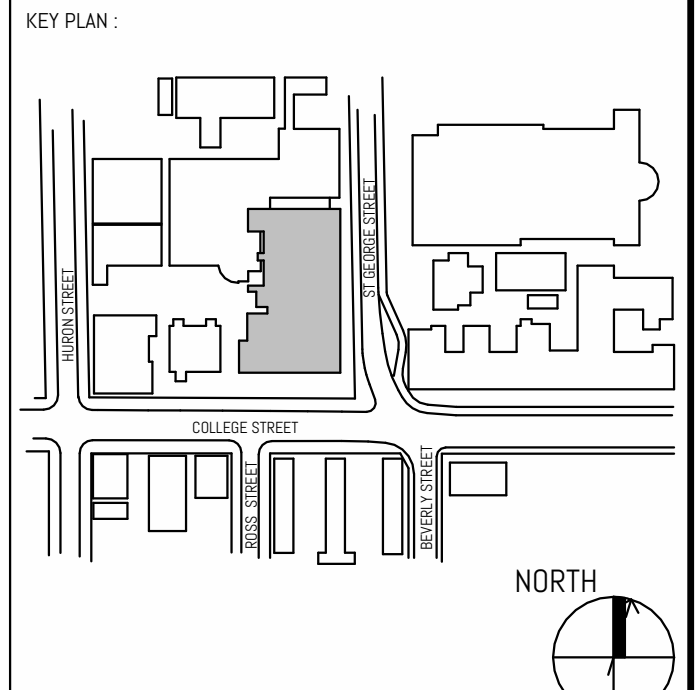
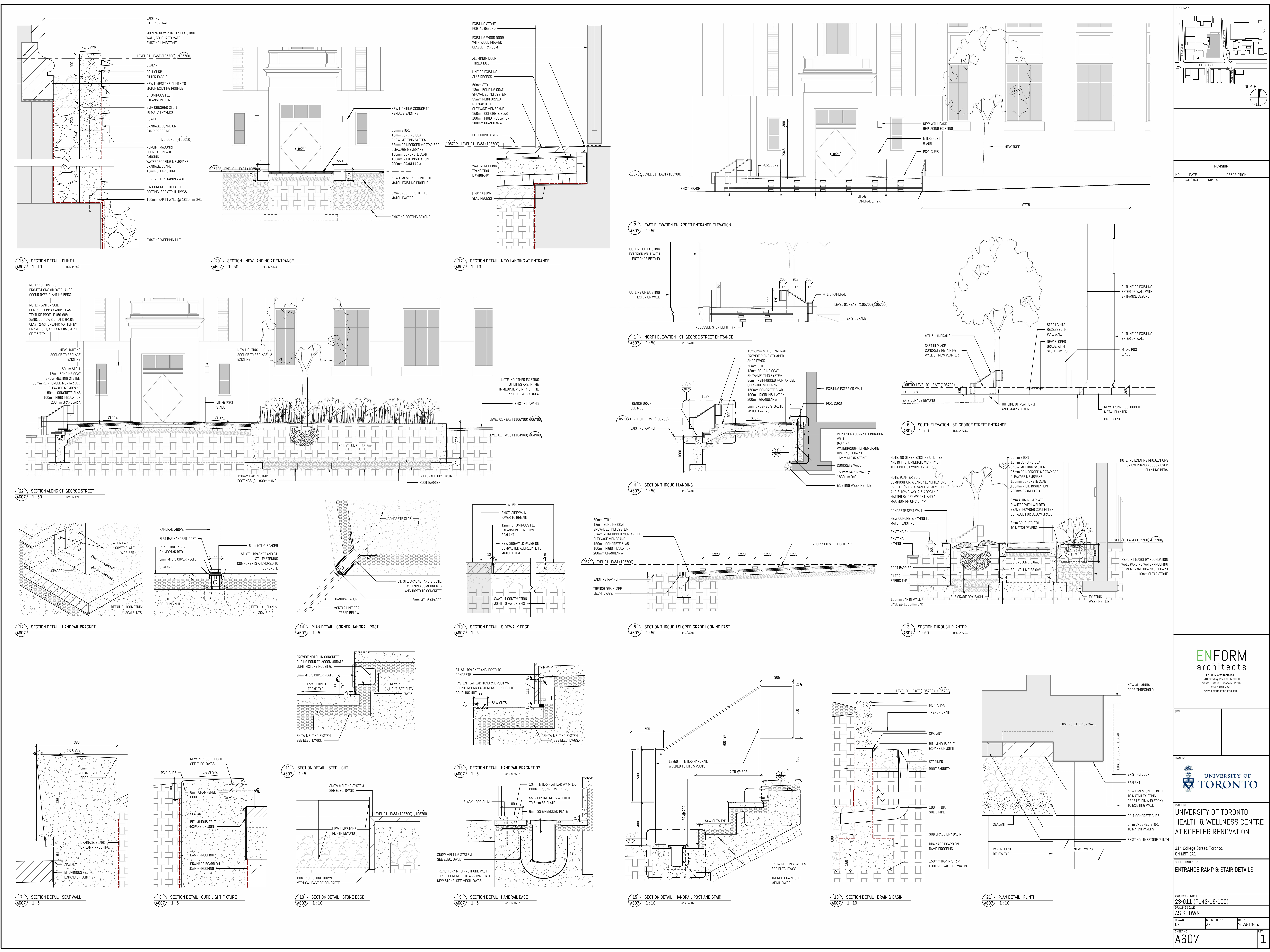
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DRAWN BY: NE CHECKED BY: AF DATE: 2024-10-04

SHEET NO: **A503** REV: **2**



| REVISION | | |
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| NO. | DATE | DESCRIPTION |
| 1 | 09/10/2024 | ISSUING SET |

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SHEET CONTENTS:
ENTRANCE RAMP & STAIR DETAILS

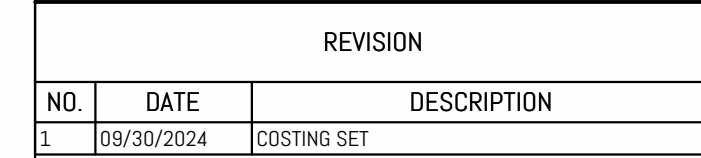
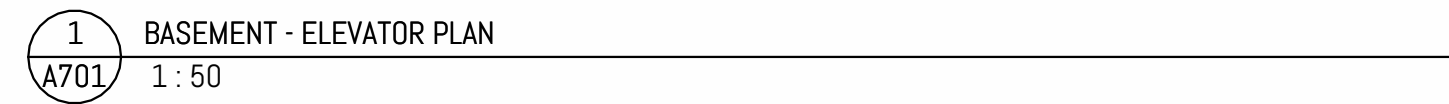
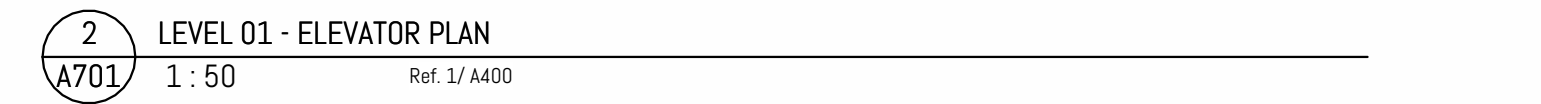
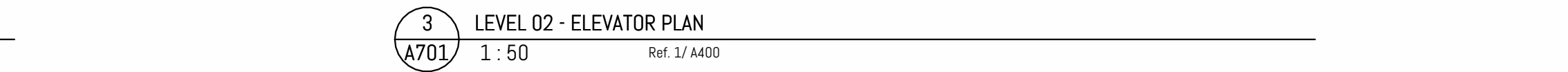
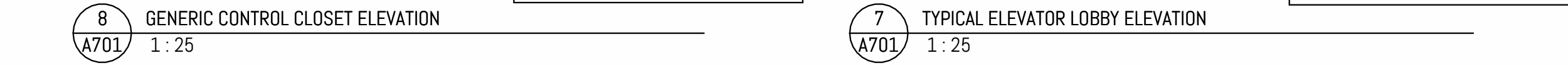
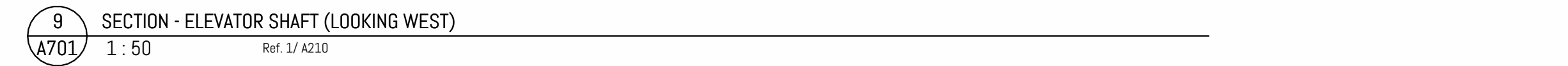
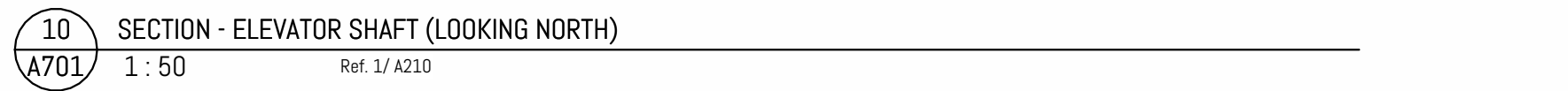
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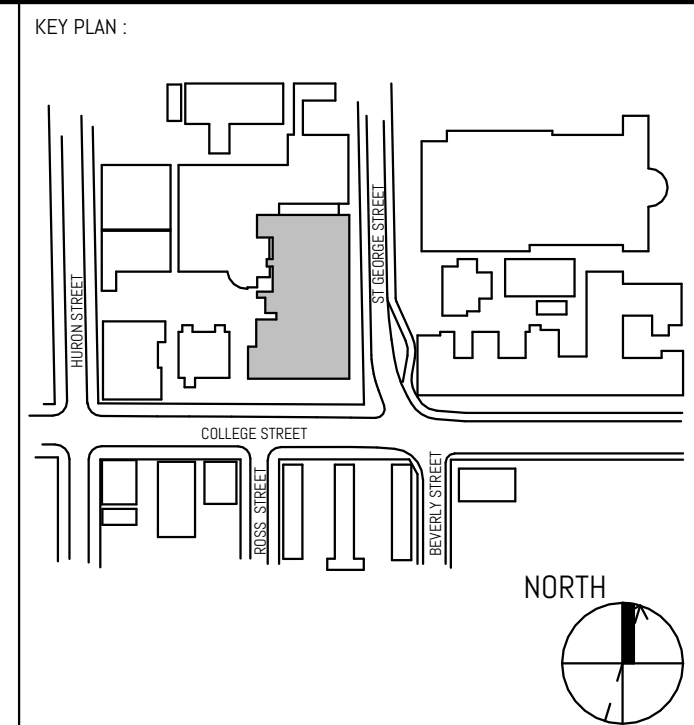
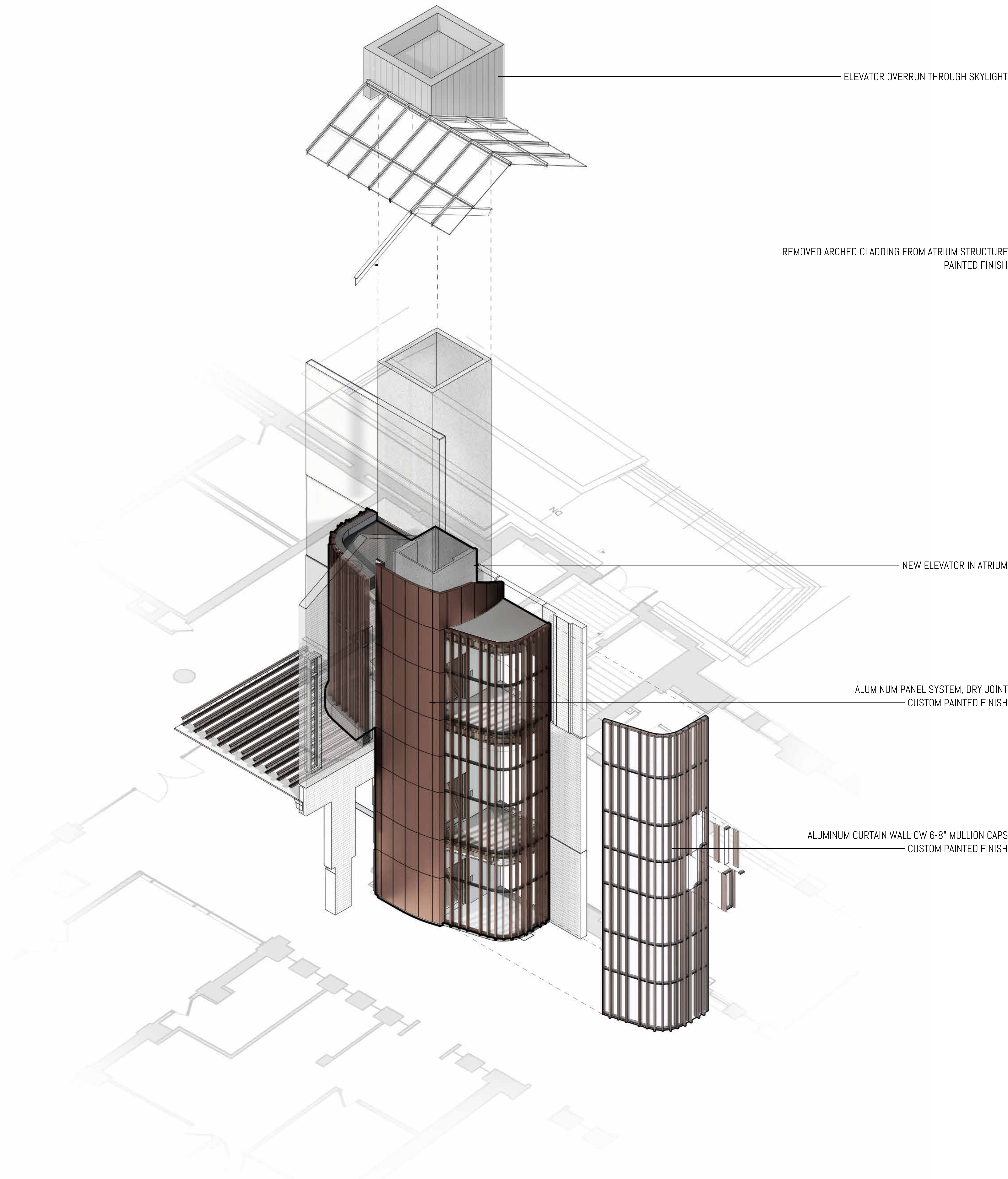
DRAWING SCALE:
AS SHOWN

DRAWN BY: NE
CHECKED BY: AF
DATE: 2024-10-04

SHEET NO:
A607

REV: 1



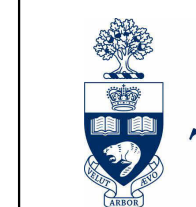


| REVISION | | |
|----------|------------|-------------|
| NO. | DATE | DESCRIPTION |
| 1 | 09/10/2024 | ISSUING SET |

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OWNER:

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PROJECT:

**UNIVERSITY OF TORONTO
HEALTH & WELLNESS CENTRE
AT KOFFLER RENOVATION**

214 College Street, Toronto,
ON M5T 3A2

SHEET CONTENTS:

ELEVATOR AND LIFT DETAILS

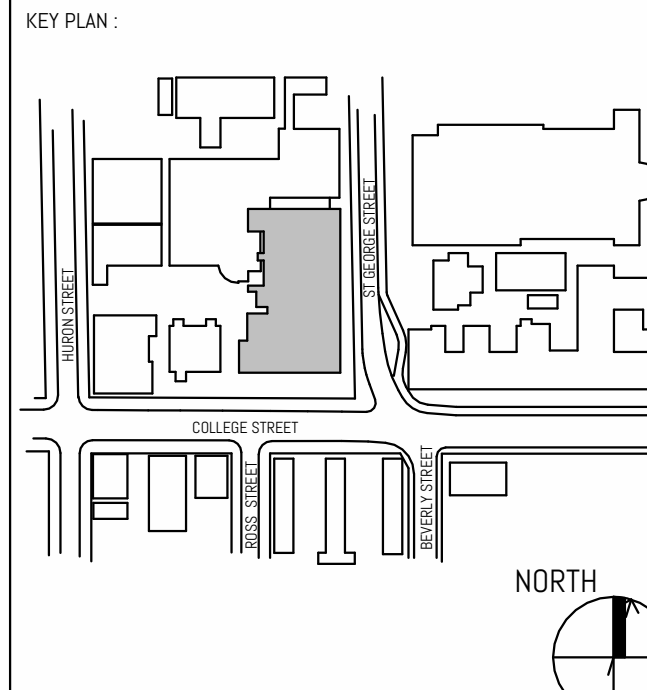
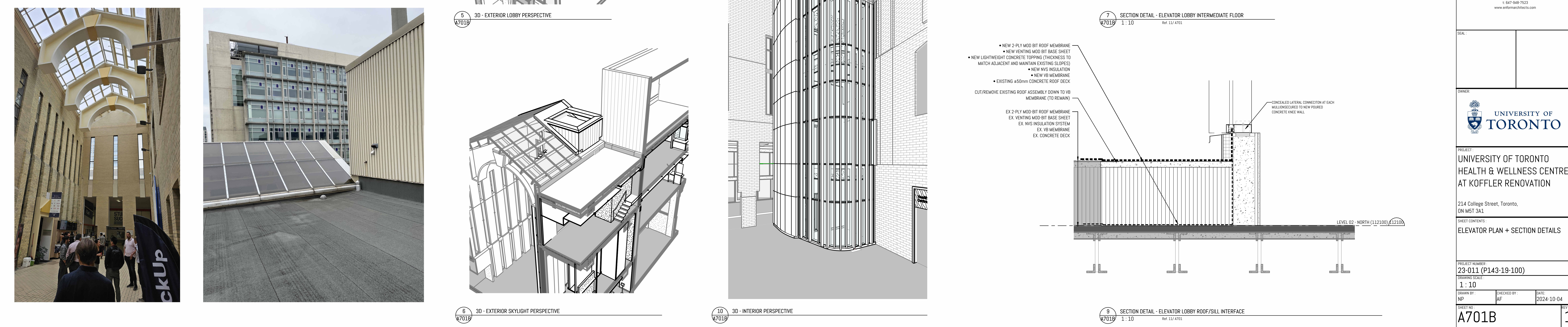
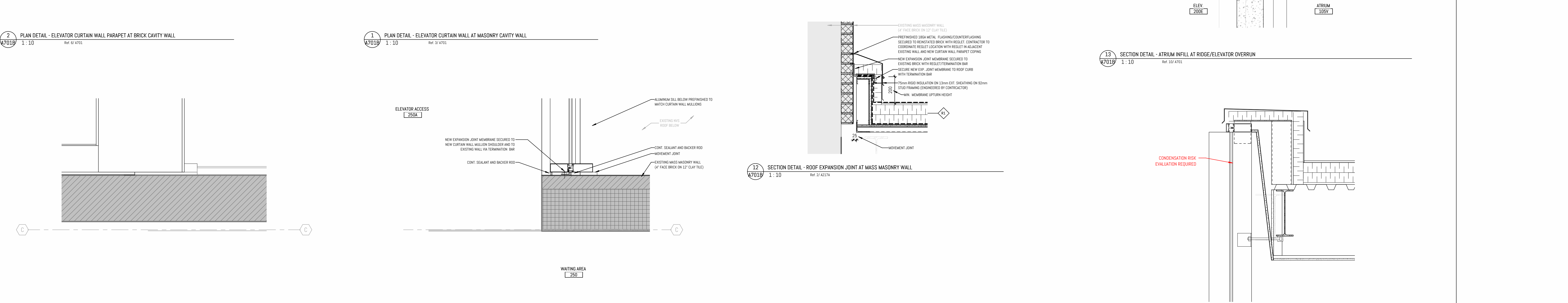
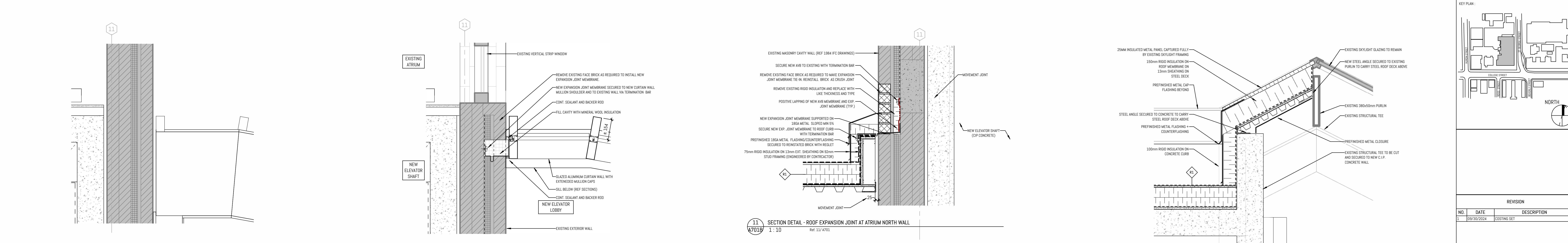
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23-011 (P143-19-100)

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DRAWN BY: **AD** CHECKED BY: **AF** DATE: **2024-10-04**

SHEET NO. **A701A** REV. **1**



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| NO. | DATE | DESCRIPTION |
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SHEET CONTENTS:
ELEVATOR PLAN + SECTION DETAILS

PROJECT NUMBER:
23-011 (P143-19-100)

DRAWING SCALE:
1 : 10

DRAWN BY: ADP CHECKED BY: JAF DATE: 2024-10-04

SHEET NO:
A701B



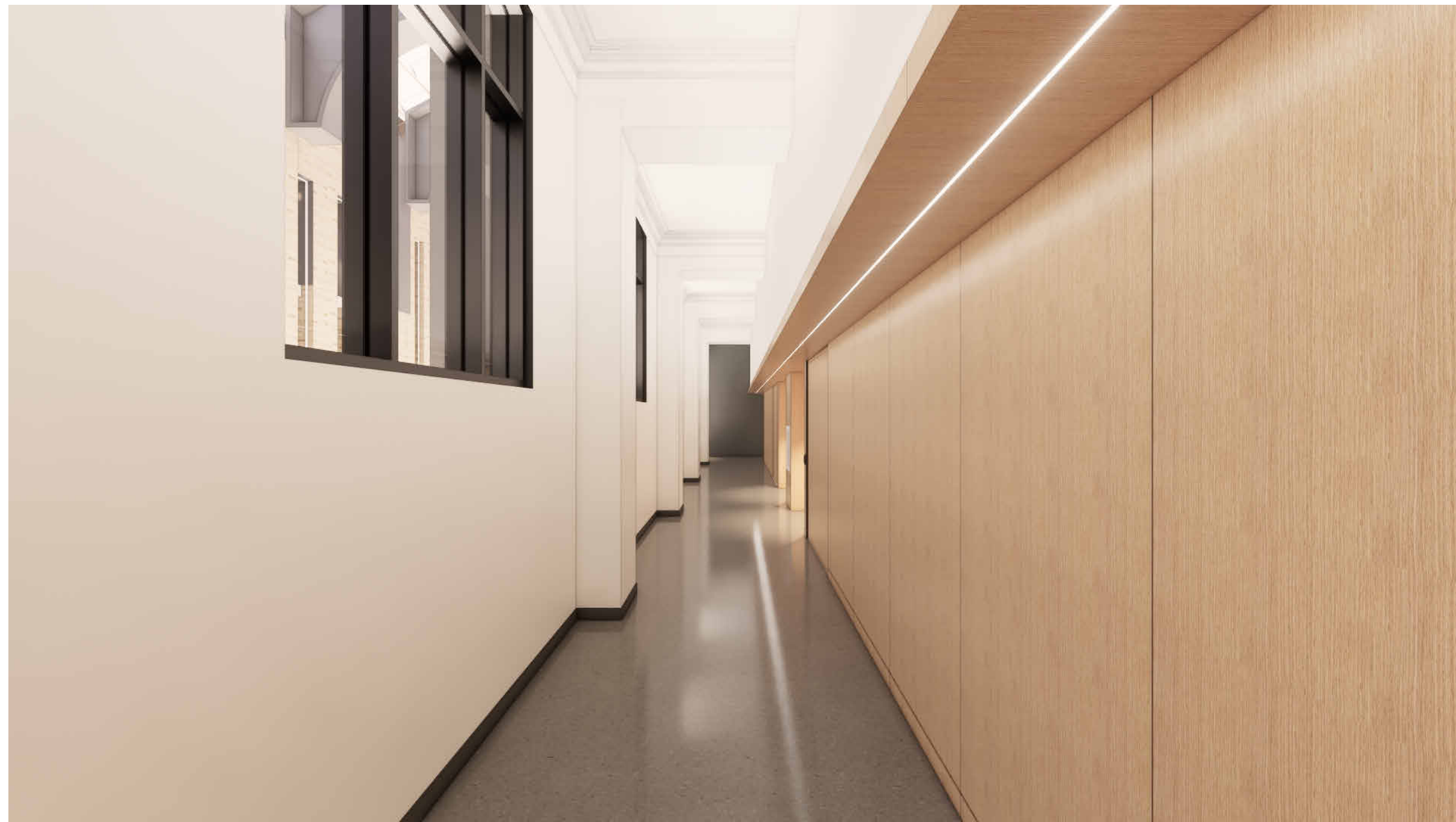
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ARTIST RENDERING - GROUND FLOOR WAITING AREA



ARTIST RENDERING - SECOND FLOOR MULTIPURPOSE ROOM



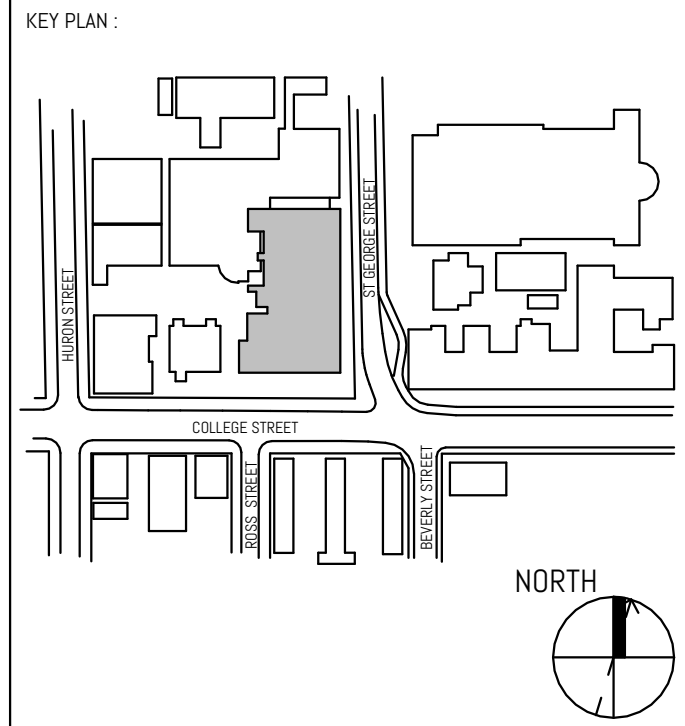
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ARTIST RENDERING - THIRD FLOOR CORRIDOR LOOKING SOUTH



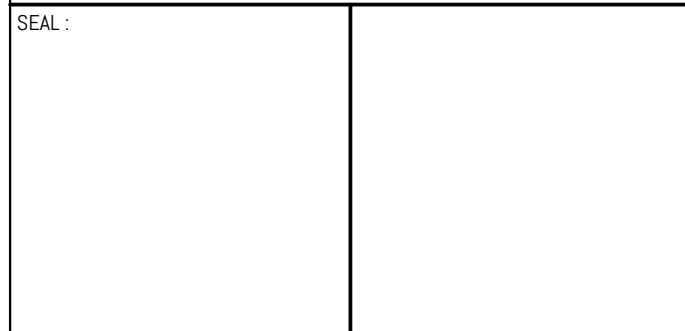
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| NO. | DATE | DESCRIPTION |
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SHEET CONTENTS:
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PROJECT NUMBER:
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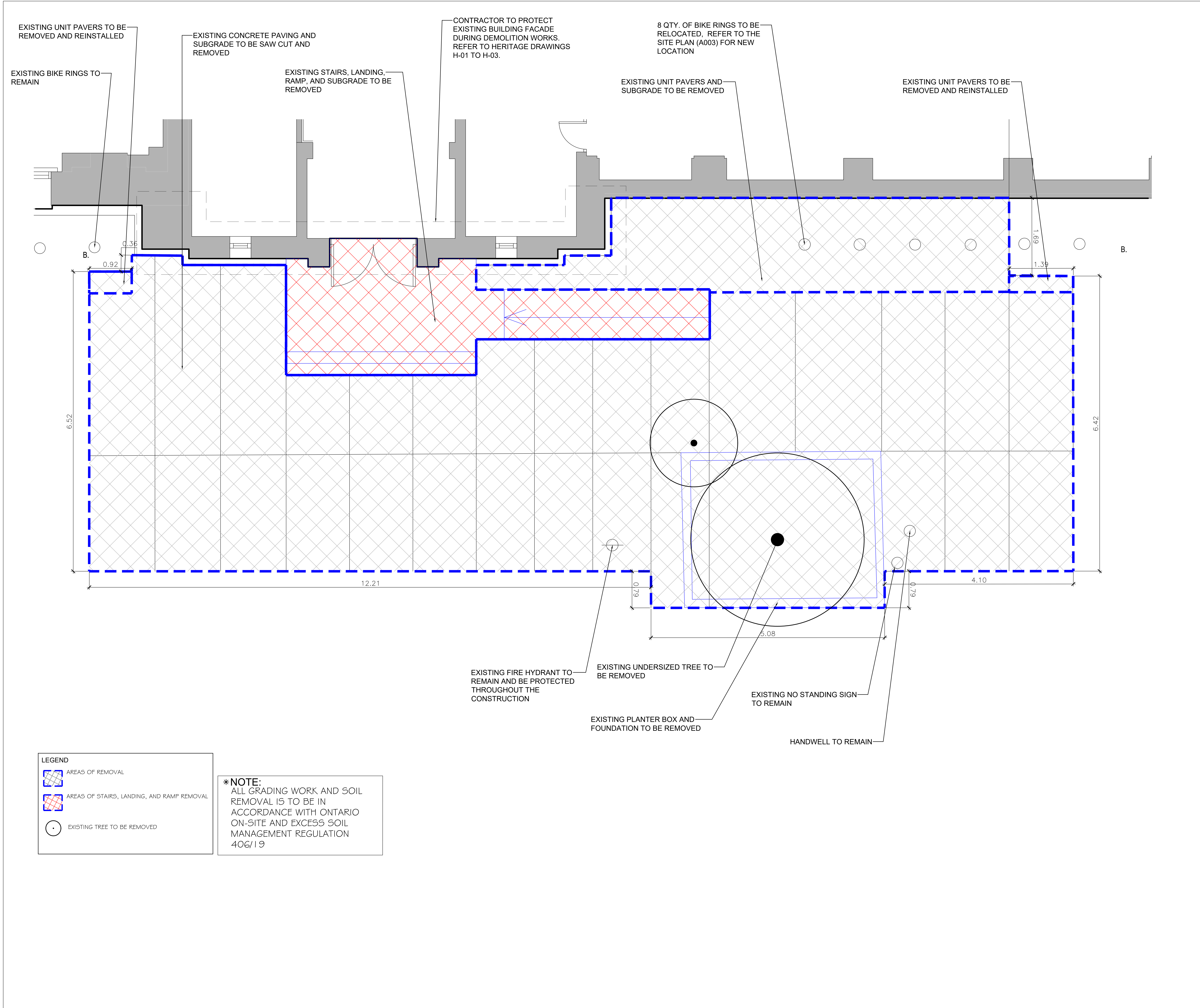
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| SHEET NO: A800 | REV: 1 |
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Appendix D

LANDSCAPE DRAWING
PACKAGE



LOCATION MAP

GENERAL NOTES

THE LOCATION OF PROPERTY LINES, ELEVATIONS AND FACILITIES ON THIS PLAN WERE DRAWN ON THE BASIS OF A DIGITAL SITE PLAN OR SURVEY DATA PROVIDED BY OTHER CONSULTANTS.

IT IS THE RESPONSIBILITY OF THE CLIENT AND HIS CONTRACTORS TO CONFIRM THE ACCURACY OF THE SETBACKS, LOCATIONS AND GRADES ETC. ANY VARIATIONS BETWEEN EXISTING CONDITIONS AND THIS PLAN SHOULD BE ADJUSTED ON SITE AND REPORTED TO THE CONSULTING LANDSCAPE ARCHITECT TO DETERMINE THE IMPACT OF THE VARIATIONS ON THE SUITABILITY OF THE PROPOSED DEVELOPMENT.

CONSTRUCTION MUST CONFORM TO ALL CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

REVISIONS

| NO. | DATE | NOTES |
|-----|------------|-----------------|
| 01 | 2024-02-16 | BUILDING PERMIT |
| | | |
| | | |
| | | |
| | | |

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230 Westney Road S Unit 308, Ajax, ON L1S 7J5
Or (905) 839-5599 | Email: info@kla.ca | Web: www.kla.ca

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND THE LANDSCAPE ARCHITECT RETAINS OWNERSHIP OF THESE DRAWINGS. THEY ARE FOR SITE PLAN APPROVAL ONLY AND MAY REQUIRE FURTHER CONSTRUCTION DETAILING AND COORDINATION WITH OTHER ASSOCIATED PROFESSIONAL DESIGN SERVICES BEFORE ACTUAL TENDER AND CONSTRUCTION COMMENCES. DIMENSIONS ARE TO BE VERIFIED PRIOR TO CONSTRUCTION. DRAWINGS ARE NOT TO BE SCALED. IT IS ADVISED THAT CONTRACTORS CONTACT THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION TO ENSURE THE USE OF THE LATEST REVISED DRAWINGS. THE LANDSCAPE ARCHITECT IS NOT LIABLE FOR ERRORS OR OMISSIONS ARISING FROM UTILIZATION OF THESE PLANS BEFORE THE SAID DRAWINGS ARE SEALED, SIGNED AND DATED. AND THE LANDSCAPE ARCHITECT IS CONTRACTED TO PROVIDE CONSTRUCTION ADMINISTRATION AND CERTIFICATION SERVICES BY THE OWNER. ALL APPARENT DISCREPANCIES ARE TO BE REPORTED IN WRITING TO THE LANDSCAPE ARCHITECT BEFORE CONSTRUCTION COMMENCES.

KEY PLAN (NTS)

SEAL

PROJECT TITLE

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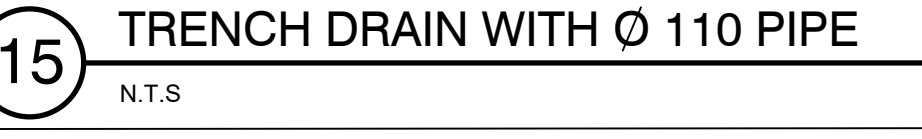
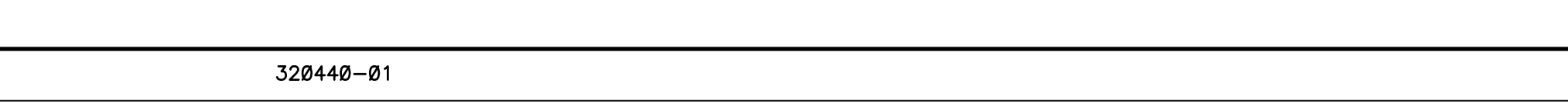
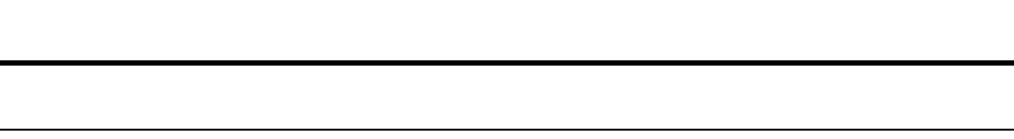
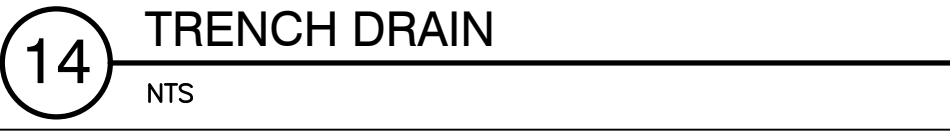
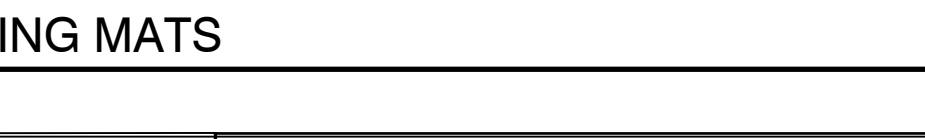
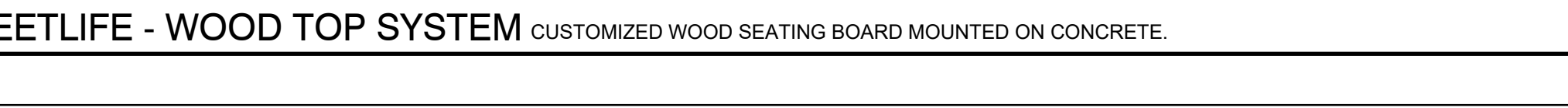
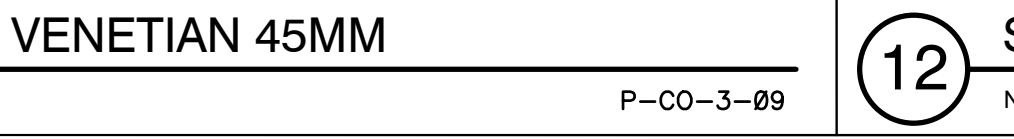
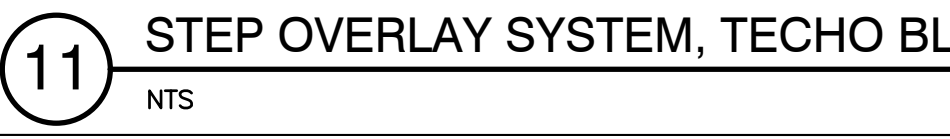
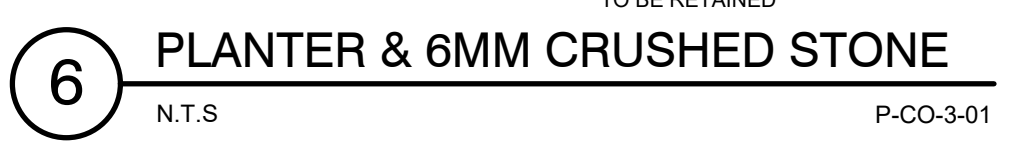
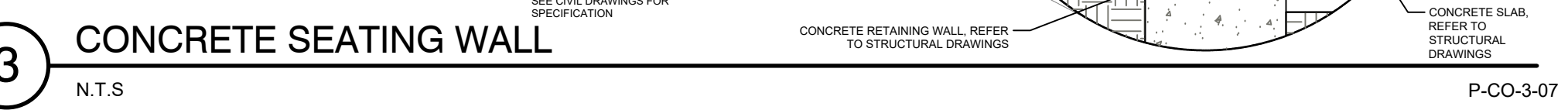
HEALTH & WELLNESS CENTRE AT KOFFLER RENOVATION

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DRAWING SHEET TITLE

REMOVALS PLAN

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| REVIEWED BY: TM | DATE CREATED: 31-OCTOBER-2023 |
| UNIVERSITY PROJECT NUMBER | NORTH POINT |
| P143-19-100 | |
| DRAWING NUMBER | REV. NUMBER |
| L-RP | 1 |



REVISIONS

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KEY PLAN (NTS) SEA



214 College Street

DRAWING SHEET TITLE

DETAIL PLAN

DETAIL PLAN

| | | | |
|-----------|----|-----------------|----------|
| DRAWN BY: | FL | SCALE: | AS SHOWN |
| | | 24 OCTOBER 2011 | |

| | |
|---------------------------|-------------------------------|
| REVIEWED BY: TM | DATE CREATED: 31-OCTOBER-2011 |
| UNIVERSITY PROJECT NUMBER | NORTH POINT |

P143 19 100

F 143-19-100 [illegible]

DRAWING NUMBER: **1001** REV. NUMBER: **1**

| | |
|-------------|----------|
| L-D1 | 1 |
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Appendix E

HERITAGE DRAWING
PACKAGE



1 DETAIL PHOTO OF AREA FOR HERITAGE REHABILITATION
H-01 NTS

ABBREVIATIONS

| | |
|----------------|---------------------------------|
| ELE | ELEVATOR |
| GAU | GAUGE |
| c/c | CENTER TO CENTER |
| RR | RISER |
| ¢ | CENTER LINE |
| PW | PLYWOOD |
| FD | FLOOR DRAIN |
| FRR | FIRE RESISTANCE RATING |
| DN | DOWN |
| EQ | EQUAL |
| UP | UP |
| ELEC | ELECTRICAL |
| THK | THICKNESS |
| STR | STAIR |
| EXT | EXTERIOR |
| RL | RAILING |
| h | HOUR |
| H | HEIGHT |
| OC | OFF-CONTRACT |
| INT | INTERIOR |
| INV | INVERTED |
| STC | SOUND TRANSMISSION CLASS RATING |
| m | METERS |
| m ² | SQUARE METERS |
| MAX | MAXIMUM |
| HR | HANDRAIL |
| MEC | MECHANICAL |
| MIN | MINIMUM |
| min. | MINUTES |
| MIR | MIRROR |
| mm | MILLIMETERS |
| RO | ROUGH OPENING |
| TS | FIRE SEPARATION |
| UOI | UNLESS OTHERWISE INDICATED |
| SIM | SIMILAR |
| STR | STRUCTURE |
| TYP | TYPICAL |
| VAR | VARIABLE |

TAGS LEGEND

NOM DE LA PIÈCE

000 ROOM DESCRIPTION
00m2 ROOM NUMBER

00 WINDOW TYPE

0000 DOOR NUMBER

ASSEMBLY TYPE

W0 WALL (EXTERIOR SHELL) TYPE

C0 CEILING TYPE

F0 FLOOR TYPE

N0 FOUNDATION TYPE

R0 ROOF TYPE

PARTITION TYPE (INTERIOR WALL)

PARTITION TYPE NUMBER

ADDITIONAL INFORMATION (IF REQUIRED):

- m = REBAR OFFSHORE BY A MOLD AND MILDREW RESISTANT GYPSUM (HEAVY MOLD SIDE)
- c = 150mm MOULD FINISH CEILING
- u = UNDER THE FINISH CEILING
- d = DRAINAGE WALL

*UNLESS OTHERWISE STATED, THE PARTITION IS FULL HEIGHT (SLAB TO SLAB)

XX/XX XX/XX MATERIAL AND FINISH

WATER, ITS PROPERTIES IDENTIFIER

FINISH AND ITS PROPERTIES IDENTIFIER

FLOOR MATERIAL AND FINISH

BASEBOARD MATERIAL AND FINISH

ACCM ACCESSORY TYPE

EQUIPMENT OR FURNITURE TYPE

0 REVISION NUMBER

| SHEET LIST | | | |
|------------|---------------------------------|--------|------------|
| # | SHEET NAME | REV. # | DATE |
| H-01 | COVER | 3 | 2024-11-15 |
| H-02 | HERITAGE PLANS | 3 | 2024-11-15 |
| H-03 | HERITAGE ELEVATIONS AND DETAILS | 3 | 2024-11-15 |



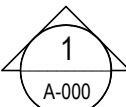




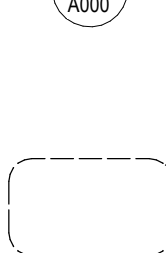
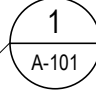
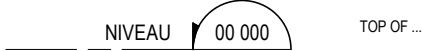

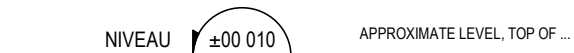



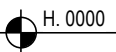
HERITAGE SCOPE SUMMARY

REFER TO COMPLETE SET OF CONTRACT DOCUMENTS FOR TOTAL SCOPE OF WORK IN CONTRACT

1. REMOVAL AND SALVAGE

- 1. **REPAIRS**
 - REMOVAL OF DETERIORATED STONE CLADDING FOR DUTCHMAN REPAIRS.
 - REMOVAL OF EXISTING WOOD ENTRANCE DOOR FOR REPAIRS AND REINSTALLATION.
- 2. **MASONRY**
 - CLEANING AND REPAIRS TO STONE FACADE.
 - REPOINTING OF MORTAR JOINTS.
 - RECREATION AND INSTALLATION OF MISSING PROFILES AND CARVED STONES.
- 3. **WINDOWS & DOORS**
 - MISCELLANEOUS REPAIRS TO EXISTING WOOD WINDOWS AND DOORS.
 - REFINISHING WOOD WINDOWS AND DOORS.
 - RESETTling OR REPLACEMENT OF GLASS LITES.
 - EXISTING HARDWARE RESTORATION.

SYMBOLS LEGEND

| | |
|---|--|
|  | GRID IDENTIFICATION BUBBLE |
|  | EXISTING GRID IDENTIFICATION BUBBLE, GRID XA, XB, XC, XI, X2, X3 |
| <hr/> | |
|  | GENERAL ELEVATION REFERENCE |
|  | GENERAL SECTION REFERENCE |
|  | WALL SECTION REFERENCE |
|  | INTERIOR ELEVATION REFERENCE |
|  | |
|  | DETAIL REFERENCE |
|  | REFERENCE TO A VIEW |
| <hr/> | |
| LEVEL BUBBLE IN SECTION OR ELEVATION | |
|  | TO P OF - |
|  | BOTTOM OF - |
|  | APPROXIMATE LEVEL, TOP OF - |
|  | APPROXIMATE LEVEL, BOTTOM OF - |
|  | LESS IMPORTANT LEVEL OR SPECIFIC ELEMENT LEVEL, TOP OF - |
|  | LESS IMPORTANT LEVEL OR SPECIFIC ELEMENT LEVEL, BOTTOM OF - |
| <hr/> | |
|  | SPOT ELEVATION BUBBLE DIFFERENCE BETWEEN FLOOR AND CEILING, IN PLAN |

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T. 647-723-2030

PRIME ARCHITECTS / PROJECT MANAGER

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| 2 | ISSUED FOR BID PACKAGE #01 | | MM | 2024-02-16 |
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PROJECT

UNIVERSITY OF TORONTO HEALTH &
WELLNESS CENTRE AT KOFFLER

DRAWING TITLE:

COVER

| | | | |
|-----------|-------|-------------|--------------|
| DESIGNED: | DC | PROJECT N°: | 9385-20-00 |
| DRAWN: | EC/MM | DATE: | 2023-10-01 |
| VERIFIED: | DC | SCALE: | As indicated |

DRAWING N°

H-01

**UNIVERSITY OF TORONTO HEALTH &
WELLNESS CENTRE AT KOFFLER**

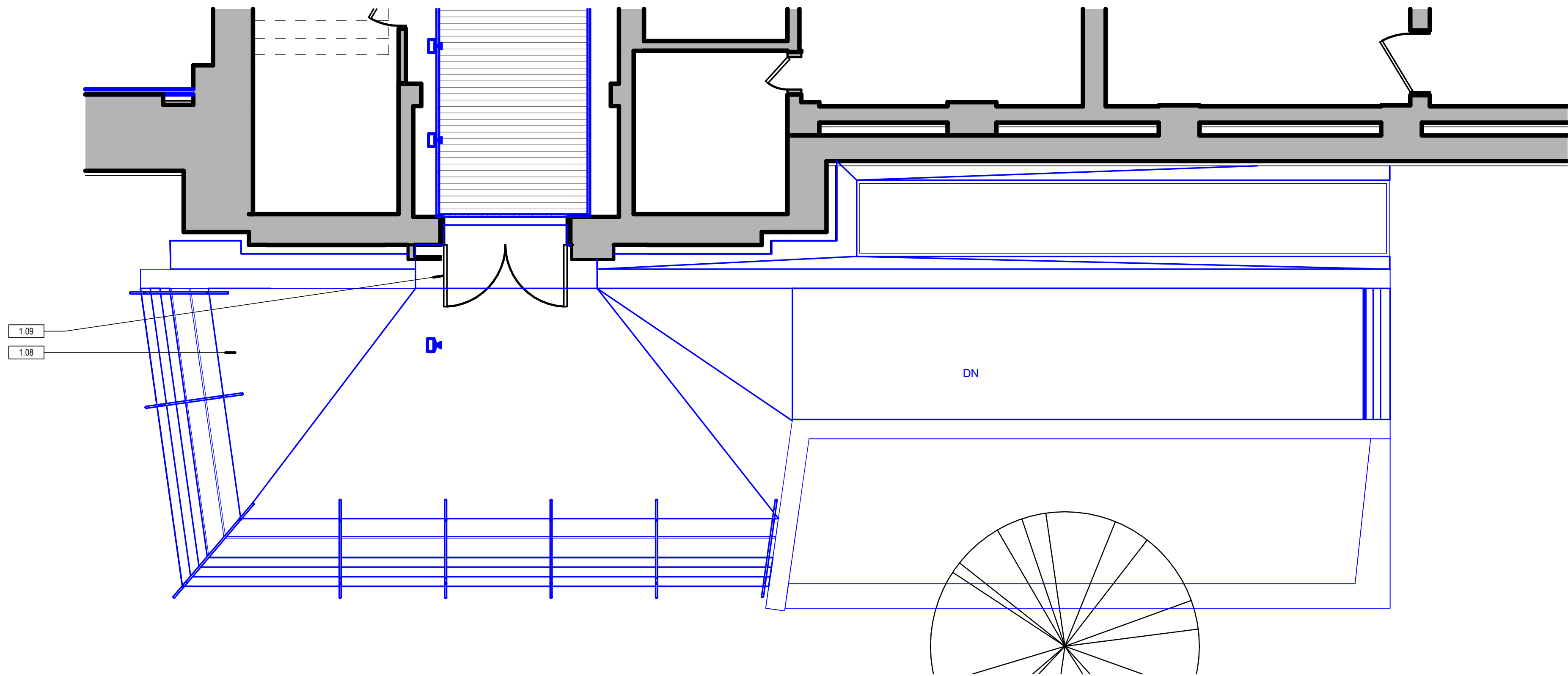
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UNIVERSITY PROJECT NO.: P143-19-100
EVOQ PROJECT NO.: 9385-20-00

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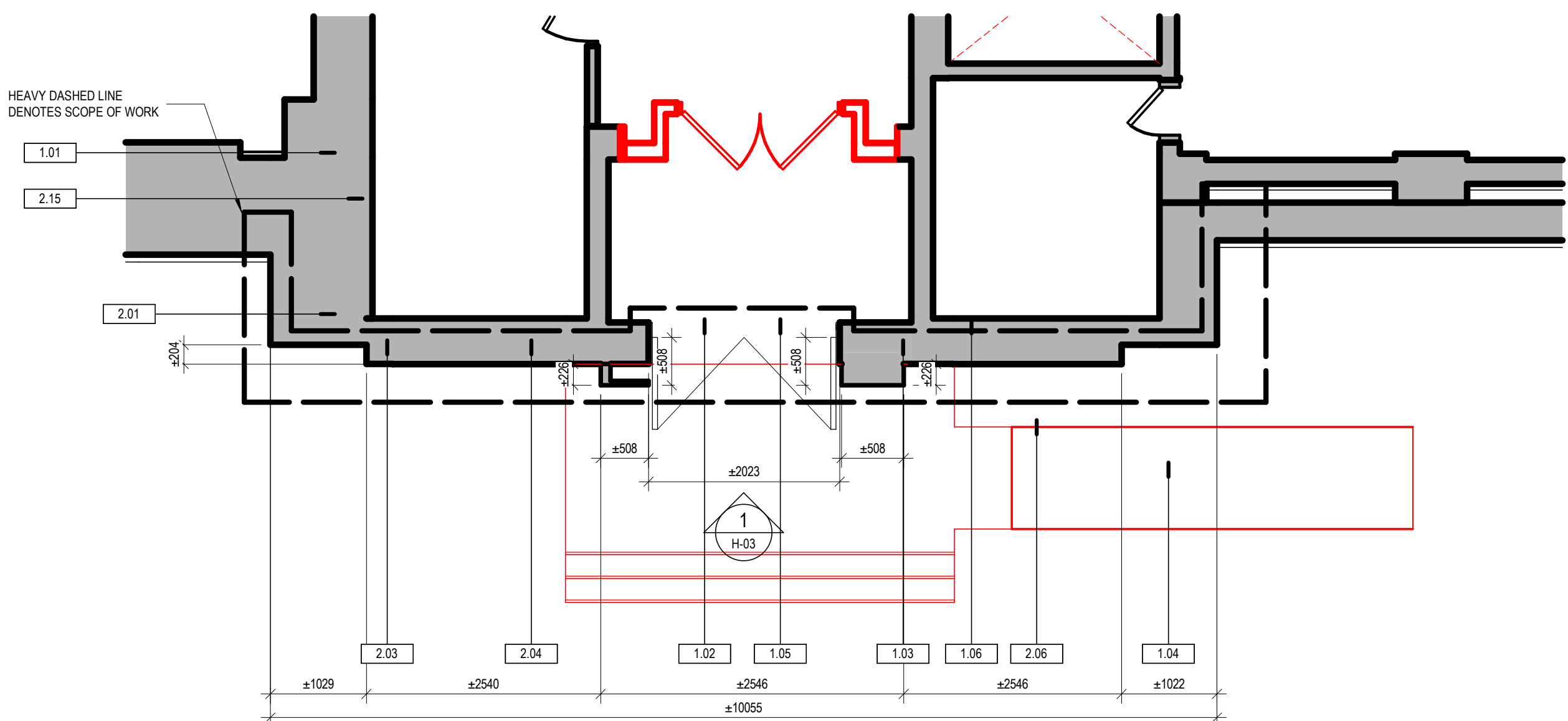
| # | Keynote |
|----|--|
| 01 | REPAIR AND REFINISH EXISTING DOORS, TRANSOM, JAMBS, CASING, FRAMES, AND HARDWARE. |
| 02 | STRIP DOORS, TRANSOM, JAMBS, CASING, & FRAMES OF ALL FINISHES BACK TO BARE WOOD, CLEAN, REPAIR, AND REPAINT OR STAIN TO MATCH ORIGINAL FINISH. |
| 03 | REPAIR HOLES FROM OLD HARDWARE, TYP. |
| 04 | REMOVE, CLEAN, AND REINSTALL ALL HARDWARE, TYP. |
| 05 | REPLACE GLASS AND BUILDING IDENTIFICATION ON DOORS. |
| 06 | REMOVE, CLEAN, AND REINSTALL GLASS ON NEWLY SET BED FROM TRANSOM. |
| 07 | REINSTALL FRAMES, DOORS, AND TRANSOM TO EXISTING LOCATION. |
| 08 | REPLACE ALL CAULKING AND SEALANTS. |
| 09 | REPLACE ALL WEATHERSTRIPPING. |

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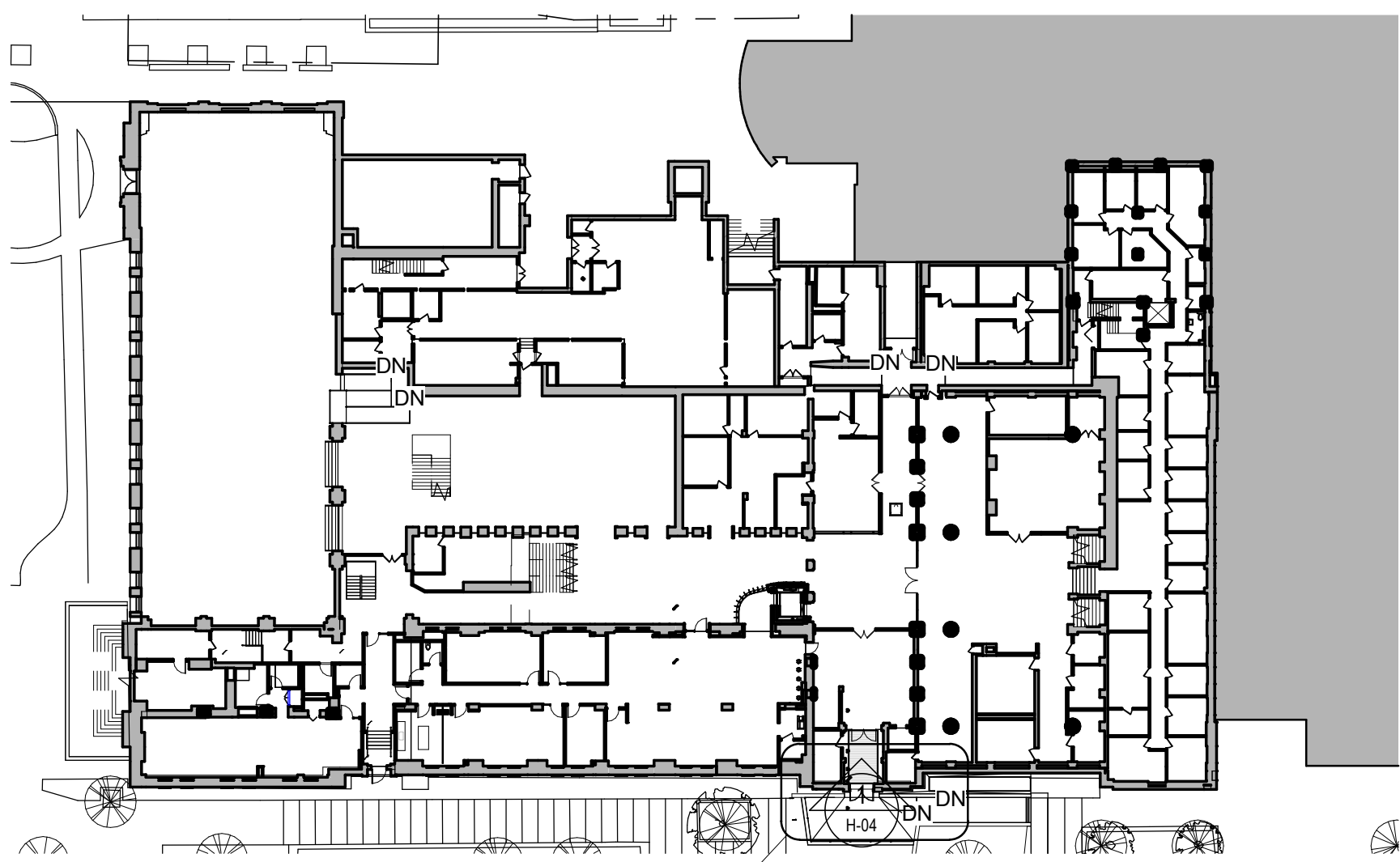
H-02



FLOOR PLAN - CONSTRUCTION
3 GROND FLOOR PLAN HERITAGE NEW CONSTRUCTION PLAN
H-02 1 : 50



FLOOR PLAN - CONSTRUCTION
2 GROUND FLOOR PLAN HERITAGE REHABILITATION PLAN
 H-02 1 : 50



1
H-02

FLOOR PLAN - CONSTRUCTION
KEY PLAN - GROUND FLOOR
1 : 500



7 CORNER OF PLINTH - DETAIL PHOTO
H-03 1:1



3 EAST ELEVATION - DETAIL PHOTO
H-03 NTS



5 EAST ELEVATION - DETAIL PHOTO
H-03 NTS



2 EAST ELEVATION - DETAIL PHOTO
H-03 1:20



4 EAST ELEVATION - DETAIL PHOTO
H-03 NTS



1 EAST ELEVATION HERITAGE SCOPE OF WORK AREA
H-03 1:50

GENERAL PROTECTION NOTES

- PRIOR TO CONSTRUCTION, ALL EXISTING CONDITIONS ARE TO BE THOROUGHLY PHOTOGRAPHED AND DOCUMENTED IN ORDER TO ESTABLISH A RECORD OF THE BUILDING PRIOR TO CONSTRUCTION. THE HERITAGE MATERIALS ARE TO BE TAGGED, CATALOGUED, PHOTOGRAPHED, AND DOCUMENTED PRIOR TO THEIR DISMANTLING.
- PROTECT ALL HERITAGE MATERIALS REMAINING IN SITU FOR THE DURATION OF CONSTRUCTION.
- PROTECTION MEASURES INCLUDE:
 - PROVIDE PROTECTION AT ALL INTERIOR PATHS OF TRAVEL DURING CONSTRUCTION.
 - PROVIDE LIVE VIBRATION MONITORING SYSTEM TO TRACK CONSTRUCTION-RELATED VIBRATIONS.
 - ENSURE STRUCTURAL WORK DOES NOT CAUSE INADVERTENT DAMAGE TO DECORATIVE PLASTER.
 - MAINTAIN TEMPERATURE AND HUMIDITY LEVELS.
- CAREFUL OVERSIGHT IS REQUIRED DURING THE CONSTRUCTION PROCESS TO PREVENT DAMAGE TO HERITAGE MATERIALS. THIS WILL INCLUDE HERITAGE ELEMENTS LOCATED WITHIN THE PROPOSED AREA OF SCOPE AS WELL AS AREAS OF CONSTRUCTION ACCESS OUTSIDE OF THE PROPOSED SCOPE OF WORK WHERE THERE ARE EXISTING HERITAGE ELEMENTS.
- SHOULD ANY CONCEALED MATERIALS OR SYSTEMS THAT MAY POTENTIALLY BE HERITAGE IN NATURE BE DISCOVERED WITHIN THE SITE DURING WORK, ACTIVITIES SHOULD BE HALTED AT THAT LOCATION IMMEDIATELY AND THE CONSULTANT SHOULD BE NOTIFIED TO REVIEW.

GENERAL DISMANTLING NOTES

- COORDINATE ALL WORK WITH THE DEMOLITION WORK OF THE EXTERIOR RAMP. REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS FOR EXTERIOR STAIR SCOPE.
- DISMANTLE HERITAGE MATERIALS TO BE REMOVED DURING CONSTRUCTION. DO NOT DEMOLISH OR DAMAGE. DISMANTLING MEASURES INCLUDE:
 - PROPER HANDLING AND STORAGE OF ALL SALVAGED HERITAGE MATERIALS TO BE REINSTALLED ON THE BUILDING SO AS TO NOT INADVERTENTLY DAMAGE THESE MATERIALS DURING THE CONSTRUCTION PROCESS.
 - CAREFUL DISMANTLING OF THE EXISTING EAST EXIT RAMP AND STAIRS TO MINIMIZE DAMAGE TO THE BUILDING'S STONE WALL.

GENERAL, PROTECTION, & DISMANTLING KEYNOTES

| # | Keynote |
|------|---|
| 1.01 | PRIOR TO CONSTRUCTION, REVIEW AND IMPLEMENT GENERAL PROTECTION AND DISMANTLING REQUIREMENTS. |
| 1.02 | ENSURE PROTECTION MEASURES NOTED IN GENERAL PROTECTION NOTES ARE IMPLEMENTED PRIOR TO PROCEEDING WITH DISMANTLING WORK. |
| 1.03 | DISMANTLE MATERIALS TO BE REMOVED DURING CONSTRUCTION WHEN IN RELATION TO HERITAGE SCOPE OF WORK. DO NOT DEMOLISH OR DAMAGE. |
| 1.04 | CAREFULLY DISMANTLE EXISTING ENTRANCE RAMP AND STAIRS TO MINIMIZE DAMAGE TO BUILDING'S MASONRY. COORDINATE ALL WORK WITH THE DEMOLITION WORK OF THE EXTERIOR RAMP. REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS FOR RAMP AND EXTERIOR STAIR SCOPE. |
| 1.05 | EXISTING DOOR AND TRANSOM TO BE REMOVED FOR REHABILITATION IN CONTRACTORS SHOP. |
| 1.06 | REMOVE EXISTING DOOR CONTROLS, LIGHT FIXTURES, SIGNAGE, AND OTHER MOUNTED FIXTURES. COORDINATE STORAGE OR DISPOSAL WITH UNIVERSITY. |
| 1.07 | INSTALL PAVING, MEMBRANE, AND DRAINAGE BOARD TO SEPARATE PROPOSED NEW RAMP AND STAIR FROM THE EXISTING FOUNDATION WALL BEHIND. REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS. |
| 1.08 | NEW STAIRS, LANDING, RAMP, HANDRAILS. REFER TO ARCHITECTURAL. |
| 1.09 | REINSTALL REHABILITATED HERITAGE DOOR AND TRANSOM. |

MASONRY KEYNOTES

| # | Keynote |
|------|--|
| 2.01 | CLEAN 100% OF SCOPE AREA TO REMOVE ALL ATMOSPHERIC SOILING. MULTIPLE PASSES MAY BE REQUIRED WHERE HEAVY SOILING PRESENT. ASSUME ENTIRE UPPER PLINTH TO REQUIRE REMOVAL OF HEAVY ATMOSPHERIC SOILING. |
| 2.02 | CLEAN ALL GRAFFITI AND FERRIC STAINING FROM MASONRY WITHIN SCOPE OF WORK AREA. |
| 2.03 | REPOINT 100% OF MASONRY JOINTS IN SCOPE AREA. |
| 2.04 | SCALE AND RUB BACK TO SOUND SURFACE 100% OF SCOPE AREA TO REMOVE LOOSE STONE FROM SURFACE. |
| 2.05 | STAR HATCH DENOTES AREA TO POULTICE FOR SALT REMOVAL. WIDTH AS INDICATE IN PLANS AND TO APPROXIMATELY 1 m IN HEIGHT. |
| 2.06 | CONSOLIDATE EXISTING MASONRY FOUNDATION WHERE THE CONCRETE LANDING IS BEING REMOVED. |
| 2.07 | REPAIR SMALL HOLES FROM EXISTING FIXTURES BEING DISMANTLED OR OTHERWISE. INCLUDES LIGHTING, SIGNAGE, SECURITY HARDWARE, ACCESS HARDWARE, AND MISCELLANEOUS HOLES. TYP. |
| 2.08 | REPAIR EXTERIOR MASONRY WALL BEHIND AND WHERE THE EXISTING ENTRANCE DOOR FRAME IS BEING REMOVED. |
| 2.09 | REMOVE CAULKING FROM STONE LEFT BY DOOR JAMBS AND FIXTURES. |
| 2.10 | REMOVE PATCH AND COMPLETE DUTCHMAN REPAIR TO REINSTATE PLINTH PROFILE. |
| 2.11 | PERFORM DUTCHMAN REPAIR APPROXIMATELY 125 mm x 200 mm x 900 mm IN SIZE, MATCH EXISTING STONE DETAILING. |
| 2.12 | PERFORM LOCALIZED SCULPTURAL MORTAR REPAIRS TO DECORATIVE STONEMWORK. CUT BACK STONE PLINTH 100 mm, REMOVE PATCH THEN COMPLETE DUTCHMAN REPAIR TO REINSTATE PLINTH PROFILE. |
| 2.14 | PERFORM CRACK INJECTION REPAIR TO MINOR CRACKS IN STONE. |
| 2.15 | REMOVE FRAGMENTED CORNER PLINTH PIECE AND PERFORM DUTCHMAN REPAIR. |

DOOR REHABILITATION KEYNOTES

| # | Keynote |
|------|--|
| 3.01 | REPAIR AND REFINISH EXISTING DOORS, TRANSOM, JAMBS, CASING, FRAMES, AND HARDWARE. |
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| 3.03 | REPAIR HOLES FROM OLD HARDWARE. TYP. |
| 3.04 | REMOVE, CLEAN, AND REINSTALL ALL HARDWARE. TYP. |
| 3.05 | REPLACE GLASS AND BUILDING IDENTIFICATION ON DOORS. |
| 3.06 | REMOVE, CLEAN, AND REINSTALL GLASS ON NEW PUTTY BED FROM TRANSOM. |
| 3.07 | REINSTALL FRAMES, DOORS, AND TRANSOM TO EXISTING LOCATION. |
| 3.08 | REPLACE ALL CAULKING AND SEALANTS. |
| 3.09 | REPLACE ALL WEATHERSTRIPPING. |

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PROJECT:

UNIVERSITY OF TORONTO HEALTH & WELLNESS CENTRE AT KOFFLER

DRAWING TITLE:

HERITAGE ELEVATIONS AND DETAILS

| | |
|--------------|------------------------|
| DESIGNED: DC | PROJECT Nº: 9385-20-00 |
| DRAWN: ECMM | DATE: 2023-10-01 |
| VERIFIED: DC | SCALE: N.T.S.caled |
| DRAWING Nº: | |

H-03

Health & Wellness Centre at Koffler Renovation

Toronto, ON
24011017

Prepared For
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ACOUSTIC, NOISE AND VIBRATION CONTROL
Basis of Design Report

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January 9, 2025

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1.0 Introduction

At the request of ENFORM Architects Inc., Thornton Tomasetti (TT) presents this acoustic design review and basis of design report for the renovation of the Health and Wellness Centre at Koffler Building in Toronto, ON (Project).

TT understands that the project consists of interior renovations in the Koffler Student Service Building at the University of Toronto's St. George campus. The 50% CD Drawing Set (October 4, 2024) as well as feedback from previous meetings was used to prepare this report.

The following areas of acoustics are considered for this project based on the currently available information:

- Interior Sound Isolation
- Room Acoustics
- MEP Noise & Vibration Control

The acoustic requirements and recommendations established in this report are based on past TT experience, industry best practices, and commonly referenced guidelines such as the Facility Guidelines Institute's Guidelines for Design and Construction of Hospitals and ASHRAE. As the design progresses, the report will be updated, and a detail list of design recommendations will be provided in a checklist-style Summary of Recommendations, along with associated detail sketches, schedules, and product cut sheets.

Refer to Appendix A for definitions of acoustic terms used throughout this report.

2.0 Interior Sound Isolation

2.1 Speech Privacy Potential

Speech Privacy for enclosed spaces is a function of the sound isolating performance of the demising construction between spaces measured in the field as Noise Isolation Class (NIC) and the background noise level in the receiving space measured in Noise Criteria (NC). The sum of these two metrics is referred to as the Speech Privacy Potential ($SPP = NIC + NC$) and has been found to correlate well with the subjective evaluation of speech privacy shown in Table 1.

Table 1: Subjective evaluation of Speech Privacy Potential

| Privacy | SPP | Subjective evaluation of STC rating |
|-----------|-----|--|
| None | <60 | No speech privacy |
| Poor | 60 | Normal voices audible and intelligible most of the time. |
| Fair | 65 | Normal voices audible and sometimes intelligible. Raised voices intelligible. |
| Good | 70 | Normal voices audible but mostly unintelligible. Raised voices partially intelligible. |
| Very Good | 75 | Normal voices barely audible. Raised voices audible but mostly unintelligible. |

| Privacy | SPP | Subjective evaluation of STC rating |
|-------------|-----|---|
| Excellent | 80 | Normal voices inaudible. Raised voices barely audible but unintelligible. |
| Outstanding | 85 | Shouting barely audible but unintelligible. |

2.2 Sound Transmission Class

Wall and floor/ceiling assemblies provide a certain level of sound isolation between two spaces depending on the assembly. These assemblies are usually specified by sound transmission class (STC) ratings, a laboratory tested rating.

The NIC performance of an assembly in the field will typically measure 5 to 10 points lower than the STC rating. This is due to the influence of flanking paths as well as imperfections in the construction of the assemblies. For this reason, it is recommended that partitions are selected with an STC rating that is 5 to 10 points higher than the required NIC rating so that performance in the field will meet the design criterion. The expected SPP performance based on the design STC rating of the partition, and the receiver room background noise is provided in Table 2

Table 2: Expected Speech Privacy Potential based on partition STC and receiver room background noise level

| Partition STC | SPP based on Receiver Room Background Noise (NC) | | | |
|---------------|--|-------|-------|-------|
| | NC 25 | NC 30 | NC 35 | NC 40 |
| 30 | 45 | 50 | 55 | 60 |
| 35 | 50 | 55 | 60 | 65 |
| 40 | 55 | 60 | 65 | 70 |
| 45 | 60 | 65 | 70 | 75 |
| 50 | 65 | 70 | 75 | 80 |
| 55 | 70 | 75 | 80 | 85 |
| 60 | 75 | 80 | 85 | 85+ |

*Sound masking typically provides approximately NC 35 in enclosed rooms (e.g. private offices), and NC 40 in open spaces (e.g. open offices)

2.3 Assembly Types

Typical assemblies with corresponding STC ratings are provided in Table 3. Project Specific recommended STC ratings are provided in Section 2.6

Table 3: Typical gypsum board constructions to achieve STC ratings

| STC Target | | | Typical Construction |
|------------|------------------|------------------|--|
| Wood Stud | 20 Ga Metal Stud | 25 Ga Metal Stud | |
| 34 | 42 | 45 | 2 layers: 1-layer 5/8" GWB each side of studs. |
| 37 | 47 | 52 | 3 layers: 2 layers 5/8" GWB on one side of studs, single layer on other side. |
| 40 | 52 | 55 | 4 layers: 2 layers 5/8" GWB each side of studs. |
| 47 | 52 | | 2 layers: Staggered stud with 1-layer 5/8" GWB each side of studs |
| 51 | 54 | | 3 layers: Staggered stud with 2 layers of 5/8" GWB on one side of studs |
| 56 | 58 | | 4 layers: Staggered stud with 2 layers 5/8" GWB each side of studs |
| 60 | 61 | | 3 Layers: Double Stud (2 independent rows of studs (to tie braces), min. 1" space on separate plates) with 2 layers 5/8" GWB on one outer side of studs. |
| 65 | 66 | | 4 Layers: Double Stud (2 independent rows of studs (to tie braces), min. 1" space on separate plates) with 2 layers 5/8" GWB on outer side of studs. |

The following apply to all partitions and should be addressed in the architectural drawings:

- All partitions full-height slab-to-slab, acoustically sealed, and batt insulation in stud cavities.
- Metal studs with STC ratings based on minimum 3-5/8" deep studs at 16" o.c. Lighter gauge studs perform better. Heavier gauge studs perform worse and if used may require partition upgrades, such as resilient clips.
- Wood Studs STC based on 2"x4" at 16" o.c. 2"x6" studs may increase expected STC listed by 1. Larger spacing between studs perform better and could be reviewed if included.
- Substituting a layer of 5/8" Type X GWB with a layer of 1/2" plywood would have negligible effect to the STC rating.
- Apply multiple layers of drywall with staggered joints.
- Wherever GWB meets another material, seal with acoustical sealant.
- No continuous GWB layers on the room-side of corridor walls, i.e., interrupt GWB at all intersections.
- Offset outlet boxes on opposite sides of partition min. 24" and in separate stud spaces.
- Provide outlet boxes acoustically sealed to GWB for all electrical and data connections, even if outlet boxes are not required per local codes.
- Use sound barrier pads (Hilti, or equal) for all outlet boxes in sound rated partitions.
- Provide 5-sided GWB enclosures around outlet/junction boxes larger than four-gang.
- Fill penetrations through acoustically rated partitions (ducts, pipes, conduit, cable trays, etc.) with batt insulation and/or fire safing and seal airtight with acoustical sealant.
- Avoid cable tray penetrations through partitions between enclosed spaces. Enter from corridor only and tightly pack cable trays with batt insulation once cables are pulled.
- Avoid recessed elements in STC 50 or higher partitions. TT will review any areas where recessed elements are required.

Impact Insulation Class (IIC) is another measure of the acoustic performance of a floor-ceiling assembly. It measures how well the impact noise on the upper floor is attenuated by the floor-ceiling assembly, with a higher number representing greater attenuation. TT recommends a target IIC of at least 55 for floor-ceiling assemblies between stacked noise sensitive spaces. This IIC will provide reasonable performance against impact noise. Higher IIC ratings can be achieved by using soft floor finishes (i.e.: carpet), or acoustic underlayment products under hard floor finishes.

2.4 Door Types

The following table defines door types for various levels of sound isolation. Door louvers or undercuts other than what is indicated below are not acceptable as a means of air return.

Table 4: Typical door type to achieve STC ratings

| Assembly Type | STC Target | Typical Construction |
|---------------|------------|--|
| 1 | 20 | Glass frameless or sliding doors. Avoid for spaces that require sound isolation |
| 2 | 30 | Solid core wood or insulated metal doors with door bottom fitted for minimal clearance to finished floor. No return air undercut, or louvers are permitted. Provide acoustical seals such as Pemko Series 88 Sound Seals or equal on the jambs and head and overlapping astragals for double lead doors such as Pemko 355S or equal. |
| 3 | 35 | Same as above, with the replacement of the door bottom with automatic door bottom such as Pemko 430 or 434 (RL/PKL) or equal and ADA compliant threshold hardware. |
| 4 | TBD | Sound-rated assemblies as needed, with STC rating specified on drawings and coordinated with standalone specification section (template to be issued as required). |

2.5 Sidelites and clerestory glass

Consider the guidelines in Table 5 for interior glass based on maintaining the sound isolation of the base partition/door construction:

Table 5: Interior Glass Recommendations

| Location | Glass Area | Minimum Glass |
|--------------------------|--|-----------------------------------|
| Partitions with doors | Equal or smaller than a single leaf door | 3/8" monolithic or 1/4" laminated |
| Partitions with doors | Larger than a door | 1/2" monolithic or 3/8" laminated |
| Partitions without doors | Any | Requires case-by-case review |

2.6 Recommended STC Ratings

Recommended SPP targets, partition STC ratings, and door types based on typical adjacencies are provided in Table 6. Note that these performance ratings are based on minimum background sound levels per Section 4.0.

Table 6: Recommended SPP targets, STC ratings and door types by room adjacency types

| Critical Room | Adjacent Room | SPP Target | Partition STC | Door Type |
|----------------------|------------------------|------------|---------------|-----------|
| Private Office | Private Office | 70 | 50 | - |
| | Corridor | 65 | 45 | 2 |
| | Lobby | 65 | 45 | - |
| | Washroom | 70 | 50 | - |
| | IT Room | 70 | 50 | - |
| | Lounge | 70 | 50 | - |
| Multi-Purpose Room | Corridor | 70 | 45 | 2 |
| | Multi-Purpose Room | 75 | 50 | - |
| | Washroom | 75 | 50 | - |
| Counselling Room | Counselling Room | 75 | 50 | - |
| | Corridor/Waiting Area | 70 | 45 | 3 |
| | Meeting Room | 75 | 50 | - |
| | Washroom | 75 | 50 | - |
| | Flex Space | 75 | 50 | - |
| | Office | 75 | 50 | - |
| Flex Space | Flex Space | 75 | 50 | - |
| | Electrical Room | 75 | 50 | - |
| | Corridor | 75 | 50 | 3 |
| Exam Room | Corridor | 75 | 50 | 3 |
| | Exam Room | 75 | 50 | - |
| | Minor Procedure Room | 75 | 50 | - |
| | Meeting Room | 75 | 50 | - |
| | Electrical Closet | 75 | 50 | - |
| | Call Room | 75 | 50 | - |
| Work Room | Corridor | 70 | 45 | 3 |
| | Quiet Room | 75 | 50 | - |
| | Kitchen | 75 | 50 | - |
| | Work Room | 75 | 50 | 3 |
| Call Room | Corridor | 70 | 45 | 3 |
| | Exam Room | 75 | 50 | - |
| Minor Procedure Room | Corridor | 75 | 50 | 3 |
| | Nursing Station | 75 | 50 | - |
| | Corridor | 65 | 50 | 3 |
| Meeting Room | Electrical Closet | 65 | 50 | - |
| | Exam Room | 65 | 50 | - |
| | Corridor | 65 | 45 | 3 |
| Quiet/Safe Room | Reception/Registration | 70 | 50 | - |
| | Work Room | 70 | 50 | - |
| | M.P. Room/Washroom | 70 | 50 | - |
| M.P. Room | Corridor | 65 | 45 | 3 |

2.7 Operable Partitions

With any operable partition, speech privacy is limited, and some audible sound transmission is unavoidable. This would be a limitation for the operable partition currently shown between Multi-Purpose Room #1/Smudging and Multi-Purpose Room #2 as well as between Work Room and Kitchen. We recommend providing a standard gypsum board partition (see previous section) to achieve desirable speech privacy between these rooms.

If operable partitions are desired despite the sound isolation limitations, include the following minimum requirements for operable partitions in relevant specifications and contract documents. These requirements are based on providing the best possible sound isolation typically available for single operable partitions.

- Laboratory sound rating: Minimum Sound Transmission Class (STC) of 50
- Installed performance: Minimum Noise Isolation Class (NIC) 42 per ASTM E336
- Operable pressure seals for the top, bottom and sides

The deflection of the overhead structure should be reviewed by the structural engineer and operable partition manufacturer to confirm that seals will maintain closure.

Surrounding constructions above and to the side must provide sound isolation equivalent to the operable partition and require detailed review. This includes providing a break in the drywall where adjoining partitions meet the operable partition and providing an overhead barrier bulkhead between the operable partition and structural deck consisting of double gypsum board on each side that is acoustically sealed. Penetrations in the overhead barrier including air ducts should also be avoided.

3.0 Room Acoustics

3.1 Reverberation Control

Occupied spaces should include appropriate quantities of sound-absorptive surfaces to control reverberant noise, promote good speech intelligibility in speech sensitive spaces, and control sound propagation in open plan areas and corridors. Reverberation criteria and initial guidelines for sound-absorptive materials in each space type are summarized in Table 7.

Table 7: Reverberation times for various room types

| Room Type | Mid-Frequency (500, 1000, 2000 Hz) Reverberation Time (s) |
|------------------------|---|
| Private Office | 0.6 |
| Multi-Purpose Room | 0.7 |
| Work Room/Work Area | 0.7 |
| Waiting Area | 0.7 |
| Reception/Registration | 0.7 |
| Exam Room | 0.6 |

| Room Type | Mid-Frequency (500, 1000, 2000 Hz) Reverberation Time (s) |
|----------------------|---|
| Minor Procedure Room | 0.7 |
| Lounge | 0.7 |
| Meeting Room | 0.7 |
| Counselling Room | 0.6 |
| Call Room | 0.7 |

3.2 Electronic Sound Masking

Background noise is important to limiting speech audibility and distraction in open-plan spaces. It is also important for speech privacy from enclosed rooms to open plan areas and corridors.

Background noise produced by mechanical systems generally varies throughout the building, and the level and sound frequency content of such noise cannot be readily controlled. It is TT's understanding that sound masking will be provided in work areas.

4.0 Mechanical Noise & Vibration Control

4.1 Background Sound Levels (HVAC)

Noise Criteria (NC) ratings will be used to specify background sound levels for this project. The ASHRAE applications handbook as well as the Facility Guidelines Institute's Guidelines for Design and Construction of Hospitals provide guidelines that will be followed for the room types that exist in the proposed building. Table 8 gives background sound level criteria for the applicable space types.

Table 8: Background Sound Level Criteria by Room Type

| Room Type | NC Level (dBA) |
|------------------------|---------------------|
| Private Offices | NC 30 - 35 (35 dBA) |
| Multi-Purpose Room | NC 35 - 40 (40 dBA) |
| Work Room/Work Area | NC 35 - 40 (40 dBA) |
| Waiting Area | NC 40 - 45 (45 dBA) |
| Reception/Registration | NC 35 - 40 (40 dBA) |
| Exam Room | NC 35 - 40 (40 dBA) |
| Minor Procedure Room | NC 35 - 40 (40 dBA) |
| Lounge | NC 35 - 40 (40 dBA) |
| Meeting Room | NC 30 - 35 (35 dBA) |
| Counselling Room | NC 35 - 40 (40 dBA) |
| Call Room | NC 35 - 40 (40 dBA) |
| Quiet/Safe Room | NC 30 - 35 (35 dBA) |
| Flex Room | NC 35 - 40 (40 dBA) |

| Room Type | NC Level (dBA) |
|-----------|---------------------|
| M.P. Room | NC 30 – 35 (35 dBA) |

Meeting the criteria above will depend on the specifics of equipment locations, sound levels and duct layouts. This information will be reviewed once it is available to provide feedback and noise control recommendations to the design team. Some general recommendations to guide the design are provided below.

4.2 Major systems (HVAC)

Major equipment including air handlers and exhaust fans will be located on the roof. Detailed analysis for noise and vibration control will be carried out once equipment selections are finalized and sound data is provided. Consider the following initial design guidelines:

- Consider selection of quiet equipment whenever possible or provide alternative options for evaluation to minimize the need for noise treatments.
- Configure air handlers with side openings and horizontal duct runs into shafts instead of vertical penetrations directly into occupied floors.
- To the extent possible, place the noisiest equipment where noise sensitive spaces such as private offices and meeting rooms are least expected.
- Sound data for mechanical equipment selections and any alternative options should be reviewed early for noise to outdoor occupied areas and surrounding areas. Noise control options may include sound attenuators and/or sound screens.

4.3 Air Distribution (HVAC)

The following general design parameters should be used to achieve the least amount of system-generated noise and assure containment of noise at or near its source:

- Main supply/return/exhaust ducts shall not be installed directly above spaces with a noise criterion of NC-35 or less.
- Air supply/return/exhaust air shafts and mechanical equipment rooms shall not be located adjacent to occupied critical spaces.
- Use the following air velocity limits (fpm) as a guideline for sizing main ductwork

Table 9: Duct Velocities (fpm)

| Noise Criterion | NC-45 | NC-40 | NC-35 | NC-30 |
|---|----------|---------|---------|---------|
| Main branch above suspended ceiling – Rectangular duct | 2000 | 1800 | 1500 | 1300 |
| Duct within 6m (20 feet) of supply diffuser/return grille | 900/1000 | 850/950 | 800/900 | 700/800 |
| Duct within 3m (10 feet) of supply diffuser/return grille | 700/800 | 650/750 | 600/700 | 500/600 |
| Supply Diffuser – ‘free’ velocity | 550 | 500 | 450 | 400 |

| Noise Criterion | NC-45 | NC-40 | NC-35 | NC-30 |
|---------------------------------|-------|-------|-------|-------|
| Return Grille – ‘free’ velocity | 650 | 600 | 550 | 500 |

Note: These velocity guidelines assume good airflow conditions. The presence of elbows, fittings, or abrupt duct transitions may require lower air velocities. If these guidelines conflict with any safety requirements, such as in duct air velocities for fume exhaust systems or room exhaust, the safety requirements shall supersede the acoustical guidelines.

- Avoid VAV boxes above NC-35 or quieter spaces, and fan coil units shall not be located directly above NC-35 or quieter spaces
- Minimize penetrations in sound-rated partitions and acoustically seal all such penetrations (see concept in Figure 1).

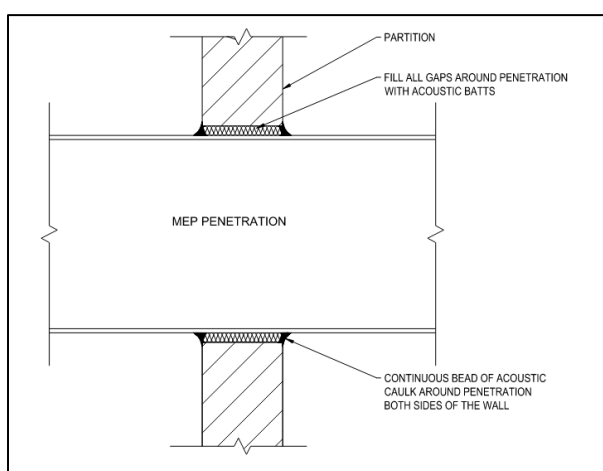


Figure 1: MEP penetration concept

- Door undercuts for air return are unacceptable for spaces with acoustical partitions.
- Provide acoustically lined transfer ducts through all acoustical partitions near or above doors. Transfer air ducts should be internally acoustically lined with a 25mm (1") thick acoustic duct liner and include a 90-degree elbow at each end of a minimum 1m (3 foot) duct length. The smallest cross-sectional dimension (width or height) should not exceed 150mm (6").
- Select supply diffusers and return grilles at least 5 NC points below the NC design criterion for the space served.
- Locate volume dampers in-branch ductwork at least 1.5m (5 feet) away from diffusers serving NC 40 spaces and at least 2m (10 feet) away from diffusers serving NC 30 and 35 spaces.
- No dampers should be located within diffuser necks, and opposed blades should not be allowed. For fire/smoke dampers, use only out-of-flow devices.
- Consider using an acoustic flex duct as this may reduce the need for other noise treatments pending noise analysis to meet project background noise criteria. Install flex duct per SMACNA 1993, Chapter 10 and with adequate support and smooth turns to avoid any kinks resulting in re-

generated noise. Limit the length of flex duct (any type) to 1.5m (5 feet) or less to maintain smooth airflow conditions.

4.4 Vibration Isolation

Structure borne noise can result in excessive or annoying noise propagating throughout a building. Once equipment selections and locations are determined and complete equipment schedules provided, we will issue a standalone vibration control specification for mechanical, electrical, and plumbing systems including piping and ductwork. This will address project requirements in terms of equipment vibration levels and equipment isolation from the building structure and include a detailed equipment isolation schedule based on equipment type, size and location relative to vibration sensitive spaces. In the meantime, make provisions for the following:

- All major rotating or reciprocating mechanical equipment should have spring isolation with a minimum static deflection ranging from 25mm (1") to 75mm (3") depending on proximity to vibration sensitive areas and support conditions.
- Fractional horsepower equipment would require minimum vibration isolation, typically pads sized to provide static deflections up to 6mm (0.25"), depending on equipment location and rpm.
- All conduit, piping, and ductwork connected to vibration-isolated equipment should at a minimum be vibration isolated for the first 10m (30 feet) horizontally from equipment. Large pipes and high-velocity ductwork should also be isolated where supported from vibration-sensitive laboratory floors.
- For stable support conditions, concrete inertia bases should be provided for pumps and external steel bases for large fans. Minimum 100mm (4") thick housekeeping concrete pads for major equipment would also be considered typical.
- Equipment selections with direct-drive fans often have lower vibration and can be more finely balanced than belt-drive fans and operate at higher frequencies and are preferred to minimize the need for vibration isolation.

4.5 Electrical Systems

Transformers located inside the building should not make contact with partitions and should be resiliently mounted to floor slabs using neoprene pads or mounts sized for a minimum of 6mm (0.25") static deflection, 40 durometers, or softer. Avoid placing transformers close to interior partitions adjoining tenant spaces to prevent bothersome electrical "hum" noise that may carry into tenant areas. Transformers should also be procured to meet the NEMA sound rating for their class.

All electrical connections to vibration isolated equipment should be made with adequate lengths of flexible conduit to prevent noise and vibration transmission.

4.6 Plumbing Systems

General guidelines for base-building plumbing noise control are as follows and include domestic water, waste lines, and roof drains.

- Plumbing supply, return and waste lines near occupied spaces should be attached using resilient mounts by Acousto-Plumb, Holdrite, or approved equal.

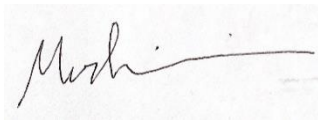
- Pipe riser supports to be isolated from building structure with neoprene pads
- It is not necessary to resiliently mount vent piping. Similarly, roof drains do not require resilient mounting if made of cast iron and not routed through or over acoustically sensitive areas.
- Piping Clearances— Allow for at least 25mm (1") gap between the outside of any pipe and a building element and acoustically seal.
- Size pipes for minimal flow velocities; this should range from 5 to 7 ft/s when near occupied spaces.
- Limit pressure at fixtures to 60 psi to reduce noise generation.
- Install air chambers or shock-absorbing devices to prevent water hammer in lines subject to abrupt shut-off.
- Avoid placing acoustically sensitive spaces common with plumbing walls.

5.0 Concluding Comments

We trust that these general recommendations meet the needs of the current phase of the design.

Please do not hesitate to contact us if there are any questions.

Yours Truly,



Farhad Mirhosseini, P.Eng.
Senior Engineer

Michael Wesolowsky, Ph.D., P.Eng.
Principal

Disclaimer: Achieving the required noise control requirements relies on correct incorporation of noise control recommendations into Architectural and Mechanical drawings and specifications, as well as correct installation during construction. On Request, TT will conduct drawing reviews and onsite reviews of noise control measures and provide observations as appropriate; however, notwithstanding the foregoing, it is expressly understood and agreed that TT shall not have control or charge of and shall not be responsible for the acts or omissions, including but not limited to means, methods, techniques, sequences and procedures, of the Design Professionals and/or Contractors performing design and/or construction on the Project. Accordingly, TT shall not be held responsible for the failure of any party to properly incorporate the noise control measures stated in this report.

Appendix A

Decibel, dB – A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure (20 μ Pa).

Ambient Noise – The sound level in a given environment usually comprised of many sources in many directions near and far with no particular sound dominant.

A-weighted Sound Level, dBA – The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.

Community Noise Equivalent Level, CNEL – The average A-weighted noise level during a 24-hour day, obtained after addition of 5 dB in the evening (7:00 pm to 10:00 pm) and after addition of 10 dB to sound levels measured in the night (between 10:00 pm and 7:00 am).

Day/Night Noise Level, LDN (or DNL) – The average A-weighted noise level for a 24-hour period, obtained after addition of 10 dB to levels measured in the night (10:00 pm to 7:00 am).

Background Noise - The total noise from all sources other than a particular sound that is of interest.

Sound level meter - An instrument that measures sound in dB. Various features are incorporated into such instrument including frequency bands, integration of sound over time and display of average, minimum, and maximum levels.

Sound pressure level - the ratio, expressed in decibels, of the mean-square sound pressure level to a reference mean-square sound pressure level that by convention has been selected to approximate the threshold of hearing (0.0002 μ bar)

Frequency – The number of times per second that the oscillation of a wave of sound or that of a vibrating body repeats itself, expressed in Hertz (Hz).

Octave band - The frequency range of one octave of sound frequencies. The upper limit is always twice the frequency of the lower limit. Octave bands are identified by the geometric mean frequency or center between the lower limit and the upper limit.

Sound Transmission Class (STC) – A laboratory measured single-number rating system used to compare the sound isolating characteristics of partitions used to separate occupied spaces.

Noise Isolation Class (NIC) - A field measured single number rating used to compare the sound isolating characteristics of the total construction between two enclosed spaces that are acoustically connected by one or more paths.

Noise Criteria (NC) Curves – These curves define the limits that the octave-band spectrum of a noise source must not exceed to achieve a level of occupant acceptance.

Appendix B: Acoustic Sketches and Summary of Recommendations

Item completed

Coordination in Progress

Design does not meet acoustic recommendations.

Building Permit

| Item | Area of Concern | Discipline | Drawing/ Specification | Current Design | Point of Concern | Criteria | Recommendation | Status |
|---------|---|--------------|---------------------------|---------------------|------------------|----------|--|---|
| General | | | | | | | | |
| AC-0.01 | Steel Studs in STC Rated Partitions | ARCH | A006A | - | STC Rating | - | <p>The STC rating for single row steel stud assemblies is heavily dependant on the stud gauge. Most STC ratings are based on the use of 25 gauge steel studs. Using heavier gauge studs will reduce the STC performance.</p> <p>Stud gauge should be indicated on drawings for acoustically rated partitions.</p> | Stud gauge to be indicated on partition schedule |
| AC-0.02 | Gypsum Board | ARCH | A006A | Type X Gypsum Board | STC Rating | - | <p>Gypsum board in acoustically rated partitions should be Type X or Type C with a minimum surface mass of 11 kg/m2 for 16mm gypsum board, or Type C with a minimum surface mass of 9.9 kg/m2 for 13mm gypsum board.</p> <p>Lightweight gypsum board must not be used.</p> | Type X gypsum board indicated in Note 10 under Acoustic Wall Construction Requirements. |
| AC-0.03 | Flanking walls | ARCH | - | - | STC Rating | - | Flanking walls should not be continous across STC rated separating walls (i.e., interior GWB should be interrupted by the seperating wall). See sketch 01/ACSK-01 for schematic. | Detail included in3/A006C |
| AC-0.04 | Slab-to-slab Partitions | ARCH | 4/A006C | - | STC Rating | - | <p>STC rated partitions should completely seal and separate adjacent spaces. Build STC rated partitions slab-to-slab.</p> <p>Details shown in drawing A006C, Detail 4 is acceptable.</p> | Details included in 4/A006C |
| AC-0.05 | Partitions terminating at window mullions | ARCH | - | - | STC Rating | - | Provide a mullion cap as indicated in sketch 02/ACSK-01 and 03/ACSK-01 or provide commercial mullion cap such as Mull-it-over | Details to be added to drawings. |
| AC-0.06 | Junction Boxes in Wall | ARCH ELEC | - | - | STC Rating | - | <p>Do not provide back to back outlets in STC rated walls. Provide at least one full cavity space between junction boxes on opposite sides of the wall. See sketch 04/ACSK-01 for schematic.</p> | Note 7 under Acoustic Wall Construction Requirement in A006A is suitable. |
| AC-0.07 | Large Junction/Media Boxes in wall | ARCH ELEC | - | - | STC Rating | - | For junction boxes larger than 4-Gang located in STC rated walls, ensure that the junction box is completely sealed on 5 sides and that there is minimum 38mm space between the back surface of the box and the opposite gypsumboard layer. Use Hilti CP-617 putty pad or equal to seal boxes where applicable. See sketch 04/ACSK-01 . | Details to be added to drawings. |

Item completed

Coordination in Progress

Design does not meet acoustic recommendations.

Building Permit

| Item | Area of Concern | Discipline | Drawing/ Specification | Current Design | Point of Concern | Criteria | Recommendation | Status |
|--------------|---|--------------|------------------------|----------------|------------------|----------|--|---|
| AC-0.08 | Acoustic sealant at STC rated partitions | ARCH | - | - | STC Rating | - | Ensure that the STC rated walls are completely sealed around the full perimeter. | Details provided in 4/A006C are acceptable. |
| AC-0.09 | Gypsum wall above interior glazing | ARCH | - | - | STC Rating | - | Provide bulkhead above interior glazing as shown in 06/ACSK-01 | Details to be added to drawings. |
| AC-0.10 | MEP penetrations in acoustically sensitive walls | ARCH MECH | - | - | STC Rating | - | <p>All penetrations through acoustically sensitive walls to be sealed airtight as follows:</p> <p>- provide 1/4" to 1/2" gap between pipe/duct and gypsum board or CMU, and ensure no contact between wall framing materials and pipe/duct penetration</p> <p>- seal gap on both sides with non-hardening acoustic caulk (paintable silicone caulk may be used where aesthetic finish is required).</p> <p>Where gaps are too large to be sealed with caulk, apply gypsum board patch achieve sealable gap as described above.</p> | Details provided in 1/A006C are acceptable. |
| Ground Floor | | | | | | | | |
| AC-G.01 | Work Room - Corridor | ARCH | 1/A210 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-G.02 | Work Room - Comp. Care Office/Safe Quiet Room | ARCH | 1/A210 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-G.03 | Comp. Care Office/Safe Quiet Room - Reception/Registration | ARCH | 1/A210 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-G.04 | Comp. Care Office/Safe Quiet Room - Corridor | ARCH | 1/A210 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-G.05 | Large Multi-Purpose Room - Corridor | ARCH | 1/A210 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-G.06 | Large Multi-Purpose Room - Medium Multi-Purpose Room/Smudging | ARCH | 1/A210 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-G.07 | Medium Multi-Purpose Room/Smudging - Corridor | ARCH | 1/A210 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-G.08 | Medium Multi-Purpose Room/Smudging - Waiting Area | ARCH | 1/A210 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |

Item completed
Coordination in Progress
Design does not meet acoustic recommendations.

Building Permit

| Item | Area of Concern | Discipline | Drawing/ Specification | Current Design | Point of Concern | Criteria | Recommendation | Status |
|-----------|--|------------|---------------------------|-------------------------|------------------|----------|---|---|
| AC-G.09 | Work Room - Kitchen | ARCH | 1/A210 & A011 | Folding Partition 115.2 | STC Rating | STC 50 | Folding partition to achieve an effective STC rating of 53 | Folding partition details required for review |
| AC-G.10 | Large Multi-Purpose Room | ARCH | 3/A310 | C6 | Reverberation | 0.7s | Current ceiling coverage is acceptable. It is also recommended that 8 sqm of the short walls be covered with acoustic panels having a minimum NRC of 0.8. | Coordination ongoing. |
| AC-G.11 | Medium Multi-Purpose Room/Smudging | ARCH | 3/A310 | C10 | Reverberation | 0.7s | Current ceiling coverage is acceptable. It is also recommended that 10 sqm of the short walls be covered with acoustic panels having a minimum NRC of 0.8. | Coordination ongoing. |
| AC-G.12 | Comp. Care Office/Safe Quiet Room | ARCH | 3/A310 | C1 | Reverberation | 0.6s | It is recommended that 12 sqm of long walls be covered with acoustic panels having a minimum NRC of 0.9. | Coordination ongoing. |
| AC-G.13 | Work Room | ARCH | 3/A310 | C8 | Reverberation | 0.7s | Current ceiling coverage is acceptable. It is recommended that 10 sqm of long walls be covered with acoustic panels having a minimum NRC 0.9. | Coordination ongoing. |
| 2nd Floor | | | | | | | | |
| AC-2.01 | Counseling Room - Counseling Room | ARCH | 2/A214 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.02 | Meeting Room - Counseling Room | ARCH | 2/A214 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.03 | Counseling Room - Public Corridor | ARCH | 2/A214 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-2.04 | Office - Reception | ARCH | 2/A214 | P5 | STC Rating | STC 45 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.05 | Office - Comprehensive Care/Medium Counseling Room | ARCH | 2/A214 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.06 | Office - Public Corridor | ARCH | 2/A214 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-2.07 | Meeting Room - BF W/C | ARCH | 2/A214 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.08 | Counseling Room - BF W/C | ARCH | 2/A214 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |

Item completed
Coordination in Progress
Design does not meet acoustic recommendations.

Building Permit

| Item | Area of Concern | Discipline | Drawing/ Specification | Current Design | Point of Concern | Criteria | Recommendation | Status |
|-----------|--|------------|---------------------------|-------------------------|------------------|----------|---|--|
| AC-2.09 | Large Counseling Room - Custodial | ARCH | 2/A214 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.10 | Flex Space - Electrical Room | ARCH | 2/A215 | P7A | STC Rating | STC 50 | Prtition type P7A is equivalent to OBC-SB3-S7a and has an STC rating of 51 and meets the recommendation. | Partition type P7A is suitable. |
| AC-2.11 | Flex Space - Flex Space | ARCH | 2/A215 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.12 | Flex Space - Public Corridor | ARCH | 2/A215 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-2.13 | Counseling Room - Flex Space | ARCH | 2/A215 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-2.14 | Multi-Purpose Room #1/Smudging - Multi-Purpose Room #2 | ARCH | 3/A213 & A011 | Folding Partition 204.1 | STC Rating | STC 50 | Folding partition to achieve an effective STC rating of 53 | Folding partition details required for review |
| AC-2.15 | Multi-Purpose Room #2 - Multi-Purpose Room #3 | ARCH | 3/A213 | P7 | STC Rating | STC 50 | Prtition type P7 is equivalent to OBC-SB3-S7a and has an STC rating of 51 and meets the recommendation. | Partition type P7A is suitable. |
| AC-2.16 | Multi-Purpose Room #3 - WC | ARCH | 3/A213 | P8 | STC Rating | STC 50 | Partition type P7 has an STC rating of 56+ and meets the recommendation. | Partition type P8 is suitable. |
| AC-2.17 | Large Counseling Room | ARCH | 1/A314 | C8 | Reverberation | 0.7s | Indicated acoustic ceiling coverage meets recommendations. Product details to be provided for acoustic performance review. | Acoustic ceiling panel details required for review |
| AC-2.18 | Meeting Room | ARCH | 1/A314 | C8 | Reverberation | 0.7s | Indicated acoustic ceiling coverage meets recommendations. Product details to be provided for acoustic performance review. | Acoustic ceiling panel details required for review |
| AC-2.19 | Multi-Purpose Room (231&233) | ARCH | 1/A314 | C10 | Reverberation | 0.7s | Indicated acoustic ceiling coverage is acceptable. It is recommended that 17 sqm of long walls as well as 30 sqm of short walls be covered with acoustic panels having a minimum NRC of 0.8. | Acoustic ceiling panel details required for review |
| AC-2.20 | Multi-Purpose Room (235) | ARCH | 1/A314 | C10 | Reverberation | 0.7s | Indicated acoustic ceiling coverage is acceptable. It is recommended that 13 sqm of long walls and 29 sqm of short wall be covered with acoustic panels having a minimum NRC of 0.8. | Acoustic ceiling panel details required for review |
| 3rd Floor | | | | | | | | |
| AC-3.01 | Counseling Room - Counseling Room | ARCH | 2/A216 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |

Item completed
Coordination in Progress
Design does not meet acoustic recommendations.

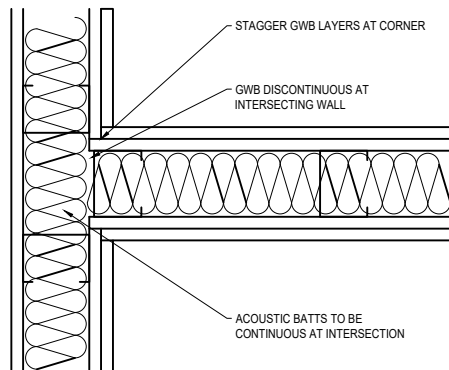
Building Permit

| Item | Area of Concern | Discipline | Drawing/ Specification | Current Design | Point of Concern | Criteria | Recommendation | Status |
|---------|---|------------|---------------------------|----------------|------------------|----------|---|---------------------------------|
| AC-3.02 | Counseling Room - Public Corridor | ARCH | 2/A216 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-3.03 | Counseling Room - Sub-Waiting Area | ARCH | 2/A216 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-3.04 | Counseling Room - BF WC | ARCH | 2/A216 | P7 | STC Rating | STC 50 | Prtition type P7 is equivalent to OBC-SB3-S7a and has an STC rating of 51 and meets the recommendation. | Partition type P7A is suitable. |
| AC-3.05 | Health Promotion Office - Health Promotion Office | ARCH | 2/A216 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-3.06 | Health Promotion Office - Public Corridor | ARCH | 2/A216 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |
| AC-3.07 | Counseling Room - Exit Corridor | ARCH | 2/A216 | P6 | STC Rating | STC 45 | Partition type P6 is equivalent to OBC-SB3-S6a and has an STC rating of 56 and meets the recommendation. | Partition type P6 is suitable. |
| AC-3.08 | Exam Room - Exam Room | ARCH | 1/A216 | P1 | STC Rating | STC 50 | Partition type P1 has an STC rating of 52 and meets the recommendation. | Partition type P1 is suitable. |
| AC-3.09 | Exam Room - Corridor | ARCH | 1/A216 | P1 | STC Rating | STC 50 | Partition type P1 has an STC rating of 52 and meets the recommendation. | Partition type P1 is suitable. |
| AC-3.10 | Exam Room - Minor Proc./Col. Room | ARCH | 2/A217 | P1 | STC Rating | STC 50 | Partition type P1 has an STC rating of 52 and meets the recommendation. | Partition type P1 is suitable. |
| AC-3.11 | Minor Proc./Col. Room - Nursing Station | ARCH | 1/A216 | P1 | STC Rating | STC 50 | Partition type P1 has an STC rating of 52 and meets the recommendation. | Partition type P1 is suitable. |
| AC-3.12 | Exam Room - Meeting Room | ARCH | 1/A216 | P1 | STC Rating | STC 50 | Partition type P1 has an STC rating of 52 and meets the recommendation. | Partition type P1 is suitable. |
| AC-3.13 | Meeting Room - Electrical Room | ARCH | 1/A216 | P1 | STC Rating | STC 50 | Partition type P1 has an STC rating of 52 and meets the recommendation. | Partition type P1 is suitable. |
| AC-3.14 | Exam Room/Isolation - Electrical Room | ARCH | 1/A216 | P1 | STC Rating | STC 50 | Partition type P1 has an STC rating of 52 and meets the recommendation. | Partition type P1 is suitable. |
| AC-3.15 | Office - Office | ARCH | 1/A218 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-3.16 | Office - Staff Corridor | ARCH | 1/A218 | P4 | STC Rating | STC 45 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and meets the recommendation. | Partition type P4 is suitable. |

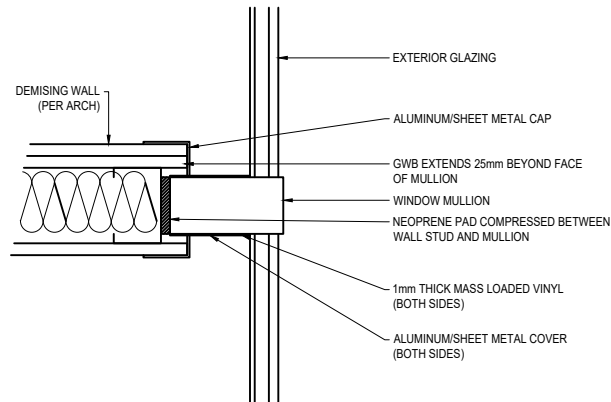
Item completed
Coordination in Progress
Design does not meet acoustic recommendations.

Building Permit

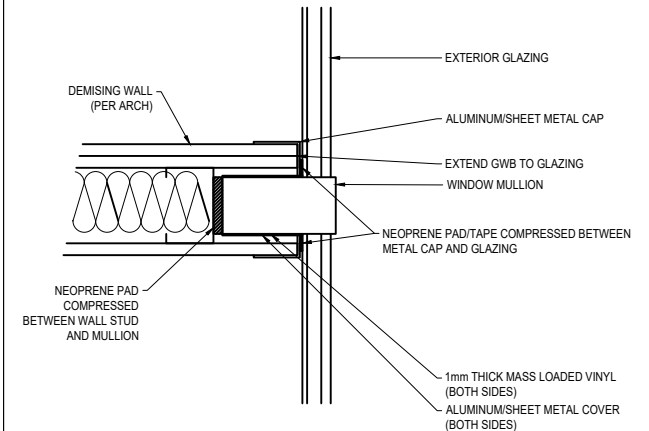
| Item | Area of Concern | Discipline | Drawing/ Specification | Current Design | Point of Concern | Criteria | Recommendation | Status |
|---------|-------------------------------------|------------|---------------------------|----------------|------------------|----------|---|--|
| AC-3.17 | Work Room - Call Room | ARCH | 1/A218 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-3.18 | Office - Lounge | ARCH | 1/A218 | P4 | STC Rating | STC 50 | Partition type P4 is equivalent to OBC-SB3- S4a and has an STC rating of 48 and does not meet the recommendation. Partition type P5 is a suitable replacement. | Coordination Ongoing. |
| AC-3.19 | Call Room - Future Office Fitout | ARCH | 1/A218 | P5 | STC Rating | STC 50 | Partition type P5 is equivalent to OBC-SB3-S5a and has an STC rating of 53 and meets the recommendation. | Partition type P5 is suitable. |
| AC-3.20 | Exam Room | ARCH | 1/A317 | C8A | Reverberation | 0.6s | Indicated acoustic ceiling coverage meets recommendations. Product details to be provided acoustic performance review. | Acoustic ceiling panel details required for review |
| AC-3.21 | Office | ARCH | 2/A318 | C7 | Reverberation | 0.6s | Indicated acoustic ceiling coverage meets recommendations. Product details to be provided acoustic performance review. | Acoustic ceiling panel details required for review |
| AC-3.22 | Meeting Room | ARCH | 2/A316 | C8 | Reverberation | 0.7s | Indicated acoustic ceiling coverage meets recommendations. Product details to be provided acoustic performance review. | Acoustic ceiling panel details required for review |



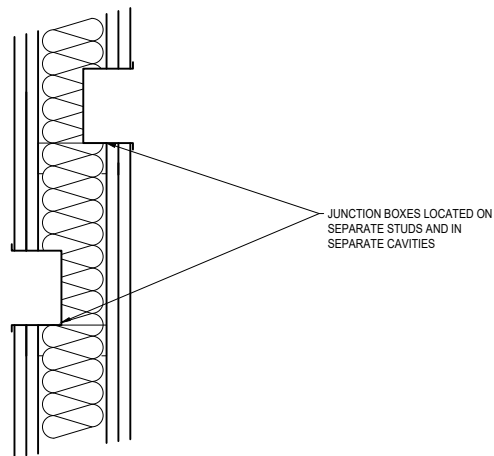
01 PARTITION AT INTERSECTING WALL



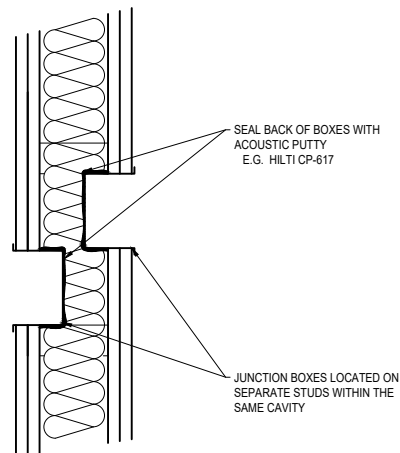
02 PARTITION AT EXTERIOR WINDOW MULLION (UP TO STC 45)



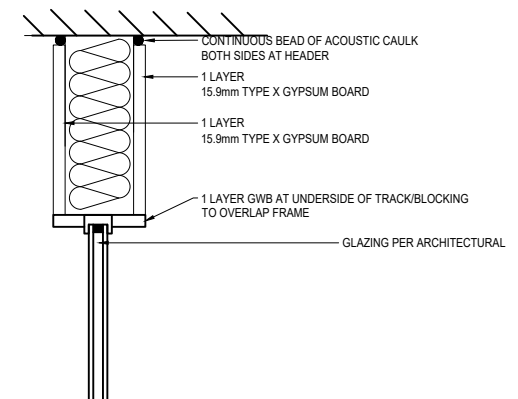
03 PARTITION AT EXTERIOR WINDOW MULLION (STC 50 AND HIGHER)



04 OPPOSITE JUNCTION BOXES OFFSET BY STUD SPACING DIMENSION



05 OPPOSITE JUNCTION BOXES IN SAME CAVITY, ON SEPARATE STUDS



06 GWB WALL ABOVE GLAZING

FIRE PROTECTION AND LIFE SAFETY
BUILDING CODE OUTLINE REPORT

UNIVERSITY OF TORONTO - KOFFLER HEALTH & WELLNESS CENTRE
INTERIOR RENOVATIONS
214 COLLEGE STREET
TORONTO, ON

October 30, 2024
Our File: 23-592

1.0 INTRODUCTION

The following is an outline of the building code concepts for the interior renovations that are proposed for the existing University of Toronto (U of T) Koffler Health & Wellness Centre, located at 214 College Street in Toronto, Ontario.

The University of Toronto Koffler Health & Wellness Centre (Project) is proposing to expand their services to better suit the needs of their university students. The existing Koffler Building currently contains the main campus bookstore, career centre and health clinic. The Project will include renovations to portions of Levels 1 through 3 creating multipurpose rooms, office areas, exam rooms as well as a new passenger elevator.

All reference numbers indicated in this report refer to the 2012 Ontario Building Code (OBC, O.Reg. 332/12 as amended by O. Reg. 158/24) unless otherwise indicated and assuming that the building permit for the proposed renovations will be applied for before January 1, 2025. This report is based on the 50% CD architectural drawings prepared by ENFORM Architects.

This report was prepared by LMDG Building Code Consultants Ltd. (LMDG) for ENFORM Architects. The material provided in this report is based on LMDG's best judgement in light of the information available to LMDG at the time of preparation. Any use of this report by third parties, or any reliance on or decisions to be made based on it are the responsibility of such third parties. LMDG accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

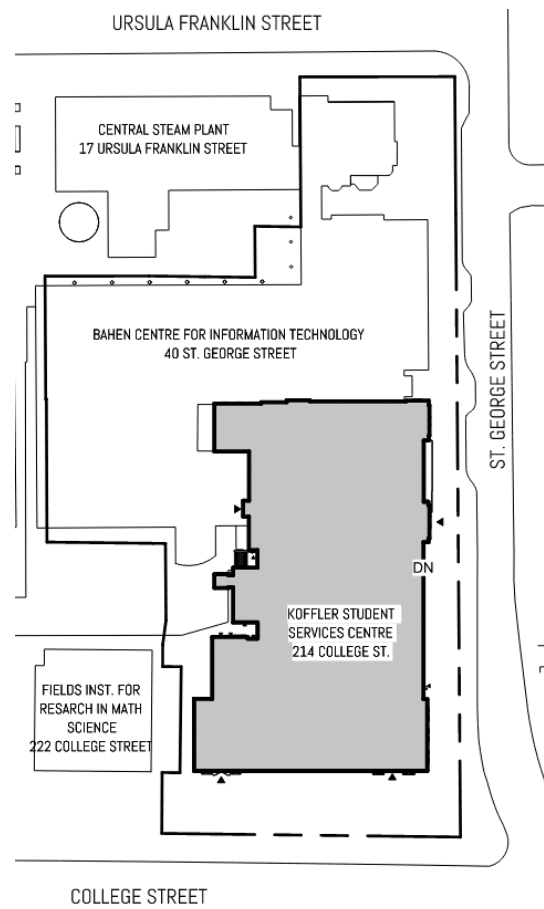
2.0 PROJECT BUILDING CHARACTERISTICS

2.1. Building Description

The Koffler Student Services Centre is connected at the North to the Bahen Centre for Information Technology (40 St. George Street). Based on existing drawing and report information associated with the Bahen Centre, it is understood that the Bahen Centre was constructed as an addition to the Koffler Centre, and together they are considered as one building for purposes of application of the OBC.

As described in the building code report for the Bahen Centre, the Koffler Centre is separated from the Bahen Centre atrium space by means of a 2-hour fire separation consisting of the existing masonry wall and a listed window sprinkler system. Additionally, a 1-hour fire separation is provided at the corridor connection at Level 1.

The Bahen Centre is an eight-storey building that is approximately 5100 m² in footprint area. The Koffler Centre is three-storeys in building height, with a footprint area of approximately 3911 m². The combined Koffler and Bahen Centre building is considered to be eight storeys in building height and 9548 m² in building area. The entire building (Koffler Centre and Bahen Centre) is equipped with automatic sprinkler protection and is served by a single-stage fire alarm system.



This report addresses the Koffler Centre only as no new construction or renovation is proposed within the Bahen Centre. Additionally, the existing fire separations between the Koffler Centre and the Bahen Centre are proposed to remain within the scope of this Project.

2.2. **Building Characteristics**

The following identifies the Project characteristics for the purpose of applying the OBC:

| | |
|--------------------------------|---|
| Applicable Building Code Part: | Part 3 (New) and Part 11 (Existing) |
| Number of buildings: | 1 |
| Building height: | 8-storeys (based on Bahen Centre) |
| Building area: | 9548m ² (Koffler area – 3911 m ²) |
| Number of streets facing: | 1 (Required) |
| Sprinklered: | Yes - see Section 6.1 for further details |
| Major occupancies: | Group A, Division 2 (Assembly) Group F, Division 3 (Parking Garage – Bahen Centre) |
| High Building: | No (*Based on code report and analysis prepared for Bahen Centre dated May 29, 2000) |
| Construction type: | Non-combustible |

2.3. **Major Occupancy**

As a university building, this building is classified as containing a Group A, Division 2 (assembly) major occupancy and includes subsidiary Group E (mercantile), Group D (Office) and Group F, Division 3 (building service and storage) occupancies.

The major occupancy classification of the building will remain unaffected within the scope of the Project.

2.4. **Part 11 – Renovations**

In accordance with Div. A, Sentence 1.1.2.7.(1) and except as provided for in Section 3.17. and Part 11, if an existing building is subject to material alteration or repair, the Building Code applies only to the design and construction of the extensions and those parts of the building that are subject to the material alteration or repair.

In accordance with Article 3.17.1.1., Section 3.17 is not applicable to this Project in consideration that there is no change in use.

2.4.1 **Proposed Construction**

With respect to the renovation to the Project, in accordance with Article 11.1.2.1., where a building is subject to extension, material alteration, or repair, the proposed construction is required to comply with Section 11.3. and the performance level of the building is required to be evaluated and compensating construction to be undertaken in accordance with Section 11.4.

As further clarified in Appendix Note A-1.1.2.7.:

...only the areas or portions of a building being renovated, or other parts of a building adversely affected by that renovation need comply with the requirements of the Code; all other areas or portions need not comply with the Code and may remain unchanged.

In accordance with Article 11.3.1.1., where an existing building is materially altered or repaired, the performance level of the building will be required to be at least equal to the performance level of the building prior to the material alteration or repair. The criteria in

Section 11.3 for evaluation of performance level of an existing building includes the following:

- structural
- increase in occupant load,
- change of major occupancy,
- plumbing, and
- sewage.

In accordance with Article 11.3.1.2., the design and construction of a new building system is required to comply with all other Parts of the Building Code or a compliance alternative as shown in Section 11.5. A compliance alternative as shown in Section 11.5 may be substituted for a requirement contained in Part 3, 4, 6 or 8 where the chief building official is satisfied that compliance with the requirement is impracticable because of structural or construction difficulties, or it is detrimental to the preservation of a heritage building.

There are no compliance alternatives proposed to be utilized within the scope of this Project.

2.4.2. Performance Level Evaluation and Compensating Construction

In accordance with Article 11.4.1.1., the performance level of the existing building is not permitted to be reduced as a result of the proposed construction.

Evaluation of the performance level as it relates to structural, plumbing, and sewage are to be reviewed by the appropriate design professionals and are not included within the scope of this report. However, it should be noted that the requirements of Articles 11.4.2.1. and 11.4.2.4. for compensating construction of structural and plumbing systems would apply to the existing building if it was determined that a reduction in performance level resulted from the proposed alterations to the building. Analysis of the remaining two criteria, increase in occupant load and change of major occupancy, is provided below.

2.4.2.1 Change in Major Occupancy

In consideration that there will not be a change in the major occupancy of the building, there will be no reduction in the performance level with respect to Article 11.4.2.3.

2.4.2.2 Increase in Occupant Load

The performance level of a building is considered to be reduced in accordance with Sentence 11.4.2.2.(1) where the proposed construction will increase the occupant load of the existing building by more than 15% or, in accordance with Sentence 11.4.2.2.(3) where the occupant load increases by 15% or less and the new occupant load will be more than 15% above the existing exit capacity.

| Storey | Existing Occupant Load ⁽¹⁾ | Proposed (New) Occupant Load ⁽²⁾ |
|---------|---------------------------------------|--|
| Level 1 | 621 p | 660 p (108 p renovated area, 552 p existing non-project area) |
| Level 2 | 324 p | 329 p |

| | | |
|--------------|---------------|---|
| | | (230 p renovated area, 99 p existing non-project area) |
| Level 3 | 440 p | 329 p (274 p renovated area, 55 p existing non-project area) |
| Total | 1385 p | 1328 p |

- (1) Existing Koffler Centre floor area occupant load totals provided by ENFORM.
(2) Existing "non-project area" occupant loads confirmed by ENFORM

Based on the above, there will not be a reduction in the performance level with respect to Article 11.4.2.2. and evaluation/upgrade in accordance with Table 11.4.3.3. is not required. However, it is noted that the early warning and evacuation measures noted in Table 11.4.3.3. will comply with Part 3 of the OBC for the renovated portions of the floor area as outlined further in this report.

3.0 **PROVISIONS FOR FIREFIGHTING**

3.1. **Fire Department Principal Entrance and Vehicle Access Route**

The existing principal entrance (fire department entrance) will be maintained as part of this Project. The principal entrance to the building is located at the East side of the building adjacent to St. George Street.

3.2 **Fire Department Connections**

There will be no modifications to the existing fire department connections within the scope of the Project. The existing fire department connection is located at the Southeast corner of the building (College Street and St. George Street).

4.0 **PROJECT CONSTRUCTION/STRUCTURAL FIRE PROTECTION**

4.1 **New Construction – Floor and Roof Ratings**

Based on the building characteristics noted in **Section 2.0** of this report, any new construction/structural fire protection elements of the Project will be governed by the following requirements:

| Occupancy Classification | Article | Max. Bldg. Height | Max. Bldg. Area | Constr. Type | Floor Assembly | Mezzanine | Unoccupied Roof | Supports |
|--------------------------|-----------|-------------------|-----------------|--------------|-----------------------|-----------------------|-----------------|----------|
| A-2 | 3.2.2.23. | Any Height | Any Area | Non-comb. | 2-hour ⁽¹⁾ | 1-hour ⁽¹⁾ | No rating | (2) |
| F3 | 3.2.2.73. | Any Height | Any Area | Non-comb. | 2-hour ⁽¹⁾ | 1-hour ⁽¹⁾ | No rating | (2) |

⁽¹⁾ Constructed as fire separations.

⁽²⁾ Load-bearing walls, columns, and arches are required to have a fire-resistance rating not less than that required for the supported assembly.

4.2 **Summary of Construction Requirements**

The construction/structural fire protection and major occupancy requirements for the addition are summarized below:

- non-combustible construction,
- automatic sprinkler protection throughout the building,
- floor assemblies to be constructed as **2-hour fire separations**,
- mezzanines to have a **1-hour fire-resistance rating**,
- unoccupied roof assemblies are not required to be rated,
- occupied roof assemblies to be constructed as **2-hour fire separations**, and
- load-bearing walls, columns, and arches are required to have a fire-resistance rating of not less than that required for the supported assembly.

4.3 **Roof Covering**

In accordance with Sentence 3.1.15.2.(1), roof coverings for this Project will have a Class A, B, or C rating, tested in conformance with CAN/ULC-S107-10, "Fire Tests of Roof Coverings."

4.4 **Permitted Combustible Elements**

The Project will be of non-combustible construction. However, Subsection 3.1.5. outlines the various combustible elements permitted in this Project. Combustible elements will be provided in accordance with the following requirements of Subsection 3.1.5.

4.4.1 **Wood Nailing Elements**

In accordance with Article 3.1.5.6., wood nailing elements attached directly to or set into a continuous non-combustible backing will be used for the attachment of interior finishes in this Project. The concealed spaces created by the wood elements will not be more than 50 mm in depth.

4.4.2 **Millwork and Wood Trim**

In accordance with Sentence 3.1.5.7.(1), the Project may contain combustible millwork, including:

- interior trim,
- shelves,
- cabinets,
- counters, and
- doors.

4.4.3 **Combustible Interior Finishes**

In accordance with Sentence 3.1.5.10.(2), combustible interior wall finishes (other than foamed plastics) used in this Project will not be more than 25 mm thick and will have a flame-spread rating of not more than 150 on any exposed surface or on any surface that would be exposed by cutting through the material in any direction.

In accordance with Sentence 3.1.5.10.(3), combustible interior ceiling finishes (other than foamed plastics) used in this Project will not be more than 25 mm thick, and will have a flame-spread rating of not more than 25 on any exposed surface or on any surface that would be exposed by cutting through the material in any direction, except that up to 10% of the ceiling area within each fire compartment will be permitted to have a flame-spread rating of up to 150. Alternatively, in accordance with Sentence 3.1.5.10.(4), the ceiling finishes may be of fire-retardant treated wood provided they are not more than 25 mm thick or are exposed fire-retardant treated wood battens.

4.4.4 Combustible Insulation

In accordance with Sentence 3.1.5.12.(4), combustible insulation (other than foamed plastics) having a flame-spread rating of more than 25 but not more than 500 throughout the material is permitted in the building (required to be of non-combustible construction), provided that the insulation is protected from adjacent spaces in the building (other than adjacent concealed spaces within the wall assemblies) by a thermal barrier (interior finish) as described in 3.1.5.12.(4).

Furthermore, in accordance with Sentence 3.1.5.12A.(2), foamed plastic insulation having a flame-spread rating of not more than 500 throughout the material is permitted in the building (required to be of non-combustible construction), provided the insulation is protected from adjacent spaces in the building (other than adjacent concealed spaces within the wall assemblies) by a thermal barrier (interior finish) as described in 3.1.5.12A.(2).

4.4.5 Flame-Spread Rating and Smoke Developed Classification Limits

In addition to the above-noted requirements, other interior finish materials on the surface of floors, walls and ceilings of this Project will not exceed the following flame-spread rating (FSR) and smoke developed classification (SDC) limits of Subsection 3.1.13.:

| Occupancy, Location or Element | Maximum FSR | | | Maximum SDC | | |
|----------------------------------|-------------------|--------------------|-------|-------------|---------|-------|
| | walls | ceiling | floor | walls | ceiling | floor |
| Exits and Exit Lobbies | 25 ⁽¹⁾ | 25 ⁽¹⁾ | — | — | — | — |
| Vertical Service Shafts | 25 | 25 | — | — | — | — |
| Elevator Cars | 75 | 75 | 300 | 450 | 450 | 450 |
| Light Fixture Lenses | — | 150 ⁽¹⁾ | — | — | — | — |
| Doors | 200 | — | — | — | — | — |
| Rooms/Spaces not mentioned above | 150 | 150 | — | — | — | — |

⁽¹⁾ Combustible doors, glazing and light diffusers and lenses are required to be considered in the calculation of wall and ceiling areas. Doors and trim are permitted to have a FSR of up to 150.

⁽²⁾ Light fixture lenses conforming to Sentence 3.1.13.4.(1) may exceed 150 FSR.

5.0 **REQUIRED FIRE SEPARATIONS**

In accordance with Article 3.1.7.1., a material, assembly of materials, or a structural member required to have a fire-resistance rating will be based on either:

- a) an assembly assigned a fire-resistance rating based on tests conforming to CAN/ULC-S101-14, "Fire Endurance Tests of Building Construction and Materials", such as listings from ULC (or an equivalent approved listing agency), or
- b) MMAH Supplementary Standard SB-2, "Fire Performance Ratings" for wall assemblies or ceiling and floor assemblies.

The following sections summarize requirements for new fire separations of the Project.

5.1. **Vertical Shafts**

In accordance with Sentences 3.4.4.1.(1), 3.5.3.1.(1) and 3.6.3.1.(1), based on **2-hour** rated floor assemblies, shafts and hoistways will be required to be constructed as fire separations having the following fire-resistance ratings (F.R.R.):

| Shaft/Hoistway Type | Shaft/Hoistway F.R.R. (Hours) |
|----------------------|-------------------------------|
| Exits/Exit Corridors | 2 |
| Elevators | 1½ |
| Vertical Service | 1 |

Where the top of a service shaft does not extend through the roof, it will terminate at an assembly having a fire-resistance rating at least equal to the walls of the shaft. Similarly, the bottom of a service shaft will terminate at an assembly having a fire-resistance rating at least equal to the walls of the shaft, except where the shaft extends to the bottom of the building.

5.2. **Service Rooms**

In accordance with Sentence 3.6.2.1.(1), fuel-fired appliances will be required to be located in a service room separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than 1-hour.

In accordance with Sentence 3.6.2.1.(8), a room containing a limited quantity of service equipment, and service equipment that does not constitute a fire hazard, will not be required to be separated from the remainder of the building by a fire separation.

5.3. **Elevator Machine Rooms**

In accordance with Sentence 3.5.3.3.(1), a room containing elevator machinery will be separated from the remainder of the building by a fire separation that has a 1.5-hour fire resistance rating.

5.4. Janitors' Closets

In accordance with Sentence 3.3.1.20.(3), janitors' closets located in sprinklered floor areas will be separated from the remainder of the building by fire separations having no fire-resistance rating.

5.5. Corridors Used by the Public

In accordance with Sentence 3.3.2.5.(4), the corridors used by the public are not required to be separated from the remainder of the floor area on the basis that the travel distance to an exit will not exceed the maximum permitted by Article 3.4.2.5. from any point in the floor area.

5.6. Building Services in Fire Separations

In accordance with Sentence 3.1.9.1.(1), piping, tubing, ducts, chimneys, optical fibre cables, electrical wires and cables, totally enclosed non-combustible raceways, electrical outlet boxes, and other similar building services that penetrate a membrane that forms part of an assembly required to provide a fire-resistance rating, or a fire separation, will be tightly fitted or sealed by a firestop system that, when subjected to the fire test method in ULC-S115-11, "Fire Tests of Firestop Systems," has an F-rating not less than the fire-protection rating required for closures in the fire separation.

5.7. Closures (Doors, Glazing and Fire Dampers)

5.7.1 Maximum Size

In accordance with Sentence 3.1.8.6.(2), the size of an opening in an interior fire separation required to be protected with a closure will not exceed 22 m² and will have no dimension greater than 6 m provided the fire compartments on both sides are sprinklered.

5.7.2 Fire Protection Rating

Closures (doors and fire dampers) for openings in all fire separations will be provided with a fire-protection rating in accordance with Article 3.1.8.4. and Table 3.1.8.4., as reproduced in part below:

| Fire-Resistance Rating of Fire Separation (Hours) | Required Fire-Protection Rating of Closure (Hours) |
|--|---|
| $\frac{1}{2}$ | $\frac{1}{3}$ |
| $\frac{3}{4}$ | $\frac{3}{4}$ |
| 1 | $\frac{3}{4}$ |
| 1½ | 1 |
| 2 | 1½ |

Doors in required fire separations (including 0-hour fire separations) will be provided with

self-closing devices and equipped with positive latching mechanisms designed to hold the door in the closed position after each use. Additionally, doors located in fire separations will not be permitted to incorporate louvres, grills, or other similar types of unprotected openings.

5.7.3 Permitted Glazing in Fire Separations

- **Wired Glass or Glass Block**

In accordance with Article 3.1.8.14., wired glass or glass block may be used as a closure in a fire separation (except as noted in Table 3.1.8.15.) provided the required fire-resistance rating of the fire separation does not exceed 1-hour.

Wired glass assemblies used in vertical fire separation assemblies with a rating of up to 1-hour installed in accordance with Supplementary Standard SB-2 will be acceptable.

- **Sprinkler Protected Glazed Wall Assembly**

In accordance with Article 3.1.8.18., a sprinkler protected glazed wall assembly may be installed in partitions with a fire-resistance rating of up to 2-hours. However, this type of protection is not permitted to be installed in the exits from floor areas of the Project. A window sprinkler system is required to be constructed in accordance with ULC/ORD-C263.1, "Sprinkler-Protected Window Systems."

- **ULC listed Assembly**

Glass assemblies that are CAN/ULC-S106 listed for use as a closure in a fire separation (such as Firelite) may also be used provided they are installed in accordance with their listing and the manufacturer's installation instructions.

5.7.4 Maximum Temperature Rise/Glass Area Limit in Doors

The maximum temperature rise and area of glazing for closures within required fire separations will be in accordance with Table 3.1.8.15, as reproduced below:

| Fire Separation | | Min. Closure Fire- protection Rating | Door Max. Temperature Rise (°C) | Max. Area of Wired Glass in Doors (m ²) | Maximum Aggregate Area of Wired Glass & Glass Block not in Door (m ²) |
|-----------------|---------|---|---------------------------------------|--|--|
| Type | Rating | | | | |
| Exits | 2-hour | 1½ hour | 250 after 1 hour | 0.0645 m ² | 0.0645 m ² |
| All Others | 2-hour | 1½-hour | N/A | per listing | individual panes not more than 0.84 m ² |
| | 1½-hour | 1-hour | | | |
| | 1-hour | ¾-hour | | | |
| | ¾-hour | ¾-hour | | | |

In accordance with Article 3.1.8.17., the temperature rise limits and glass area limits are waived for a closure between an exit enclosure and an enclosed vestibule or corridor

provided:

- the vestibule or corridor is separated from the remainder of the floor area by a $\frac{3}{4}$ -hour rated fire separation containing no wired glass or glass block within 3 m of the closure into the exit enclosure, and
- the vestibule or corridor contains no occupancy.

5.7.5 Fire and Smoke Dampers

In accordance with Sentence 3.1.8.7.(1), a fire damper having a fire-protection rating is required to be installed in ducts or air-transfer openings that penetrate an assembly required to be a fire separation.

In accordance with Sentence 3.1.8.7.(2), a smoke damper or a combination smoke and fire damper is required to be installed in ducts or air-transfer openings that penetrate an assembly required to be a fire separation, where the fire separation:

- contains an egress door described in Sentence 3.4.2.4.(2), or
- serves an assembly occupancy.

5.7.5.1 Fire Dampers Waived

In accordance with Sentence 3.1.8.8.(1), the requirement for fire dampers is permitted to be waived for:

- ducts that serve commercial cooking equipment,
- ducts or air-transfer openings that penetrate a vertical fire separation not required to have a fire-resistance rating, and
- non-combustible ducts or air-transfer openings that penetrate a horizontal fire separation not required to have a fire-resistance rating.

In accordance with Sentence 3.1.8.8.(2), the requirement for fire dampers is permitted to be waived for non-combustible branch ducts having a melting point above 760°C that penetrate a fire separation:

- provided the ducts,
- have a cross-sectional area not more than 130 cm² and serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1.2 m above the floor, or
- extend not less than 500 mm inside exhaust duct risers that are under negative pressure and in which the airflow is upward as required by Article 3.6.3.4., or
- provided the fire separation separates a vertical service space from the remainder of the building and provided each individual duct exhausts directly to the outdoors at the top of the vertical service space.

5.7.5.2 Smoke Dampers Waived

In accordance with Clause 3.1.8.8A.(1), the requirement for smoke dampers or combination smoke and fire dampers is permitted to be waived for

- ducts that serve commercial cooking equipment, or

- ducts, in which all inlet and outlet openings serve not more than one fire compartment.

In accordance with Sentence 3.1.8.8A.(2), the requirement for smoke dampers or combination smoke and fire dampers is permitted to be waived for non-combustible branch ducts having a melting point above 760°C that penetrate a fire separation,

- provided the ducts,
- have a cross-sectional area not more than 130 cm² and serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1.2 m above the floor, or
- extend not less than 500 mm inside exhaust duct risers that are under negative pressure and in which the airflow is upward as required by Article 3.6.3.4., or
- provided the fire separation separates a vertical service space from the remainder of the building and provided each individual duct exhausts directly to the outdoors at the top of the vertical service space.

5.7.6 Self-Closing and Latching Devices

In accordance with Sentence 3.1.8.11.(1), doors in required fire separations will be provided with self-closing devices (closers) designed to return the door to the closed position after each use.

In accordance with Article 3.1.8.13., swing-type doors in fire separations will be equipped with a positive latching mechanism designed to hold the door in the closed position after each use.

5.7.7 Clearances at Door Sills

In accordance with NFPA 80-2013, “Fire Doors and Other Opening Protectives”, doors required to provide a fire-protection rating of $\frac{3}{4}$ to 2-hours will have a maximum clearance below the bottom of the door of 9.5 mm where a non-combustible raised sill (threshold) is provided, and 19 mm where there is no sill (floor).

5.7.8 Hold-Open Devices for Doors

In accordance with Article 3.1.8.12., hold-open devices may be provided for any door of this Project except exit stair doors. If provided, these hold-open devices will be designed to release upon signal from dedicated smoke detector(s) located as described in CAN/ULC-S524-14, “Installation of Fire Alarm Systems” and upon signal from the fire alarm system of the Project.

6.0 FIRE PROTECTION AND LIFE SAFETY SYSTEMS

In accordance with Sentence 3.2.10.1.(1), where fire protection and life safety systems and systems with fire protection and life safety functions are integrated with each other, they are required to be tested as a whole in accordance with CAN/ULC-S1001-11, “Integrated Systems Testing of Fire Protection and Life Safety Systems,” to verify that they have been properly integrated.

6.1 Sprinkler System

The existing sprinkler system will be modified where necessary to provide coverage within the renovated areas.

All modifications and new installations to the existing sprinkler system will be completed in accordance with NFPA 13-2013, "Installation of Sprinkler Systems."

6.2 Standpipe System

Any alterations or new installations to the existing standpipe system serving the building will be completed in accordance with NFPA 14 "Standard for the Installation of Standpipe and Hose Systems".

It is understood that existing fire hose cabinets are provided throughout the building, each containing 22.9 m (75 ft) of fire hose. Fire hose coverage provided from these existing fire hose cabinets will be maintained within the renovated areas of this building (22.9 m)).

In accordance with Article 3.2.9.4., new fire hose cabinets within the renovated floor areas will provide a 33 m fire hose coverage (30 m hose length plus 3 m hose stream). Additionally, where fire hose cabinet locations are modified within the scope of the Project, they are required to be located within 5 m of every required exit.

6.3. Fire Alarm System

The existing building is equipped with a single-stage fire alarm system. This fire alarm system will be modified as necessary within the proposed renovated areas in accordance with Subsection 3.2.4. and CAN/ULC-S524-14, "Installation of Fire Alarm Systems." The existing fire alarm annunciator panel is located within the South entrance vestibule adjacent to St. George Street.

All modifications or new installations to the existing fire alarm system will be completed in accordance with CAN/ULC-S524-14, "Standard for the Installation of Fire Alarm Systems."

Upon completion of works, the existing fire alarm system will be verified in accordance with CAN/ULC-S537-13 "Standard for the Verification of Fire Alarm Systems".

6.3.1 Location of Fire Alarm System Devices

The existing fire alarm annunciator panel will be located in the vicinity of the principal Fire Department entrance of this building (refer to Section 3.1 of this report).

6.3.2 Sprinkler Waterflow Devices

In accordance with Article 3.2.4.17., sprinkler zones will be equipped with waterflow detecting devices to activate the fire alarm system.

6.3.3 Smoke Detectors

In accordance with Article 3.2.4.12., Article 3.2.4.13., Article 3.1.8.12., and CAN/ULC-S524, smoke detectors will be installed:

- a) in each elevator machine room or machinery space,

- b) in ducts where recirculating air-handling systems serve more than one storey, and
- c) at openings in fire separations where closures are equipped with hold-open devices.

6.3.4 Manual Pull Stations

If new pull stations are required to be installed, they will be provided near every required exit from each storey such that it will not be possible to leave the floor area without passing by a pull station (3.2.4.18.).

Pull stations (new or relocated) are required to be installed at a height of not less than 1050 mm and not more than 1150 mm, measured to the centre of the device, in accordance with CAN/ULC-S524 (refer to Section 12.0 of this report for barrier-free requirements for manual pull station mounting height).

6.3.5 Zone Configuration

In accordance with Sentence 3.2.4.9.(2), zones will be provided throughout the Project based on the following:

- a) sprinkler system area limits as determined by NFPA 13 (but not more than one storey),
- b) shafts required to be equipped with smoke detectors,
- c) air-handling systems required to be equipped with smoke detectors, and
- d) fire compartments required to be separated by vertical fire separations having a fire-resistance rating not less than 2 hours.

6.3.6 Fire Alarm Signals

In accordance with Article 3.2.4.20., audible signal devices forming part of the fire alarm system will be installed such that:

- fire alarm signals are clearly audible throughout each floor area (with alarm signals being not less than 10 dBA above ambient noise level and not less than 65 dBA when any intervening doors between the device and the rest of the floor area are closed), and
- the alarm signal will follow the temporal pattern as defined in Clause 4.2 of ISO 8201, "Acoustics – Audible emergency evacuation signal".

In accordance with Sentence 3.2.4.19.(4)., visual signal devices shall be provided in addition to alarm signal devices in:

- assembly occupancies in which music and other sounds associated with performances could exceed 100dBA,
- in any floor area in which the ambient noise level is more than 87 dBA,
- in corridors used by the public serving a Group A major occupancy, and
- in barrier-free washrooms.

6.4. Portable Fire Extinguishers

In accordance with Article 3.2.5.17., portable fire extinguishers will be required to be provided throughout the Project in accordance with the Ontario Fire Code.

6.5. Emergency Lighting & Power

In accordance with the requirements of Subsection 3.2.7., a **½-hour** emergency power supply will be required for:

- a) emergency lighting,
- b) exit signs, and
- c) fire alarm system (existing).

The emergency electrical power supply system will be installed in conformance with CSA C282-15, "Emergency Electrical Power Supply for Buildings" in accordance with Article 3.2.7.5.

In accordance with Article 3.2.7.3., emergency lighting is required to be provided at an average of 10 lx in the following areas:

- a) exits,
- b) principal routes providing access to exit in an open floor area and in service rooms,
- c) corridors used by the public,
- d) corridors serving classrooms,
- e) floor areas or parts of them where the public may congregate having an occupant load of 60 or more in a Group A, Division 2 occupancy, and
- f) washrooms with fixtures for public use.

In accordance with Sentence 3.2.7.10.(1), electrical conductors serving emergency lighting are required to be protected in accordance with Sentences 3.2.7.10.(2) to (9).

7.0 SPATIAL SEPARATION

7.1. Spatial Separation

There are no modifications to the unprotected openings (i.e. increase in size/area) within the renovated portions of the floor areas within the scope of the Project.

8.0 INTERCONNECTED FLOOR SPACE

In accordance with Clause 3.2.8.1.(1)(a), floor assemblies that do not terminate at an exterior wall, a firewall or a vertical shaft will terminate at a vertical fire separation having a fire-resistance rating not less than that required for the floor assembly and extending from the floor assembly to the underside of the floor or roof assembly above.

8.1. Existing Koffler Centre Atrium

An existing interconnected floor space (atrium) is located within the central portion of the Koffler Centre building. This atrium area contains a communication stair and is open to portions of Levels 1 and 2 (i.e. the first and second storeys). The existing walls that form the inner perimeter of the atrium at Level 3 are constructed of masonry/brick and contain

unprotected windows. As such, the existing interconnected floor space is currently considered to include all three storeys of the building (L1 to L3).

A new passenger elevator, serving Levels 1 to 3, is proposed to be constructed within the existing interconnected floor space. This new elevator will be located within a 1.5-hour shaft.

As noted in **Section 10.4** of this report, travel distance to exit will not exceed 30 m from renovated portions of Levels 2 and 3 that are located within the interconnected floor space as required by Sentence 3.2.8.4.(4). The remainder of the renovated floor areas at Levels 2 and 3 (i.e. East of Column Line 11) will be separated from the interconnected floor space by a 2-hour fire separation.

9.0 **HIGH BUILDING REQUIREMENTS**

Based on the previous Bahen Centre code report and design documentation, it is understood that the combined Koffler Centre and Bahen Centre building has not been considered to be a high building regulated by the provisions of Subsection 3.2.6. Calculation of the total cumulative occupant load and available exit stair widths provided to all storeys of the Bahen Centre for purposes of determining applicability of high building requirements was based on the Bahen Centre occupant loads and exit stairs only (i.e. Koffler Centre, which is fire-separated from Bahen Centre, was not considered).

In consideration that the Project consists of interior renovations to the Koffler Centre only, and based on the above information, the Project will not affect the classification of the building as it relates to Subsection 3.2.6. and high building requirements will not be applicable to the Project.

10.0 **EGRESS/EXITING REQUIREMENTS**

Exit systems in this Project used singly or in combination will consist of existing exit stairs and doors that discharge to the exterior at grade.

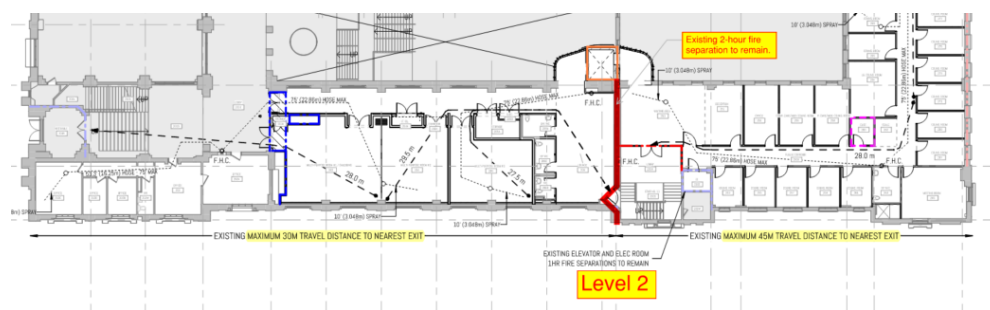
There will be no new exit stairs constructed within the scope of the Project.

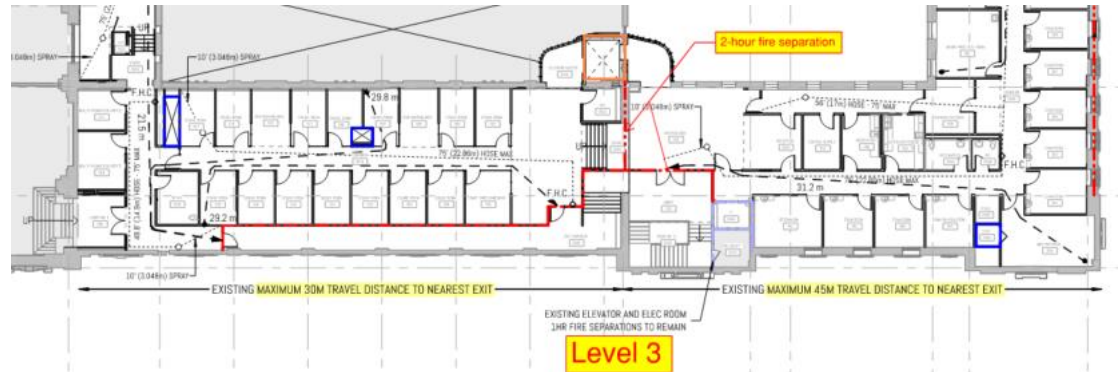
10.1. **Egress from Rooms and Mezzanines**

In accordance with Sentence 3.3.1.5.(1) and Table 3.3.1.5.B, a minimum of two egress doorways will be provided from every room or suite intended for an occupant load exceeding 60 persons; or where the following area and/or egress distance limits are exceeded in a floor area that is fully sprinklered:

| Occupancy Type | Area | Egress Distance |
|---------------------|--------------------|-----------------|
| Group A, Division 2 | 200 m ² | 25 m |
| Group D | 300 m ² | 25 m |
| Group E | 200 m ² | 25 m |
| Group F, Division 3 | 300 m ² | 25 m |

In accordance with Sentence 3.3.1.5.(2), where two egress doorways are required, the doorways are to be located a minimum distance from one another equal to one-third the maximum overall dimension of the room.





In accordance with Clause 3.4.2.5.(1)(c), a 45 m maximum travel distance to an exit will be provided and will be measured from any point in the Level 1 and Basement floor areas of the Project.

10.5 Minimum Number of Exits

In accordance with Sentence 3.4.2.1.(1), every floor area of the Project is required to be served by at least two exits.

10.6 Distance Between Exits

In accordance with Article 3.4.2.3., the least distance between two required exits in a floor area will be:

- one-half the maximum diagonal dimension of the floor area, but not less than 9 m in floor areas not served by a public corridor, or
- one-half the maximum diagonal dimension of the floor area, but need not exceed 9 m in floor areas served by a public corridor.

The minimum distance between two exits is required to be measured as the shortest distance that smoke would travel between the exits, assuming that the smoke will not penetrate an intervening fire separation.

10.7 Integrity of Exits

In accordance with Sentence 3.4.4.4.(1), the fire separations that enclose the exit stairs/corridors of the Project will have no openings/penetrations except for:

- a) standpipe and sprinkler system piping,
- b) electrical wires and cables, totally enclosed non-combustible raceways and non-combustible piping that serve only the exit,
- c) exit doorways, and
- d) wired glass and glass block permitted by Article 3.1.8.14.

In accordance with Sentences 3.4.4.4.(7), (8) and (9), service rooms, mechanical rooms, electrical rooms, and auxiliary rooms such as storage rooms, washrooms, and janitor's closets which are adjacent to exits will not open directly into an exit.

Where necessary, vestibules will be placed between the prohibited rooms and the exit.

10.8 Occupant Loads and Exit Capacities

In accordance with Article 3.3.1.16 and Sentences 3.4.3.2.(1) and (2), the aggregate required width of egress/exits serving the floor areas of the Project has been determined by multiplying the occupant load of the area served by:

- 6.1 mm per person for ramps with a gradient of not more than 1 in 8, doorways, corridors, and passageways,
- 8.0 mm per person for a stair consisting of steps whose rise is not more than 180 mm and whose run is not less than 280 mm, or
- 9.2 mm per person for a ramp with a slope less than 1 in 8 or stairs other than those described in b) above.

The required exit capacities and therefore the widths of the exit doors and stairs for the Project will be based on the occupant loads for which the area is designed in accordance with Subclause 3.1.17.1.(1)(c)(i). The following provides a summary of the occupant load and exit capacity provided to the Koffler Centre:

| Floor Area | Occupant Load ⁽¹⁾ (persons) | Aggregate Width of Exits Required (mm) | Aggregate Width of Exits Provided (mm) |
|------------|---|---|---|
| Level 1 | 108p (Renovated area) 552 p (non-project area) Total = 660 p | 4026 mm (doors) | 4430 mm (doors) |
| Level 2 | 230 p (Renovated area) 99 p (non-project area) Total = 329 p | 3027 mm (stairs) | 5578 mm (stairs) + 1880 mm (doors) |
| Level 3 | 274 p (Renovated area) 55 p (non-project area) Total = 329 p | 3027 mm (stairs) | 5048 mm (stairs) |

10.9 Exit and Corridor Widths

In accordance with Subsection 3.3.1. and Sentences 3.4.3.2.(7) and 3.8.3.3.(1), the minimum widths for new egress/exit facilities will be as follows:

- Corridors/Passageways/Ramps: 1100 mm
- Exit Doors: 790 mm
- Room Entry/Egress Doors: (clear) 800 mm
- Doorways in a barrier-free path of travel: (clear) 860 mm

The width of existing exit facilities will remain unchanged.

10.10 Direction of Door Swing

In accordance with Sentence 3.3.1.10.(2), where a room or suite is intended for an occupant load of more than 60 persons, all egress doors from the room or suite will swing on a vertical axis in the direction of exit travel.

All exit doors will swing on a vertical axis in the direction of exit travel, as per Sentence 3.4.6.12.(1).

10.11 Clearance beyond Door Swing

In accordance with Sentence 3.4.3.4.(3), swinging doors in their swing will not reduce the effective width of exit stairs or landings to less than 750 mm. This effective width is measured from the arc of the door swing to the closest portion of the outer face of the dividing wall, or other obstruction. Additionally, in accordance with Sentence 3.4.3.4.(3) swinging doors in their swing will not reduce the required width of an access to exit or an exit passageway to less than the minimum required width.

10.12 Door Hardware

Doors and door hardware are to be provided in accordance with Article 3.3.1.12. A door in an access to exit will be readily openable in travelling to an exit without requiring keys, special devices or specialized knowledge of the door opening mechanism.

Door release hardware will be operable by one hand and the door will be openable with not more than one releasing operation. Door release hardware will be installed not more than 1200 mm above the finished floor. A door in an access to exit that is also a barrier-free path of travel provided with door opening devices that are the only means of operation will be designed to be operable using a closed fist and be mounted not less than 900 mm and not more than 1100 mm above the finished floor.

In accordance with Article 3.4.6.16., locking, latching and other fastening devices on every exit door will permit the door to be readily opened from the inside with not more than one releasing operation and without requiring keys, special devices or specialized knowledge of the door opening mechanism. Door hardware will be installed at a height not more than 1200 mm above the finished floor.

In accordance with Sentences 3.3.2.6.(1), 3.4.6.16.(2), and 3.8.3.3.(7), doors will be equipped with panic hardware that will release the latch and allow the door to swing open when a force of not more than 22 N for interior doors and 38 N for exterior doors is applied to the device in the direction of travel to the exit in the following locations:

- a) at every egress or exit door serving an assembly occupancy with an occupant load exceeding 100 persons, and
- b) at every exterior exit door from a stair shaft or exit lobby in a building containing an occupant load of more than 100 persons.

10.13 Exit Signs

In accordance with Sentence 3.4.5.1.(1), every exit door will have an illuminated exit sign placed over it. Where illuminated exit signs at exit doors are not visible from open floor areas or corridors used by the public, directional exit signs will be provided to indicate the direction of egress. Specifications for these exit signs will conform to the requirements of Subsection 3.4.5.

In accordance with Sentence 3.4.5.1.(2), exit signs will consist of a green pictogram and white graphic symbol meeting the visibility specifications referred to in ISO 3864-1,

“Graphical Symbols – Safety Colours and Safety Signs – Part 1: Design Principles for Safety Signs and Safety Markings”, and conform to ISO 7010, “Graphical Symbols - Safety Colours and Safety Signs - Registered Safety Signs” for the following symbols:

- a) E001 emergency exit left,
- b) E002 emergency exit right,
- c) E005 90-degree directional arrow, and
- d) E006 45-degree directional arrow.

All existing exit signs (i.e. conventional red “EXIT” signs) within the renovated areas will be replaced with exit signs complying with Article 3.4.5.1.

11.0 **HEALTH REQUIREMENTS**

11.1 **Water Closet Requirements**

In accordance with Sentence 3.7.4.2.(2), water closets shall be provided for each sex assuming that the occupant load is equally divided between males and females.

The required number of washroom fixtures will be based on the requirements of Sentence 3.7.4.3.(15) applicable to non-residential college buildings, which is one fixture for each 100 males and one fixture for each 75 females.

As identified in the table below, based on the occupant loads, there will be sufficient water closet fixtures provided to the Project.

| Level | Water Closet Summary (Renovated Areas) | | | |
|---------|--|-----------------------|---|--|
| | Occupant Load | Occupant Load per Sex | Number of Water Closets Required (male/female) | Number of Water Closets Provided (male/female) |
| Level 1 | 108 p | 54 p | Male: 1 w/c Female: 1 w/c | 3 provided |
| Level 2 | 230 p | 115 p | Male: 1 w/c Female: 1 w/c | 5 provided |
| Level 3 | 274 p | 137 p | Male: 1 w/c Female: 1 w/c | 6 provided |
| | | | Total Required Male: 3 w/c Female: 3 w/c | Total Available 14 provided |

12.0 REQUIREMENTS FOR BARRIER-FREE DESIGN

12.1 Applicability

New construction proposed as part of the Project is required to meet the requirements of Section 3.8. of the OBC.

12.2 Barrier-Free Path of Travel

In accordance with Sentence 3.8.2.1.(1), a barrier-free path of travel will be provided from the barrier-free accessible main entrance and throughout the entrance storey.

In accordance with Article 3.8.1.3., a barrier-free path of travel having a minimum unobstructed width of 1100 mm will be provided throughout the Project. An unobstructed turnaround space of 1800 mm by 1800 mm will be provided at intervals not exceeding 30 m where the barrier-free path of travel has a width less than 1600 mm.

In accordance with Sentence 3.8.2.1.(3), a barrier-free path of travel is not required to extend:

- into service rooms,
- into janitors' rooms, or
- into service spaces.

In accordance with Article 3.8.1.6., all portions of a barrier-free path of travel will be equipped to provide a level illumination and will comply with Sentence 3.2.7.1.(1). An average level not less than 50 lx at floor level must be provided.

12.3 Power Door Operators

In accordance with Article 3.8.3.3., every door that provides a barrier-free path of travel through a barrier-free entrance required by Article 3.8.1.2. will be equipped with a power door operator. Where barrier-free entrance doors are affected within the scope of the project, a power door operator will be provided (where not already equipped with a power door operator).

Where a barrier-free entrance required by Article 3.8.1.2. incorporates a vestibule, a door leading from the vestibule into the floor area will be equipped with a power door operator.

A door will be equipped with a power door operator where the door serves:

- a washroom for public use required to be barrier-free, or
- a universal washroom conforming to Article 3.8.3.12.

12.4 Doorways and Doors

In accordance with Sentence 3.8.3.3.(1), new doorways in a barrier-free path of travel will have a clear width of 860 mm.

In accordance with Sentence 3.8.3.3.(10), all new doors in a barrier-free path of travel will be required to provide a clear space of 600 mm on the latch side of the door when the door swings toward the approach side. A 300 mm clear space is required on the latch side of

the door when the door swings away from the approach side or on both sides of a sliding door. Alternatively, a power door operator may be provided in lieu of the latch side clear spaces.

In accordance with Sentence 3.8.3.3.(11), vestibules located in a barrier-free path of travel will be arranged to allow the movement of wheelchairs between doors. A distance of 1500 mm plus the width of any door that swings into the space in the path of travel from one door to another is required when the doors into the vestibule are in series. A turning diameter of 1500 mm is required within the vestibule, clear of any door swing, when the doors into the vestibule are not aligned.

In accordance with Sentence 3.8.3.3.(15), a door in a barrier-free path of travel consisting of a sheet of glass will be marked with a continuous opaque strip that:

- will be colour and brightness contrasted to the background of the door,
- will be at least 50 mm wide,
- will be located across the width of the door at a height of 1350 mm to 1500 above the finished floor, and
- may incorporate a logo or symbol provided such logo or symbol does not diminish,
 - the opacity of the strip.
 - the width of the strip,
 - the colour and brightness contrast of the strip to the background of the door, and
 - the continuity of the strip across the width of the door.

12.5 **Controls**

In accordance with Article 3.8.1.5., controls for the operation of building services or safety devices, including electrical switches, thermostats and intercom switches, intended to be operated by the occupant and located in a barrier-free path of travel will:

- Be mounted
 - 1200 mm above the finished floor, in the case of thermostat or a manual pull station, and
 - Not less than 900 mm and not more than 1100 mm above the finished floor, in the case of all other controls, and
- Be located so as to be adjacent to and centred on either the length or the width of a clear floor space of 810 mm by 1370 mm, and
- Be operable
 - Using one hand, without requiring tight grasping, pinching with fingers or twisting of the wrist, and with a force of not more than 22.2 N, in the case of a manual pull station, and
 - Using a closed fist and with a force of not more than 22.2 N, in the case of all other controls.

A signal intended for the public to indicate the operation of a building security system that controls access to a building will consist of an audible and visual signal.

12.6 Areas of Refuge (Protection on Floor Areas)

In accordance with Article 3.3.1.7., areas of refuge are not required in sprinklered buildings.

12.7 Drinking Fountains

In accordance with Sentence 3.8.3.16.(1), if drinking fountains are provided, at least one will be barrier-free that conforms to 3.8.3.16. (2) and (3):

In accordance with Sentence 3.8.3.16.(2), a barrier-free drinking fountain shall,

- have a spout located near the front of the unit at a height not more than 915 mm above the finished floor,
- be equipped with controls that activate automatically or are easily operable from a wheelchair using one hand with a force of not more than 22 N,
- project the water at least 100 mm high at a water stream conforming to (3.8.3.16.(2)(d)),
- be detectable by a cane at a level at or below 680 mm from the finished floor,
- comply with the water fountain requirements in Clause 3.8.3.16.(f) if the drinking fountain is cantilevered.

A barrier-free drinking fountain required by 3.8.3.16.(1) shall have a minimum clear floor space in front of, or adjacent to, the fountain that is a minimum of 810 mm deep by 1370 mm wide.

12.8 Washrooms Required to be Barrier-Free

Each gender-neutral washroom will be designed as a barrier-free accessible washroom enclosure as required by Sentence 3.8.2.3.(1).

In accordance with Article 3.8.3.8., a barrier-free water closet stall will have a minimum turning space within the stall or enclosure of 1,500 mm in diameter and a minimum clear floor space in front of the stall or enclosure of at least 1,500 mm in diameter. An in-swinging door will be provided with a clear floor area in the stall of 820 mm by 1440 mm to permit the door to close without interfering with a wheelchair.

12.8.1 Door Hardware

In accordance with Article 3.8.3.8., a minimum 860 mm wide self-closing door will be provided that is capable of being latched from the inside with a mechanism that is operable using a closed fist.

The door will be provided with a D-shaped, visually contrasting door pull on both sides mounted on the vertical centreline of the door and located at a height not less than 800 mm and not more than 1,000 mm above the finished floor. The latch will be capable of being released from the outside in case of an emergency.

12.8.2 Water Closet

In accordance with Article 3.8.3.9., a water closet will be located so that the centre line of the water closet is not less than 460 mm and not more than 480 mm from one side wall. In addition, a clear transfer space of at least 900 mm wide and 1,500 mm deep will be provided on the other side of the water closet.

The water closet will be equipped with a seat located at not less than 430 mm and not more than 485 mm above the finished floor. A back support will be provided if there is no seat lid or tank.

12.8.3 Grab Bars

In accordance with Article 3.8.3.8., a grab bar will be provided at the side wall that is a continuous L-shape with 750 mm long horizontal and vertical components and be wall mounted with the horizontal component 750 mm above the finished floor and the vertical component 150 mm in front of the water closet.

A grab bar will be provided behind the water closet that is at least 600 mm in length and mounted horizontally from 840 mm to 920 mm above the finished floor and, where the water closet has a water tank, be wall mounted 150 mm above the tank.

12.9 Universal Washrooms

A new universal washroom will be provided at Level 2 within the renovated floor area (Room 206A).

12.9.1 Room Dimensions

In accordance with Article 3.8.3.12., a universal washroom will be served by a barrier-free path of travel and have a minimum internal dimension of 1,700 mm. In addition, the washroom will have an unobstructed turning diameter of 1,700 mm for a wheelchair.

12.9.2 Adult-Sized Change Table

In accordance with Article 3.8.3.12., a clear space not less than 810 mm wide and 1,830 mm long will be provided in each universal washroom for an adult-size change table.

The space for the adult-sized change table may encroach upon the 1,700 mm turning circle only where the change table is moveable and is not permanently fixed or stored within the washroom.

Where the clear space provided for an adult-size change table is adjacent to a wall, reinforcement will be installed in the wall to permit the future installation of the change table.

Where an adult-size change table is installed, it will:

- when fully loaded, have a surface height above the finished floor that can be adjusted from between 450 mm and 500 mm at the low range to between 850 mm and 900 mm at the high range,
- be designed to carry a minimum load of 1.33 kN,

- have a clear floor space parallel to the long side of the table not less than 760 mm wide and 1500 mm long, and
- in the case of a fold-down table,
 - be installed so that it does not encroach into a clear transfer space described in the washrooms section above, and
 - have no operating mechanisms higher than 1,200 mm.

12.9.3 Door Hardware

In accordance with Article 3.8.3.12., door hardware will consist of a graspable latch-operating mechanism located not less than 900 mm and not more than 1,000 mm above the finished floor and, is capable of being locked from the inside and released from the outside in case of emergency.

A door to a Universal Washroom will be equipped with a powered door operator.

12.9.4 Lavatory

In accordance with Article 3.8.3.11., the lavatory will be located so that:

- the distance between the centre line of the lavatory and the side wall is not less than 460 mm,
- the top of the lavatory is not more than 840 mm above the finished floor,
- the clearance beneath the lavatory is not less than,
 - 920 mm wide,
 - 735 mm high at the front edge,
 - 685 mm high at a point 205 mm back from the front edge, and
 - 350 mm high from a point 300 mm back from the front edge to the wall,
- faucets operate automatically or are lever type handles that do not require application of continuous force to maintain water flow, and are located so that the distance from the centre line of the faucet to the edge of the basin or, where the basin is mounted in a vanity, to the front edge of the vanity, is not more than 485 mm,
- there is a minimum 1,370 mm deep floor space to allow for a forward approach, of which a maximum of 500 mm can be located under the lavatory, and
- a soap dispenser and a towel dispenser located to be accessible to persons in wheelchairs and not more than 1,200 mm above the finished floor not more than 610 mm measured horizontally from the edge of the lavatory.

A mirror will be provided above that lavatory that is mounted with its bottom edge not more than 1,000 mm above the finished floor or inclined to the vertical to be usable by a person in a wheelchair.

12.9.5 Water Closet

In accordance with Article 3.8.3.9., the water closet will be located so that the centre line of the water closet is not less than 460 mm and not more than 480 mm from one side wall. In addition, a clear transfer space of at least 900 mm wide and 1,500 mm deep will be provided on the other side of the water closet.

The water closet will be equipped with a seat located at not less than 430 mm and not more than 485 mm above the finished floor.

12.9.6 Grab Bars

In accordance with Article 3.8.3.8., a grab bar will be provided at the side wall that is a continuous L-shape with 760 mm long horizontal and vertical components and be wall mounted with the horizontal component 750 mm above the finished floor and the vertical component 150 mm in front of the water closet.

A grab bar will be provided behind the water closet that is at least 600 mm in length and mounted horizontally from 840 mm to 920 mm above the finished floor and, where the water closet has a water tank, be wall mounted 150 mm above the tank.

12.9.7 Emergency Call Button

In accordance with Article 3.8.3.12., an emergency call system will be provided that consists of audible and visual signal devices inside and outside of the washroom that are activated by a control device inside the washroom.

In addition, an emergency sign will be posted above the emergency call button that that contains the words IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY BUTTON AND AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE in letters at least 25 mm high with a 5 mm stroke.

13.0 CONCLUSION

The 2012 Ontario Building Code provides a minimum set of requirements which establishes an acceptable level of fire protection and life safety for buildings. This Building Code Outline Report outlines the various approaches to meet the intent of the applicable requirements with the 2012 Ontario Building Code.

In conclusion, the proposed fire protection and life safety features for the Project, as described in this report, will provide a level of fire protection and life safety that equals or exceeds the minimum acceptable levels established by the requirements of the 2012 Ontario Building Code.

Prepared by:

LMDG BUILDING CODE CONSULTANTS LTD.

Andrew McPherson, FPET
BCIN 22705

Reviewed by:

Erin L. McClintock, P.Eng.

**CAFCO INDUSTRIES INC.**

151 Nashdene Road, Unit 12,
Toronto, Ontario, M1V 2T3
Telephone: 416.679.2830

August 19, 2024

ENFORM Architects Inc.
302B – 128A Sterling Rd.
Toronto, Ontario
M6R 2B7

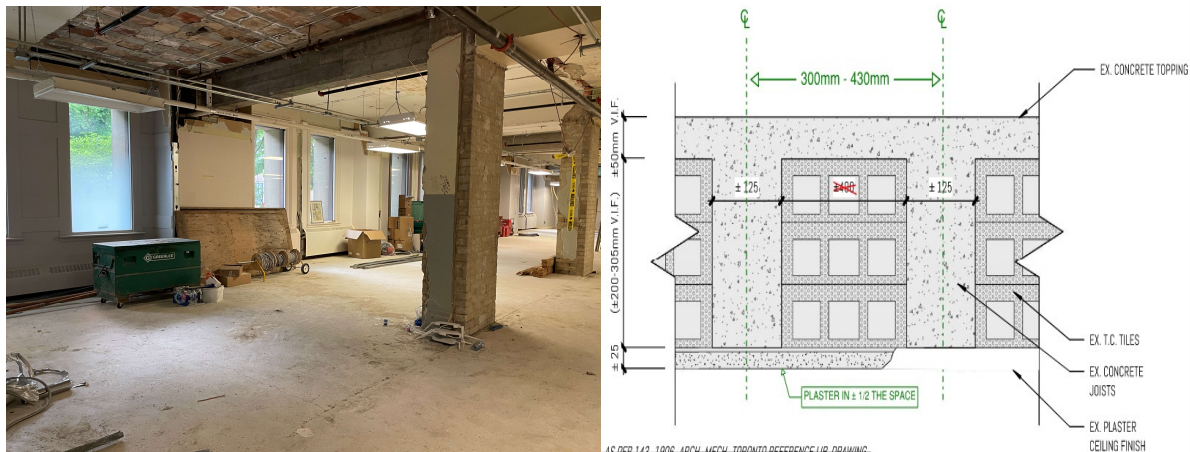
Attention: Mr. Sean Cain

Re: UofT - Koffler Health and Wellness, 214 College Street, Toronto ON

To whom it may concern:

This letter has been written regarding your inquiry into the application of our CAFCO Blaze-Shield II Spray-Applied Fire Resistive Material (SFRM) to obtain a 1-hour Fire Resistance Rating (FRR) to existing conditions at the above-mentioned project.

Area 1:

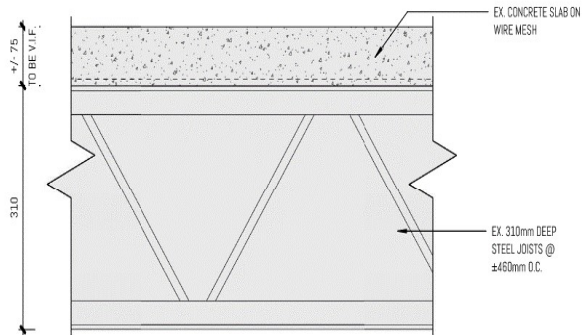


**CAFCO INDUSTRIES INC.**

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Toronto, Ontario, M1V 2T3
Telephone: 416.679.2830

Page 2 of 2

Area 2:



For this area, there are also no ULC/cUL listings for a concrete floor with welded wire mesh. Our recommendation would be to apply our CAFCO Bond-Seal as adhesive to the concrete slab, and reference cUL design J809 for the Blaze-Shield II SFRM thickness requirement. The fireproofing thickness required to the concrete would be determined by the thickness of the slab. The OWSJ's would achieve the 1-hour FRR by utilizing cUL N860.

The above proposal has been provided to assist the architect, owner and authority having jurisdiction to determine a suitable protection method. Authorities having jurisdiction must be consulted for approval for all conditions which fall outside the scope of UL design testing.

We trust this information will be of assistance.

Yours truly,

Tom Parish
Technical Sales Manager | Canada
CAFCO Industries Inc. / Isolatek International



Brand

www.cafco.com

ISOLATEK[®]
Brand



October 15, 2009

Mr. Rudy Jagnandan
Isolatek International
41 Furnace Street
Stanhope, NJ 07874

Our Reference: R3749; 09CA43616

Dear Mr. Jagnandan:

This is in response to your request that Underwriters Laboratories, Inc. (UL) undertake an investigation to summarize fire test data pertaining to the thermal transmission properties of your Types DC/F, II, or HP Spray-Applied Fire Resistive Material (SFRM) when applied to expanded metal lath substrates.

Thermal transmission properties were developed through engineering studies and small-scale testing. The small scale test samples were 4 ft. by 4 ft. with expanded metal lath weighing 2.5 lb./sq. yd. applied directly to framing. The tests were conducted under project 96NK34305.

The Type II SFRM was applied to the metal lath at various thicknesses. Thermocouples were placed on the unexposed surface of the assemblies to measure temperature rise. The small-scale specimens were tested on UL's small scale horizontal furnace with temperatures controlled in accordance with the UL 263 time temperature curve. These tests were conducted to establish the time at which the temperature on the unexposed surface was raised an average of 250 °F over the surface or 325 °F at an individual location.

Test data was studied to develop equations for forecasting the time at which assemblies would reach an average of 250 °F over the surface or 325 °F at an individual location for a thickness of material over the substrate. The following table has been developed based on these equations.

| Thickness of Types DC/F, II, or HP Spray-Applied Fire Resistive Material (SFRM) when applied over metal lath surface | | | |
|---|--------------|------------------|--------------|
| Hourly Rating | 1 hr. | 1-1/2 hr. | 2 hr. |
| Thickness (in.) | 2-1/16" | 2-5/8" | 3-1/4" |

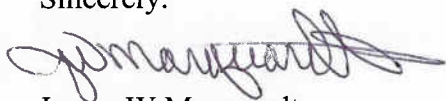
The density of the fireproofing material shall be in accordance with Design P819 contained in the UL Fire Resistance Directory. Authorities having jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Listed or Classified products, equipment, systems, devices and materials.

Only those products bearing the appropriate Classification Marking and the company's name, trade name, trademark, or other recognized identification should be considered as covered by UL's Classification and Follow-Up Service. Any information and documentation involving UL

Mark services are provided on behalf of Underwriters Laboratories, Inc. (UL) or any authorized licensee.


We trust the above answers your inquiry. However, if you should have any additional questions, please feel free to contact the writer.

Sincerely:



James W Marquardt
Staff Engineer
Fire Protection Department

Reviewed:



Patrick A Zeeveld
Staff Engineer
Fire Protection Department

SIGNAGE & WAYFINDING PROGRAM UofT — HEALTH & WELLNESS CENTRE

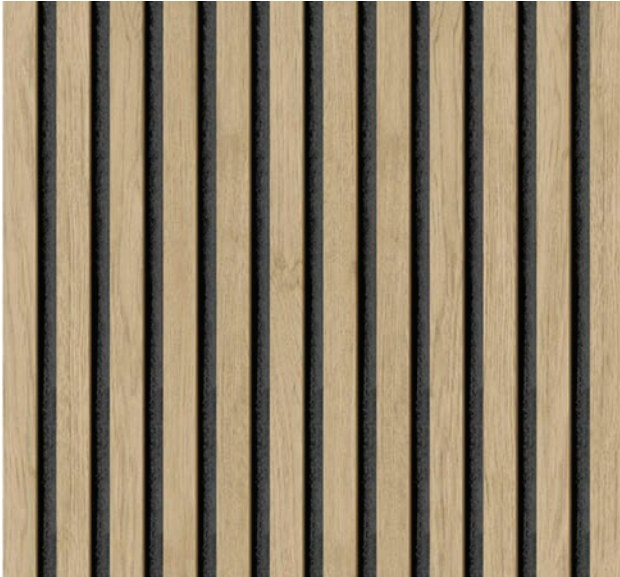
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January 31, 2025

SIGNAGE DESIGN

LOOK & FEEL

Inspired from arches and line-based architectural features.



SIGNAGE & WAYFINDING PROGRAM
UOFT KOFFLER HEALTH & WELLNESS CENTRE

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Drawing
Precedent Images

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| | EW/SA | NG |

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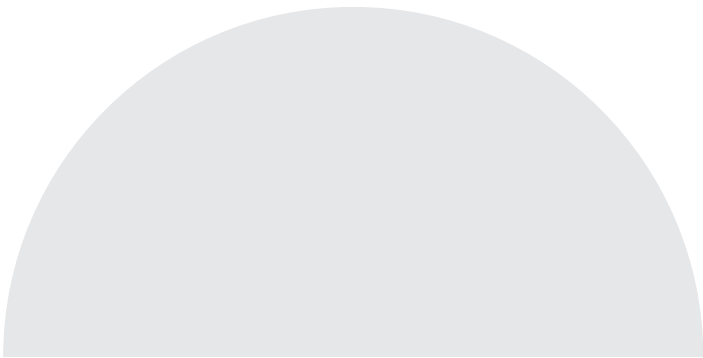
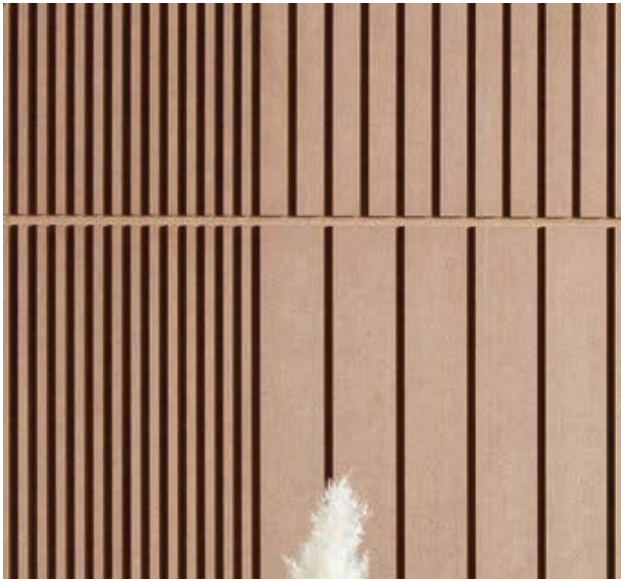
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| 0490 | October, 2024 |

Drawing No.
GEN-06

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DESIGN ELEMENTS

Rounded forms and linear patterns.



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Drawing

Title

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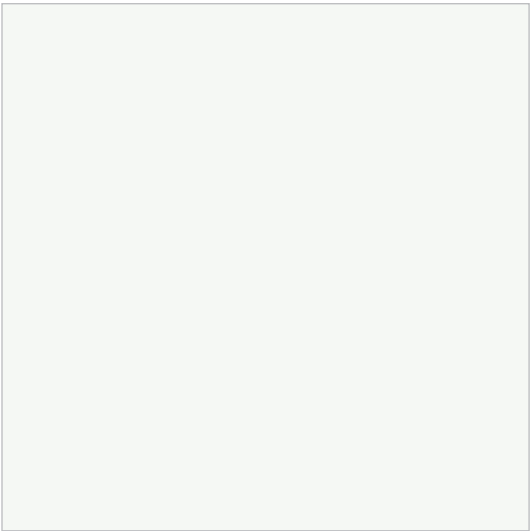
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Drawing No.
LOC-Level #

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COLOURS

From interior finishes, consistent, and legible.



WHITE

Interior signage background panel



BRONZE

Text colour on white background.



STAINLESS STEEL

Donor dimensional lettering.

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Drawing

Typography

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Drawing No.
GEN-02

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TYPOGRAPHY

Gotham Rounded, friendly, welcoming and approachable.

Aa

Gotham Rounded, Book

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890

Gotham Rounded, Medium

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890

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Drawing
Typography

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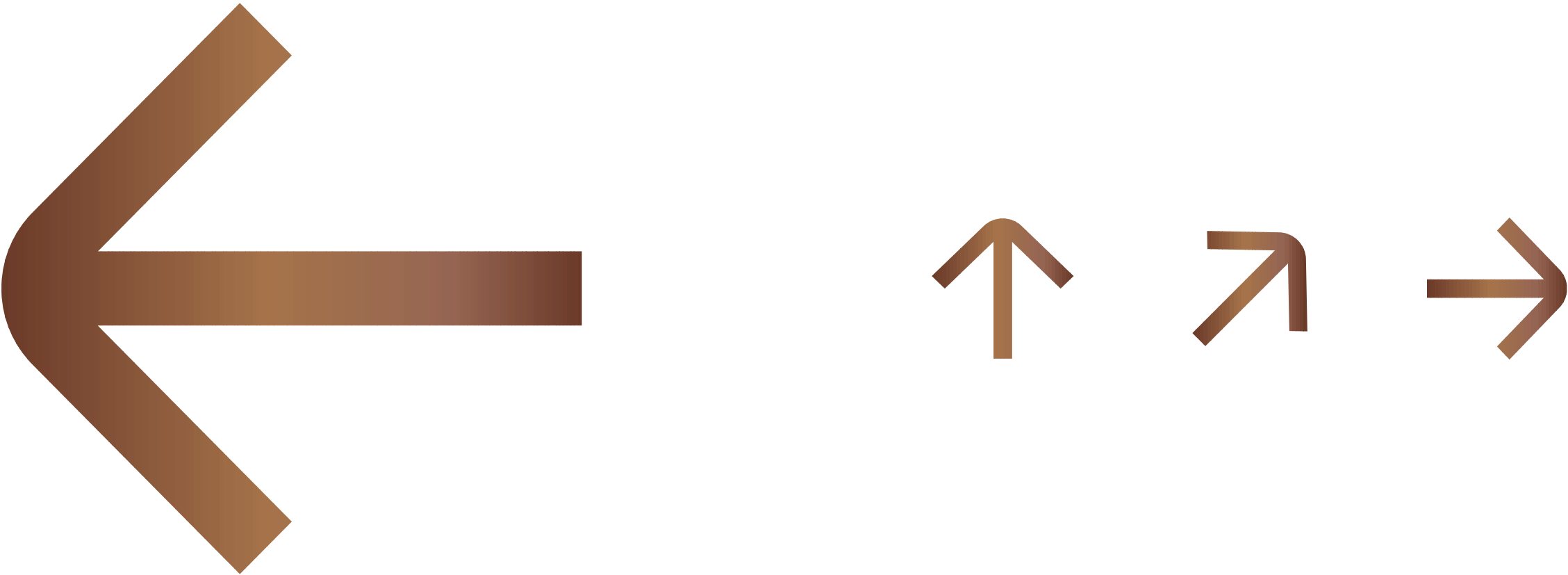
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Drawing No.

ARROWS

Gently curved arrows, consistent design and character.



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Drawing

Arrows

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| Job No. | Project Start Date |
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Drawing No.

PICTOGRAMS

Easily recognizable, universal, and accessible.



Accessible



Inclusive Accessible
Washroom



Men Accessible



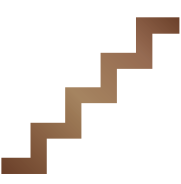
Women Accessible



Nursing



Information



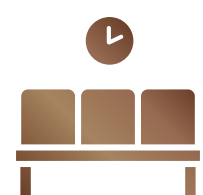
Stairs



Elevator



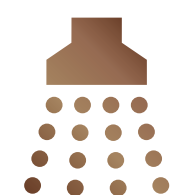
Kitchen



Waiting Area



Lockers



Showers

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Drawing
Pictograms

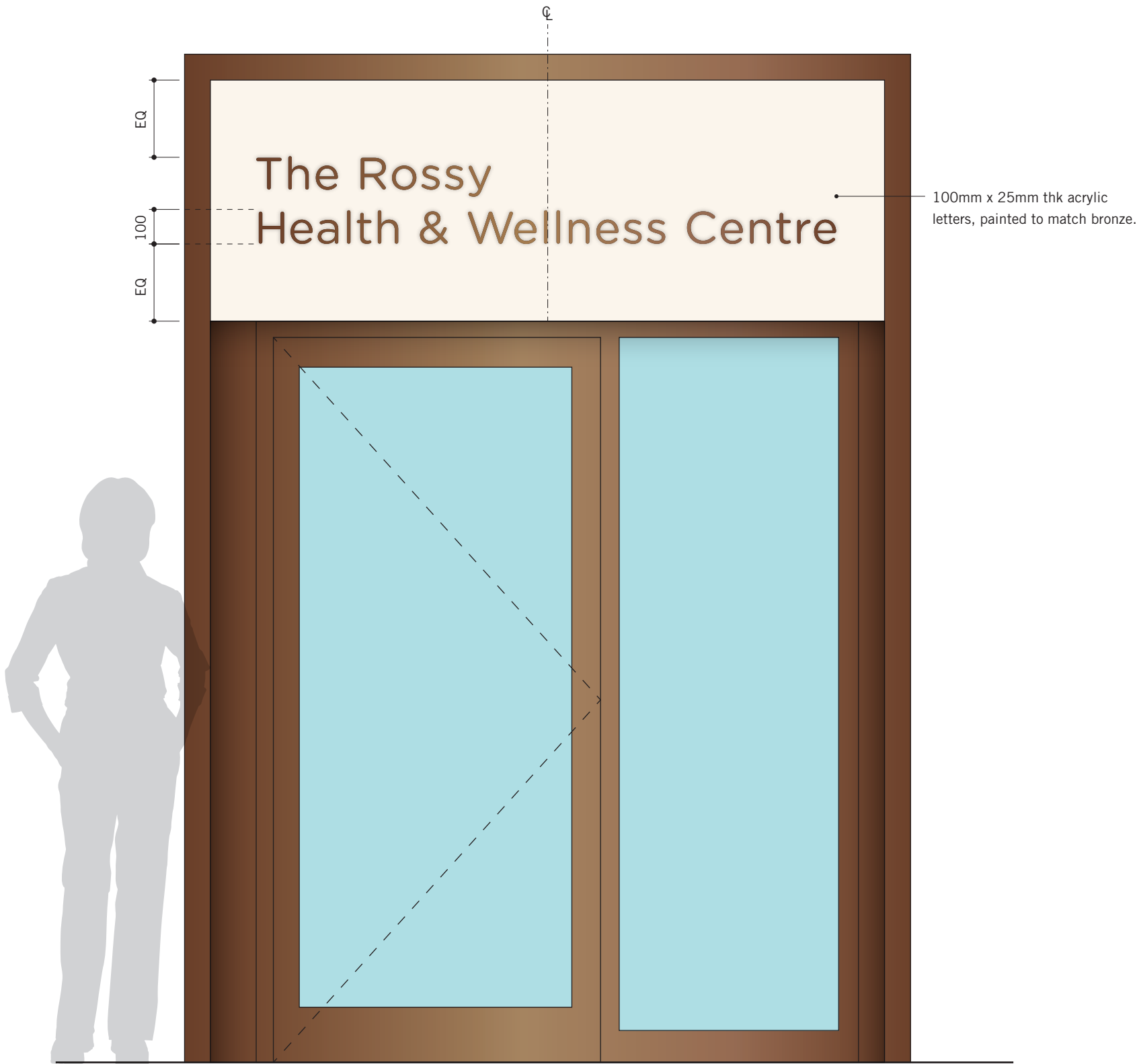
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Drawing No.

ENTRANCE IDENTIFICATION
DONOR RECOGNITION - PIN LETTER SIGNAGE



A1.1 ENTRANCE ID
Scale 1:15



TYPICAL PLACEMENT
NTS

SIGNAGE & WAYFINDING
PROGRAM
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Drawing
A1.1 Entrance ID

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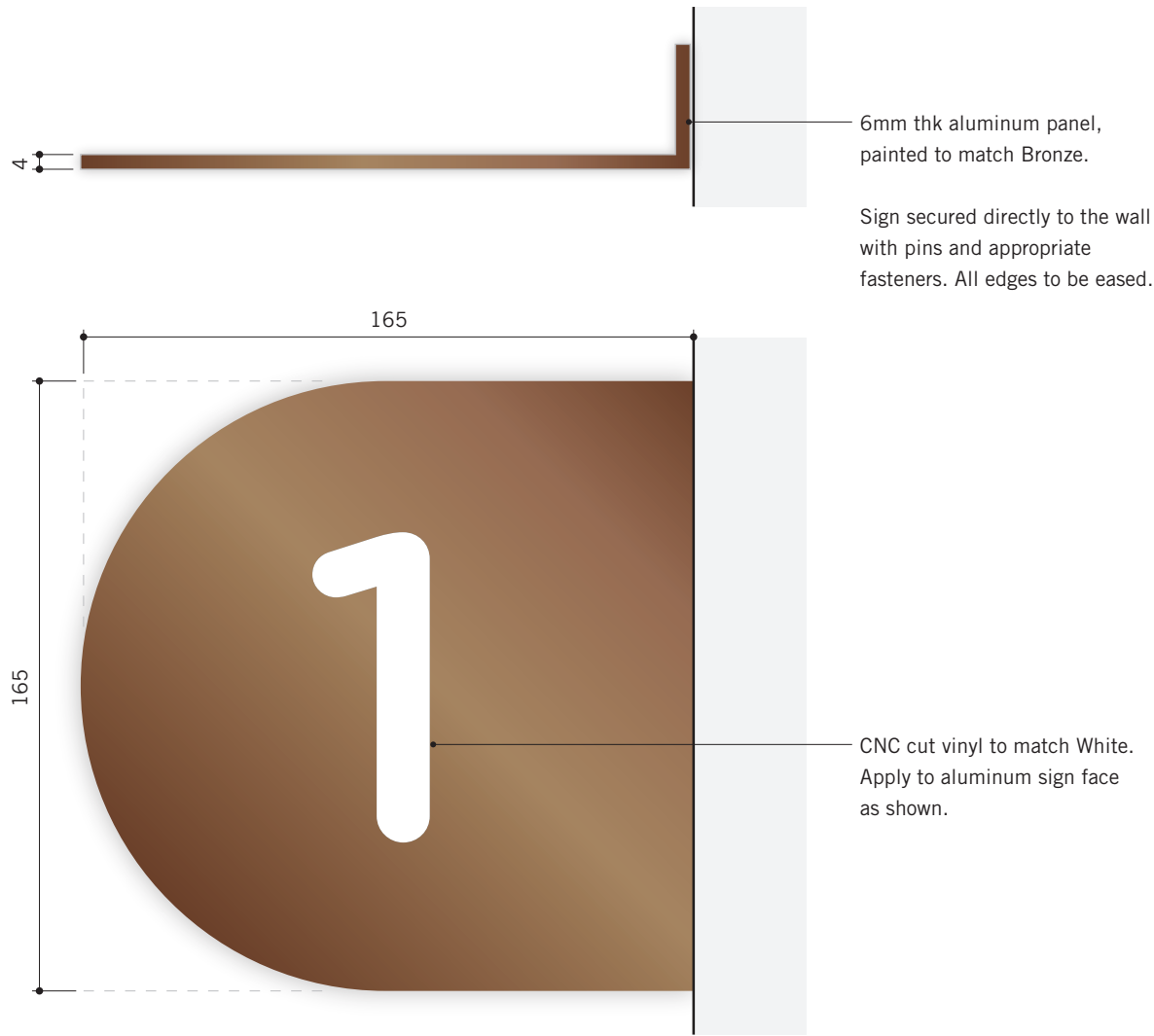
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| Scale | Dimensions |
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DESK NUMBER ID — RECOMMENDED



A2.1 DESK NUMBER ID
Scale 1:2



TYPICAL PLACEMENT
NTS

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Drawing

A2.1 Desk Number ID

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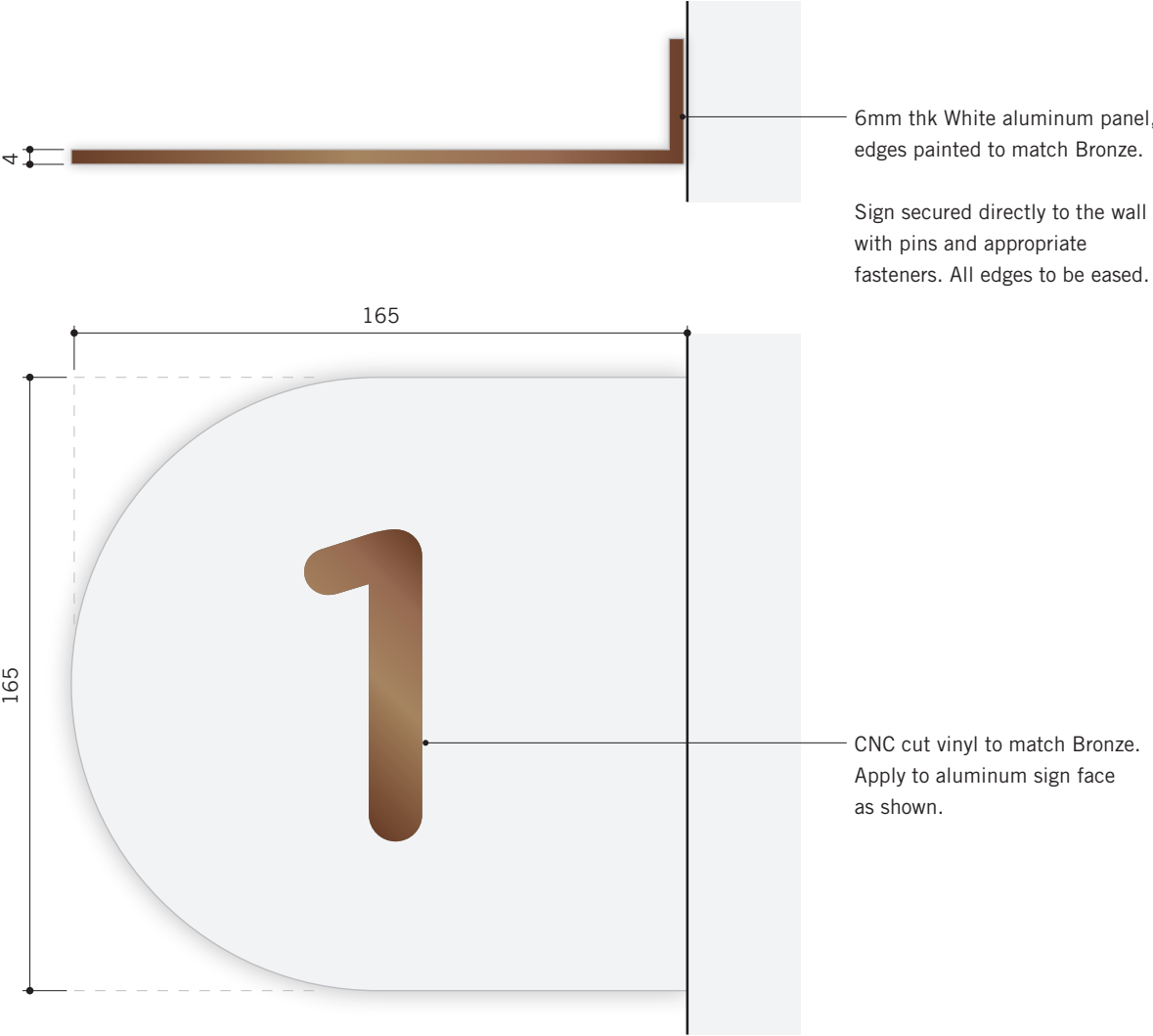
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DESK NUMBER ID



A2.1 DESK NUMBER ID
Scale 1:2



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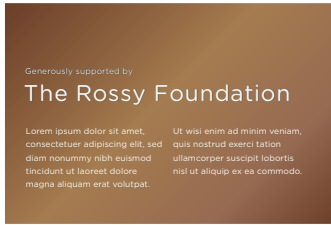
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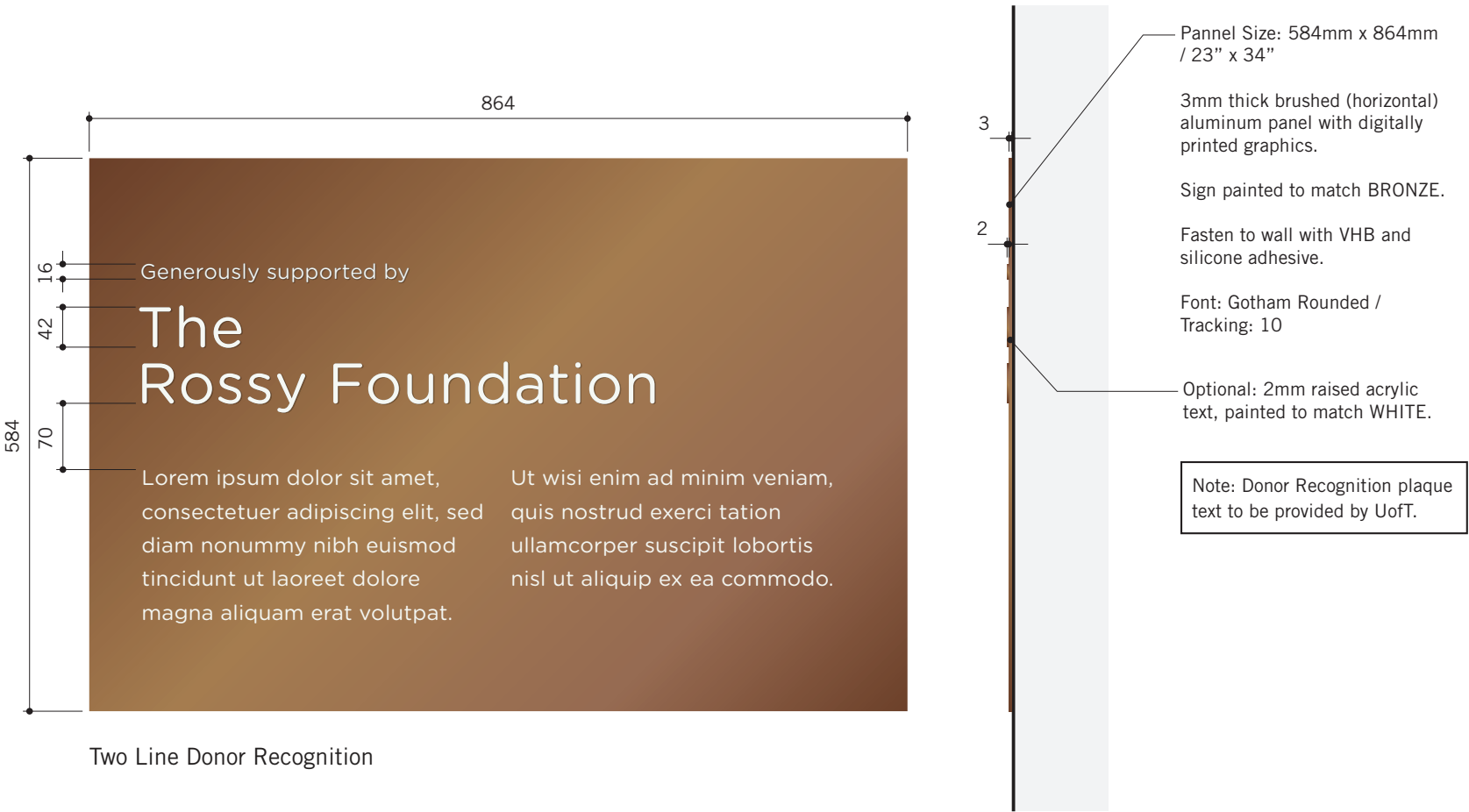
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DONOR RECOGNITION – STORYTELLING PLAQUE



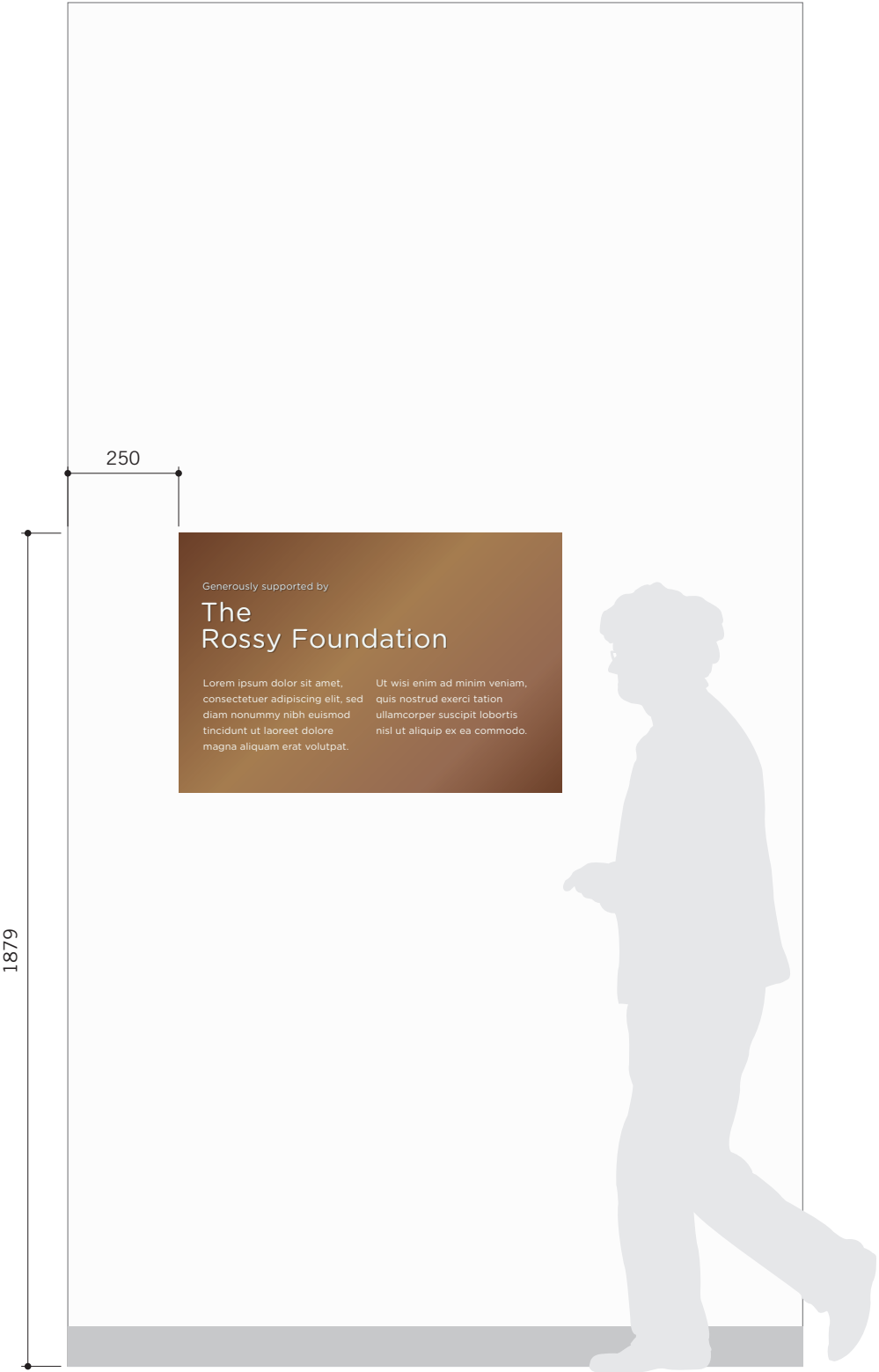
One Line Donor Recognition

MESSAGING VARIATIONS
Scale 1:20



Two Line Donor Recognition

D1.1 DONOR RECOGNITION
Scale 1:7



TYPICAL PLACEMENT
Scale 1:15

Note: Vertical mounting height to be specified when final floor to ceiling height is provided.

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Drawing

D1.1 Donor Recognition

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DONOR RECOGNITION – STORYTELLING PLAQUE
SUGGESTED PLACEMENT LOCATION



Generously supported by
**The
Rossy Foundation**

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat.

Ut wisi enim ad minim veniam, quis nostrud exerci tation ullamcorper suscipit lobortis nisl ut aliquip ex ea commodo.

DRAWING IS NOT TO SCALE
SCALE: N/A

LEVEL ID



DEBOSSSED LINES



DEBOSSSED LINES

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Drawing

A3.1 Level ID

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| Job No. | Project Start Date |
| 0490 | October, 2024 |

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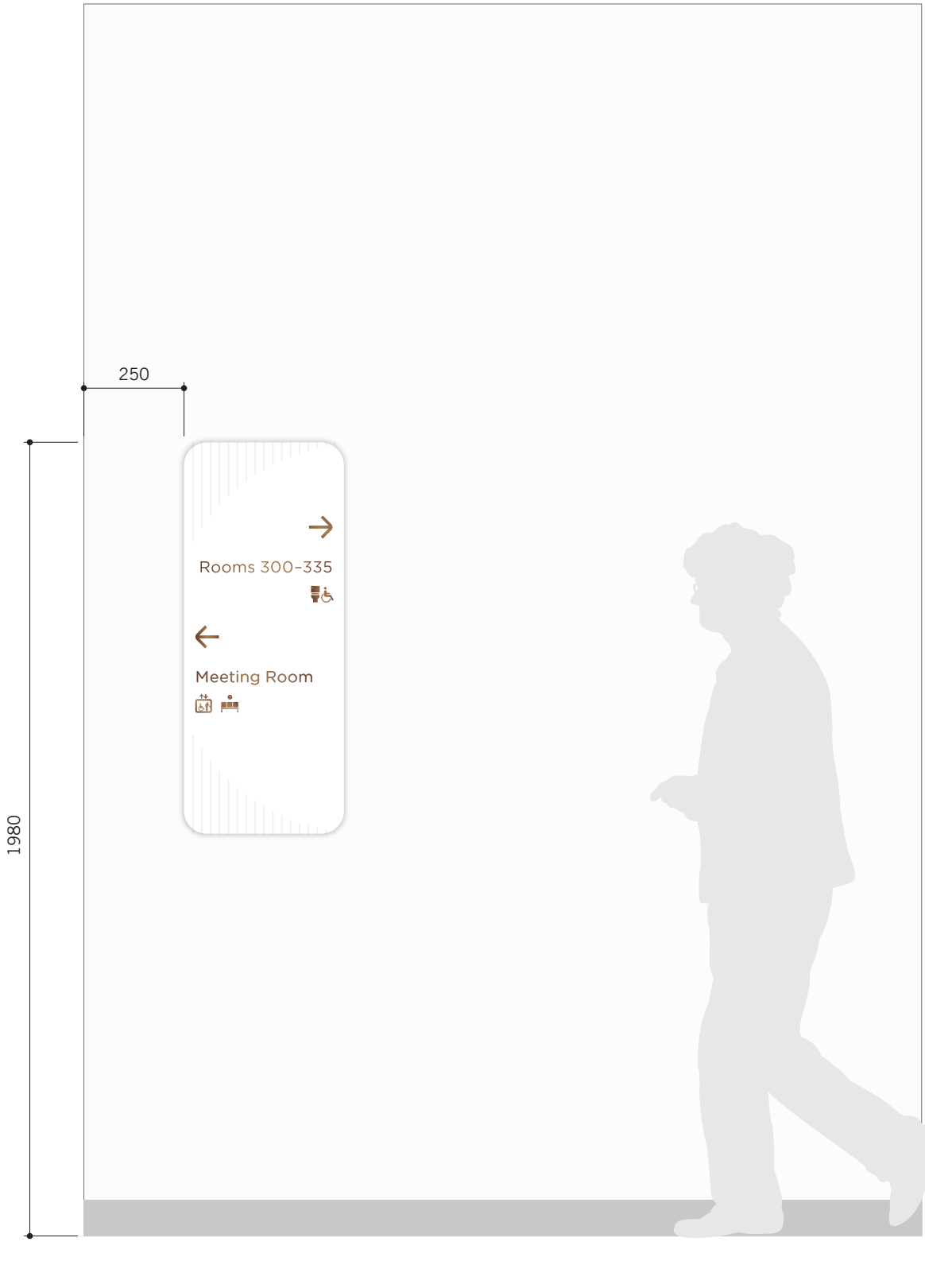
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DIRECTIONAL



B1.1 DIRECTIONAL
Scale 1:5



TYPICAL PLACEMENT
Scale 1:15

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Drawing
B1.1 Directional

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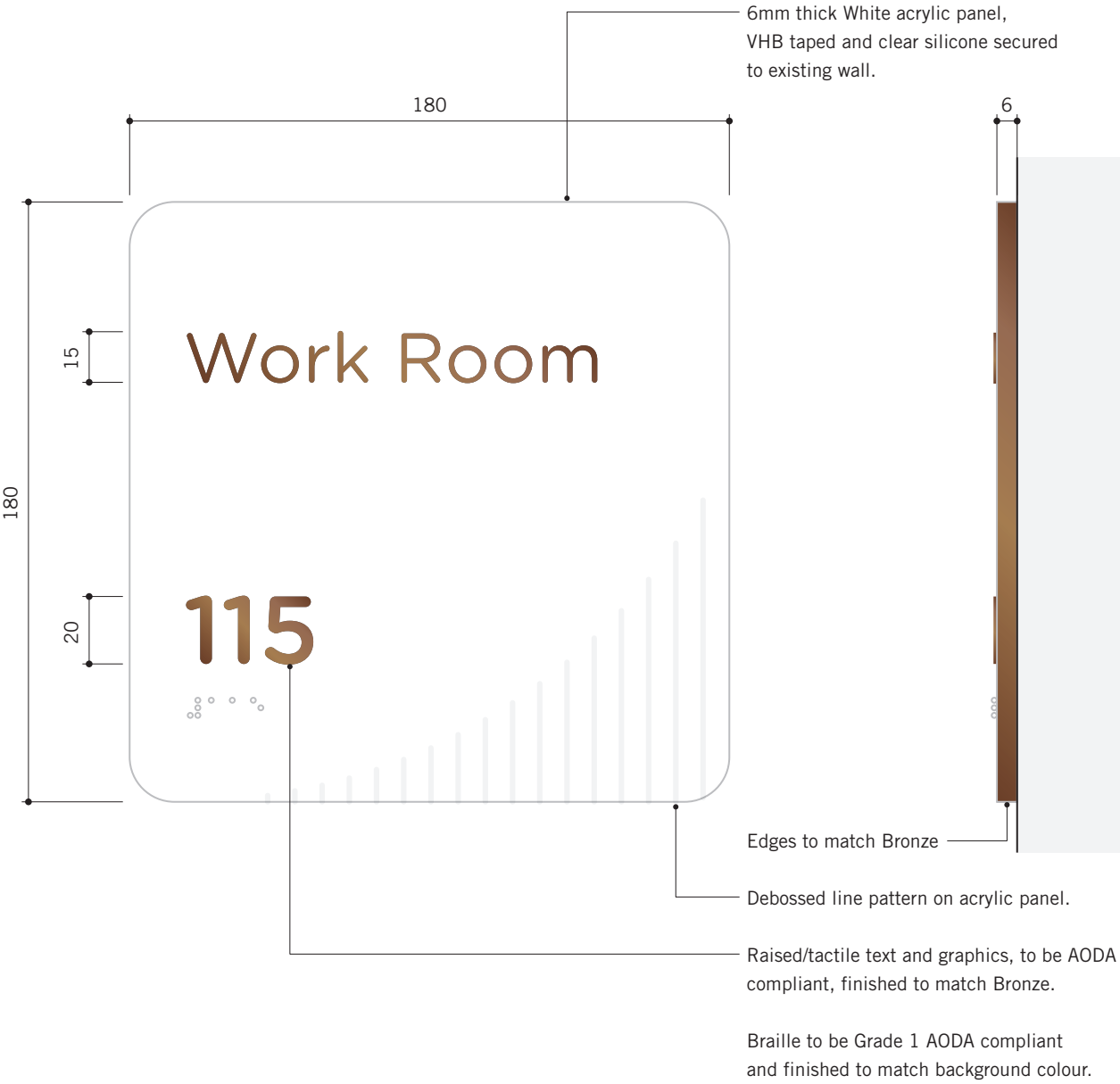
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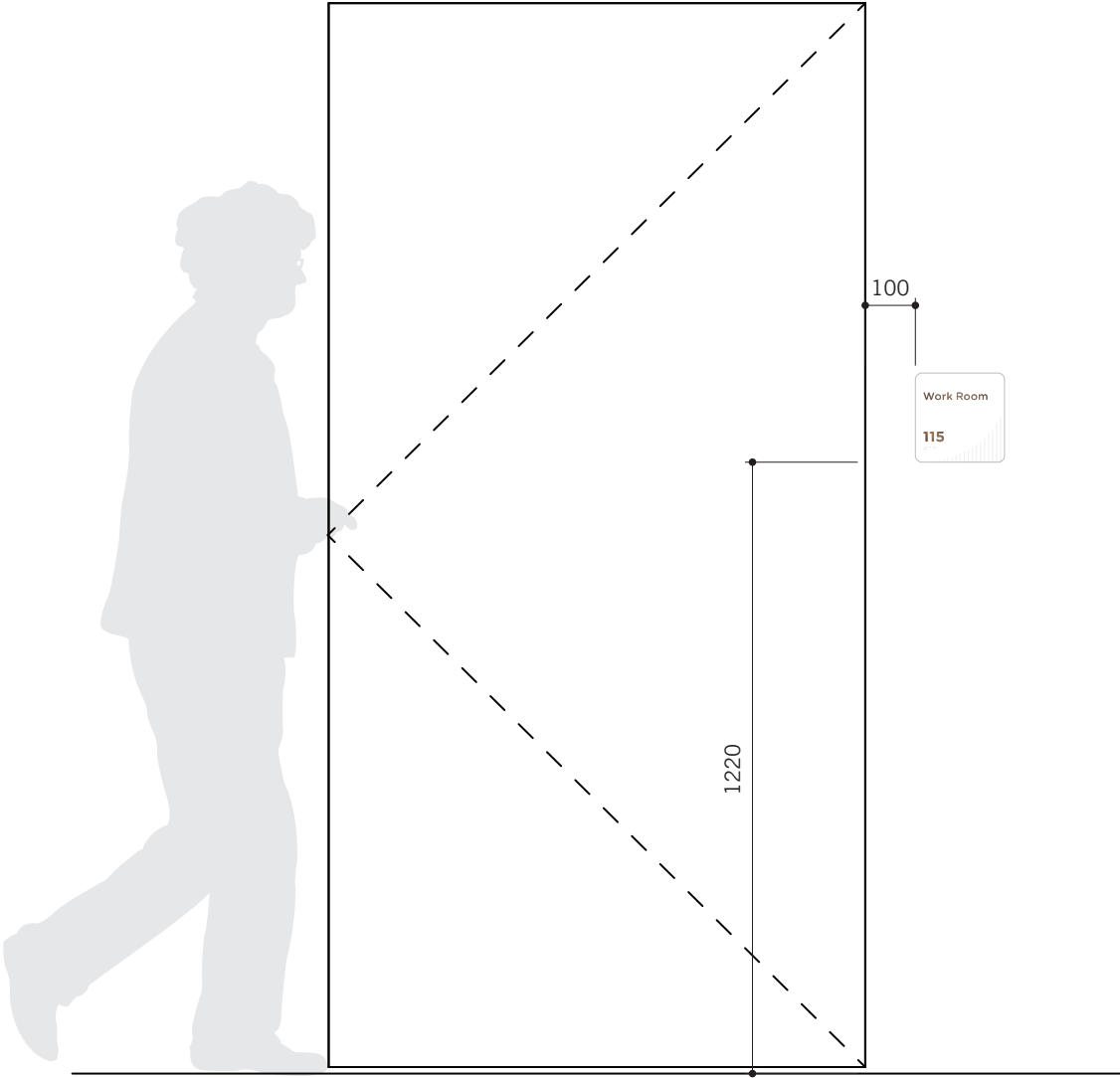
ROOM ID



E1.1 ROOM ID
Scale 1:2



E1.2 ROOM ID – NUMBER ONLY



TYPICAL PLACEMENT
Scale 1:15

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| No. | Description | Date |

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Drawing
E1.1 Room ID

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| E1.1 | EW/SA | NG |

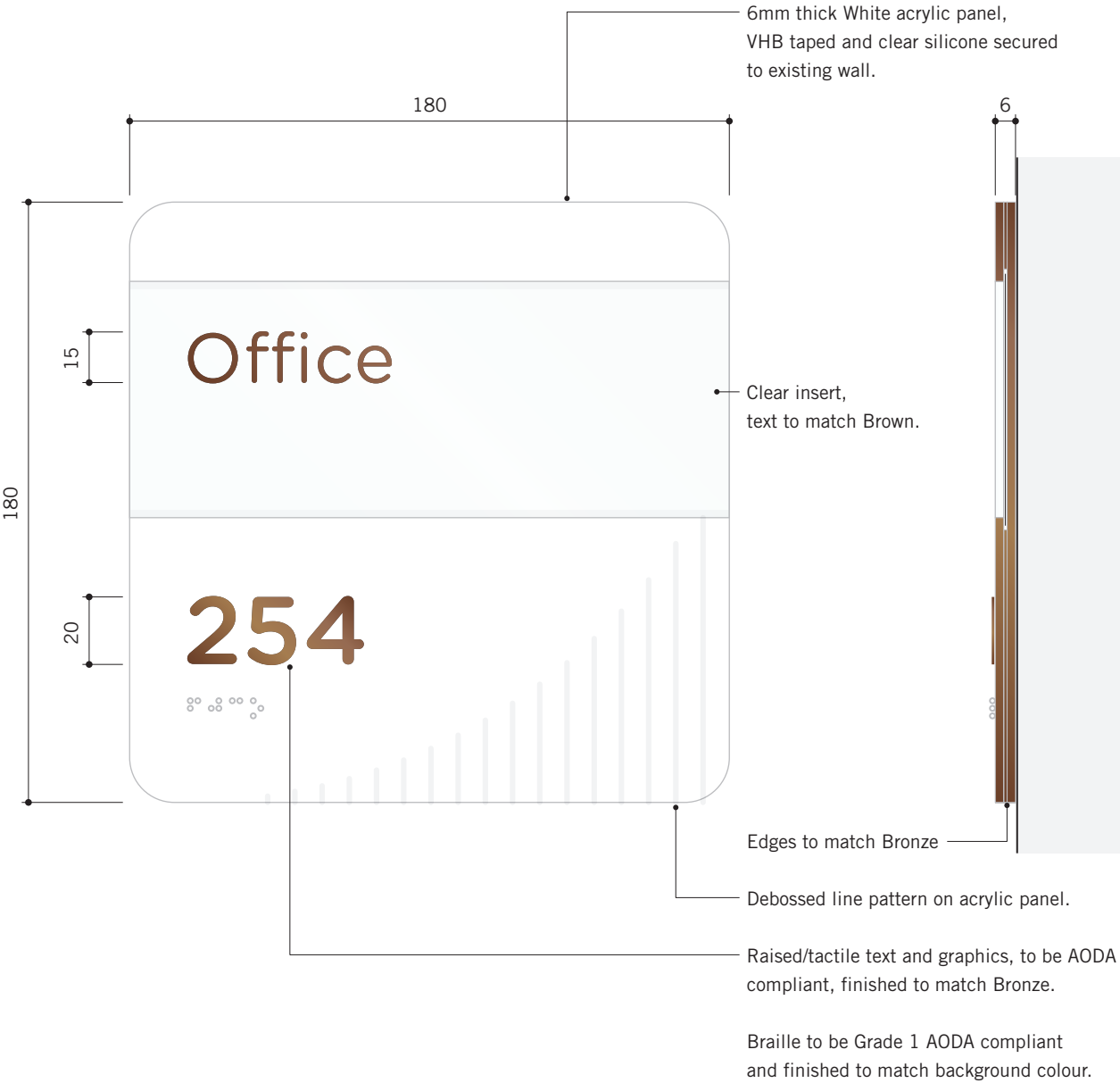
| | |
|-------|------------|
| Scale | Dimensions |
| -- | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

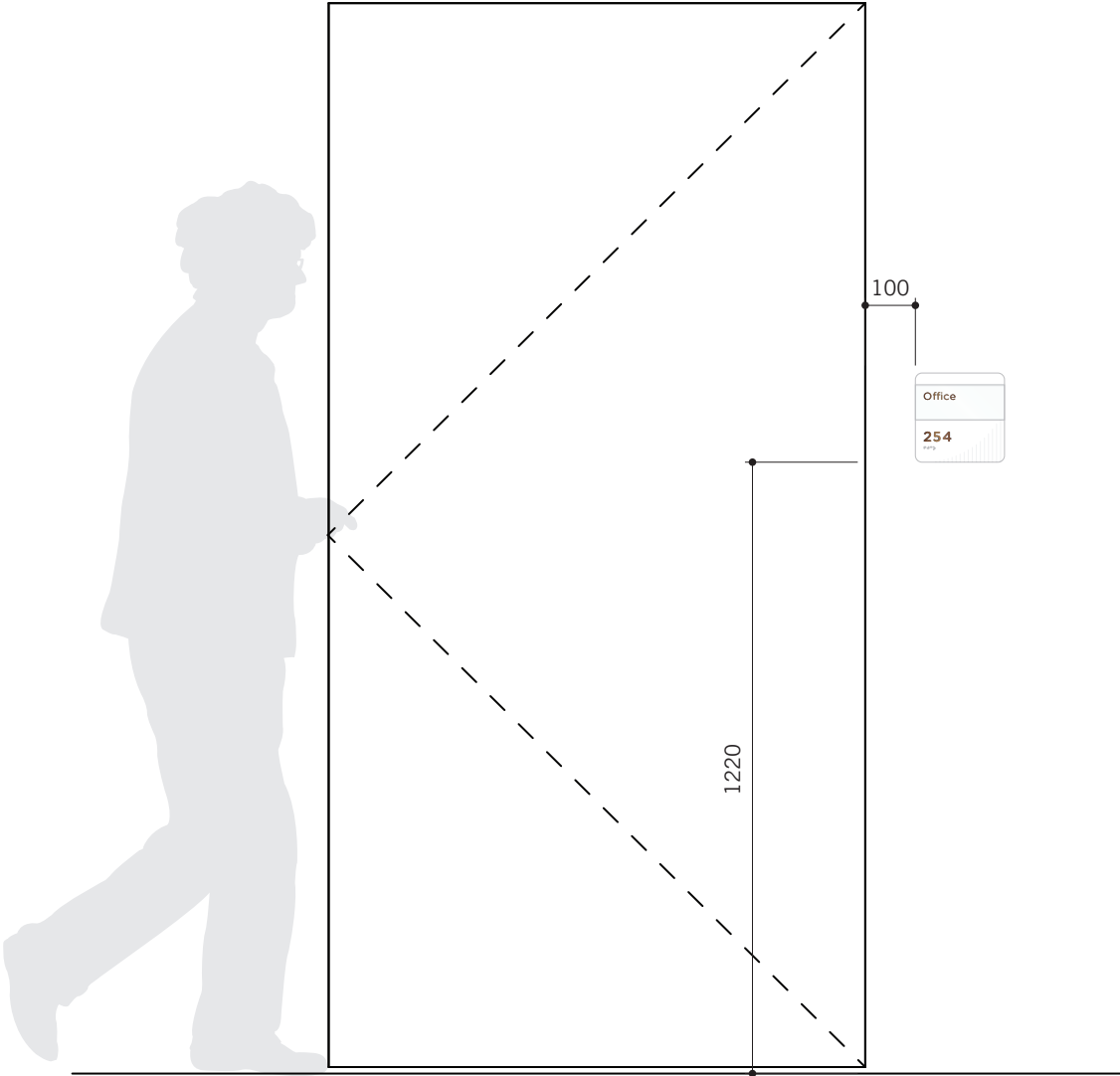
Drawing No.

| | | |
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ROOM ID (INSERT)



E2.1 ROOM ID – WITH INSERT
Scale 1:2



TYPICAL PLACEMENT
Scale 1:15

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Drawing
E2.1 Room ID – Insert

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| E2.1 | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| -- | Metric |

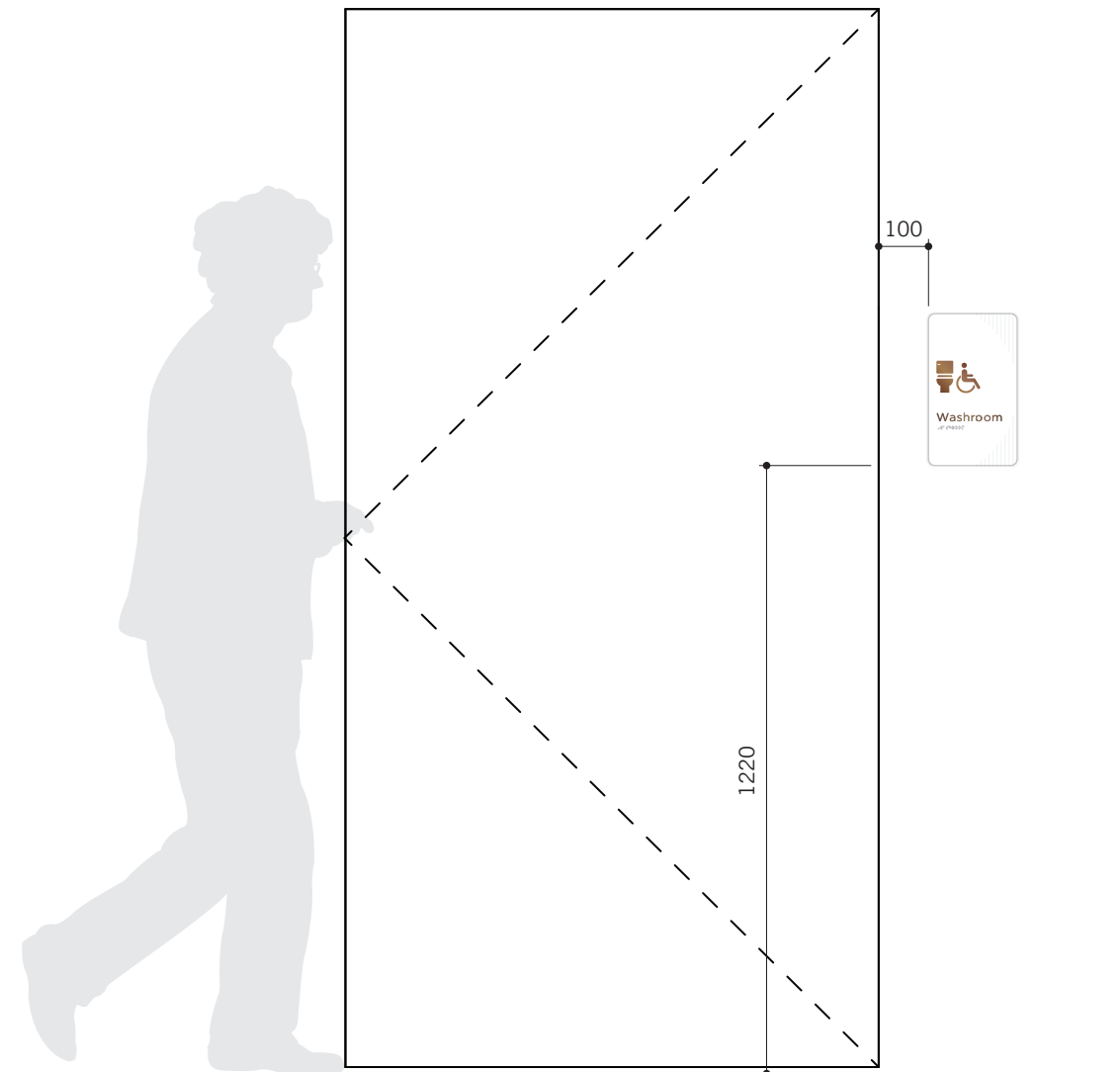
| | |
|---------|--------------------|
| Job No. | Project Start Date |
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Drawing No.

AMENITY ID



H1.1 AMENITY ID – WALL MOUNTED
Scale 1:2



TYPICAL PLACEMENT
Scale 1:15

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Drawing

H1.1 Amenity ID – Wall Mounted

| | | |
|-------------|----------|------------|
| Sign Type | Drawn By | Checked By |
| H1.1 | EW/SA | NG |

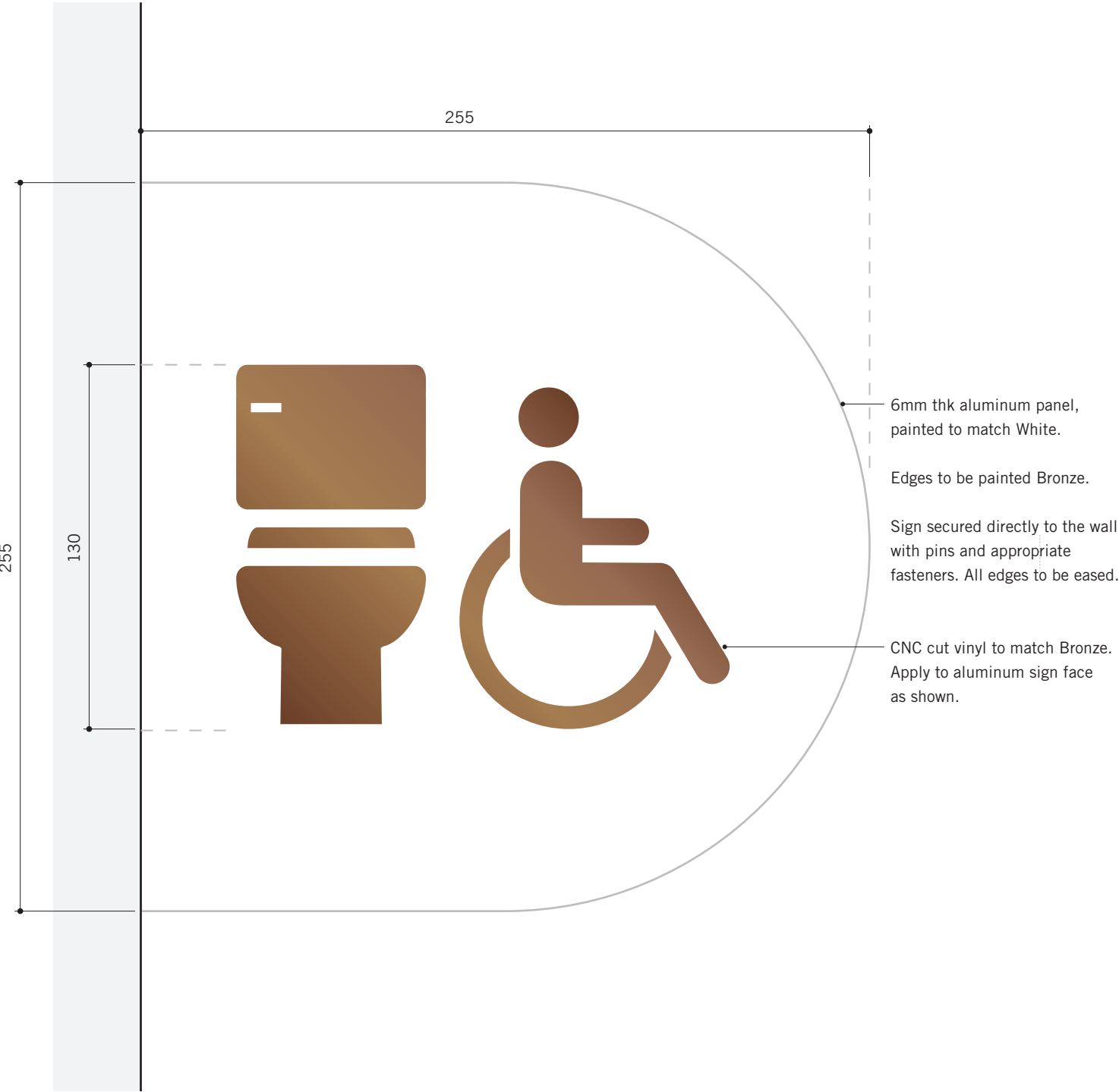
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|-------|------------|
| -- | Metric |

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|---------|--------------------|
| Job No. | Project Start Date |
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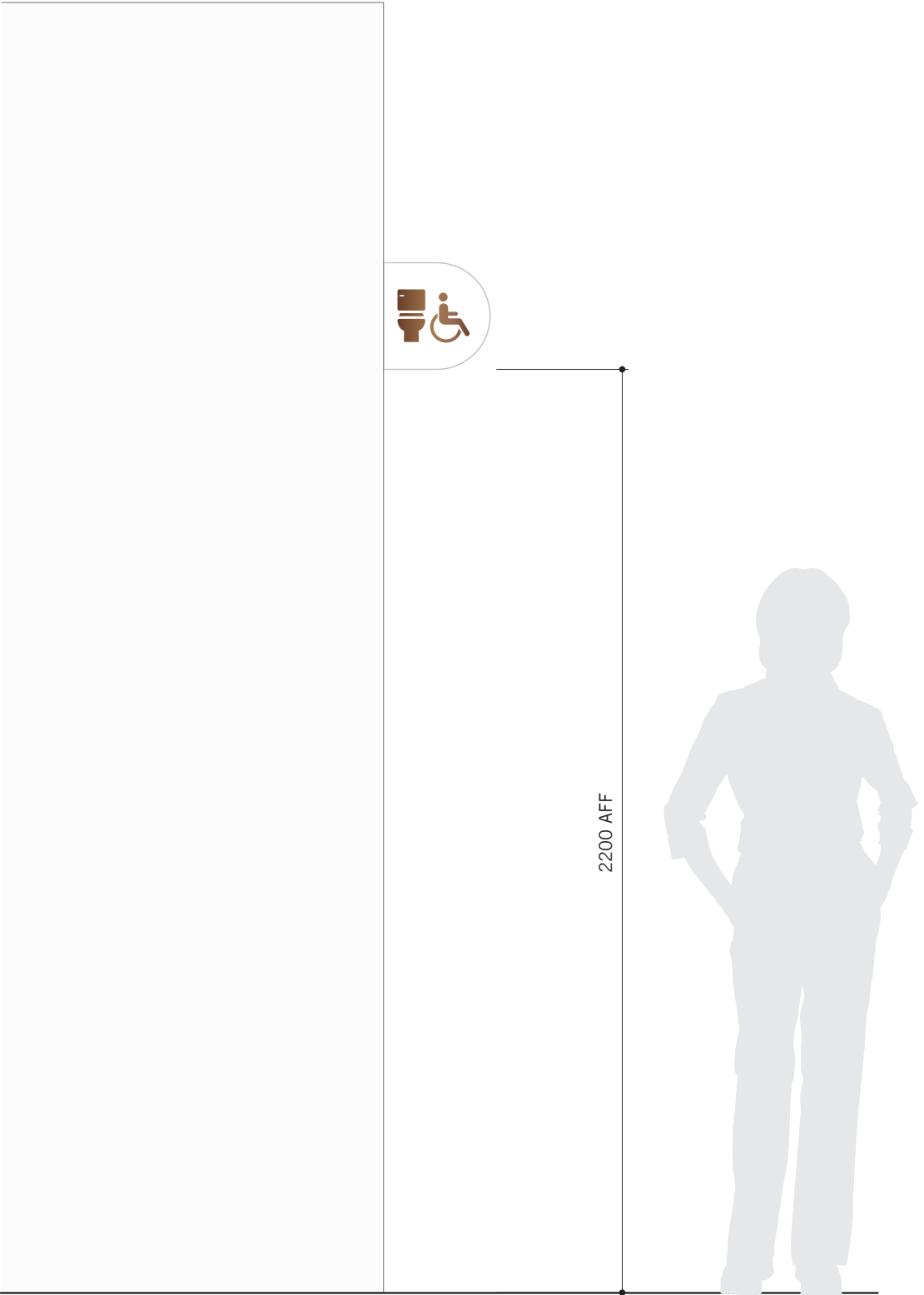
Drawing No.

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PROJECTING AMENITY ID



H2.1 AMENITY ID – PROJECTING
Scale 1:2



TYPICAL PLACEMENT
Scale 1:15

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Drawing

H2.1 Amenity ID – Projecting

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| H2.1 | EW/SA | NG |

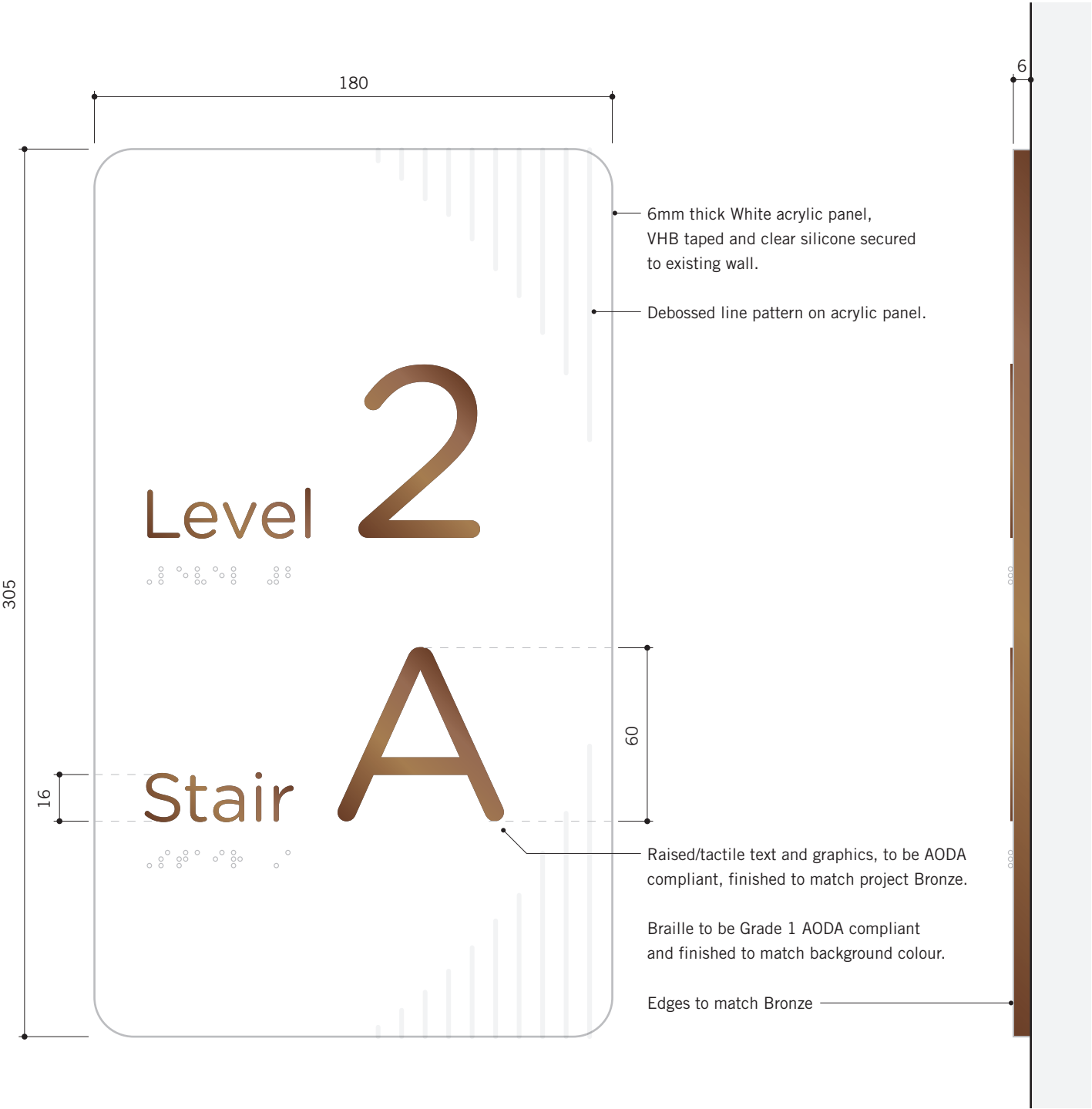
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| Scale | Dimensions |
| -- | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

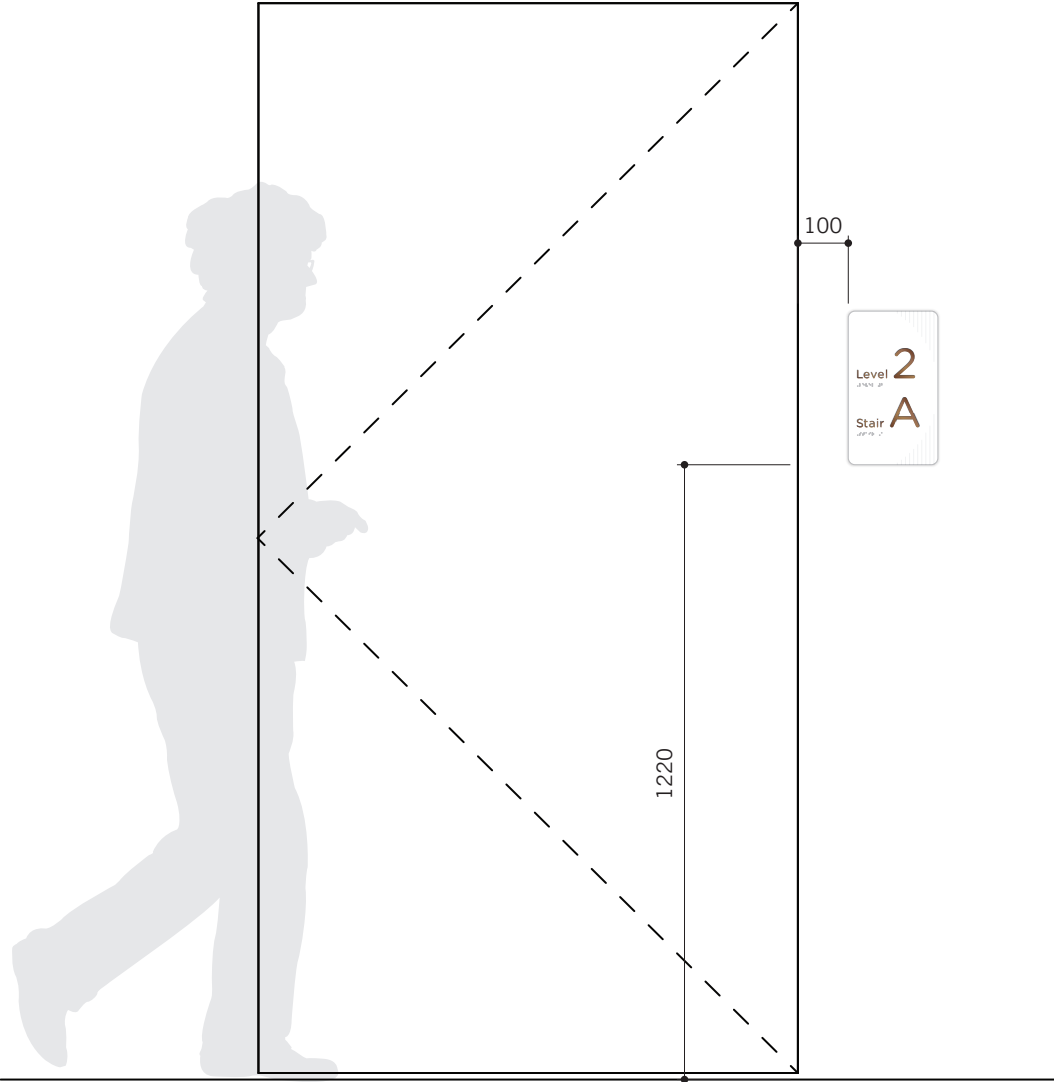
Drawing No.

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STAIR ID



S1.1 STAIR ID
Scale 1:2



TYPICAL PLACEMENT
Scale 1:15

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Drawing
S1.1 Stair ID

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| S1.1 | EW/SA | NG |

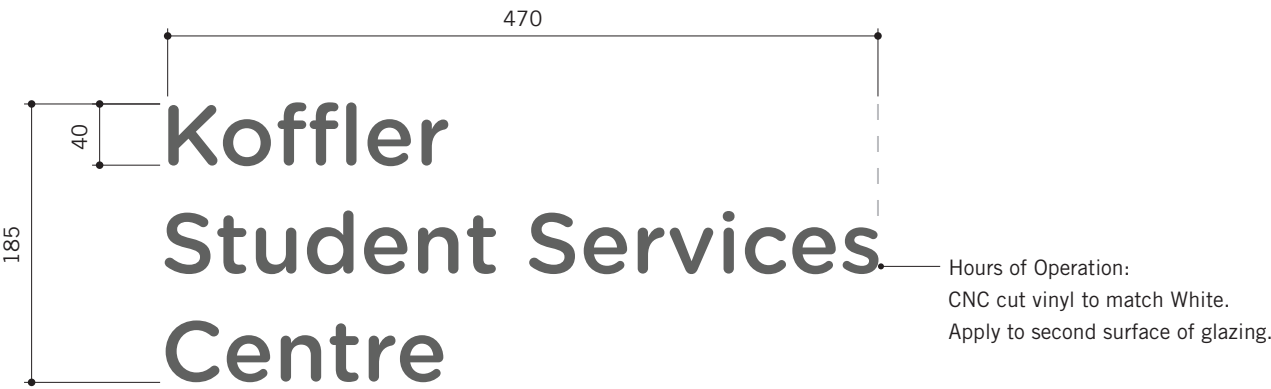
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|-------|------------|
| Scale | Dimensions |
| -- | Metric |

| | |
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| Job No. | Project Start Date |
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EXTERIOR ID



A10.1 EXTERIOR ID
Scale 1:5



TYPICAL PLACEMENT
Scale 1:15

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Drawing
A10.1 Exterior ID

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| A10.1 | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| -- | Metric |

| | |
|---------|--------------------|
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SIGNAGE FAMILY OF PRODUCTS

The Rossy Foundation
Health & Wellness Centre

A1.1 ENTRANCE ID

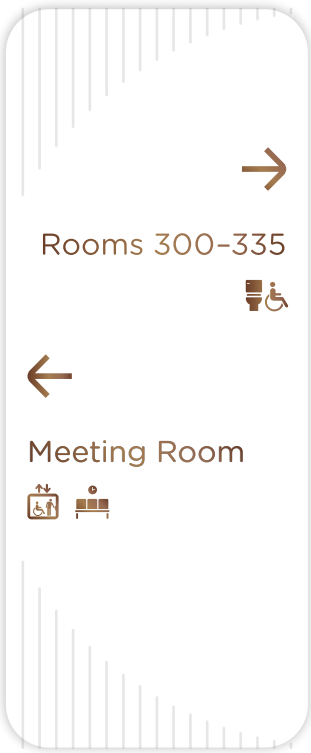


A2.1 LEVEL ID

Koffler
Student Services
Centre

A10.1 EXTERIOR ID

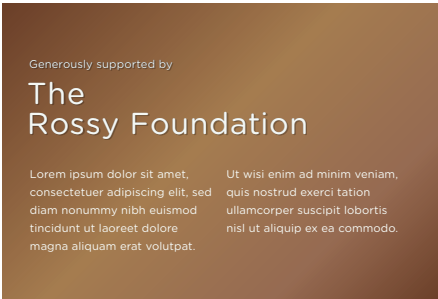
FAMILY OF PRODUCTS
Scale 1:10



B2.1 DIRECTIONAL



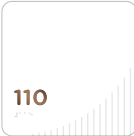
A2.1 DESK NUMBER ID



D1.1 DONOR RECOGNITION – STORYTELLING PLAQUE



E1.1 ROOM ID



E1.2 ROOM ID
(NUMBER ONLY)



E2.1 ROOM ID
(WITH INSERT)



S1.1 STAIR ID



H1.1 AMENITY ID



H2.1 AMENITY ID
(PROJECTING)

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Drawing
Signage Family of Products

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| -- | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| 1:10 | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

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| | | |
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SIGN SCHEDULE



SIGN SCHEDULE

PROJECT: UofT Koffler Centre
ISSUED FOR Issued for Draft DD
DATE: January 17, 2025

| SIGN TYPE | SIGN TYPE DESCRIPTION | LOCATION DESCRIPTION / NOTES | PWR | DATA | INSTALL. CODE |
|-----------|--|------------------------------|-----|------|---------------|
| A1.1 | Entrance ID | | N | N | WN |
| A2.1 | Desk Number ID | | N | N | PN |
| A3.1 | Level ID | | N | N | WN |
| A4.1 | Sub Department ID | | N | N | WN |
| A5.1 | Hours of Operation - on glass | | N | N | GN |
| A7.1 | Waiting Area ID | | N | N | WN |
| A10.1 | Exterior ID | | N | N | GN |
| B1.1 | Entrance Directional | | N | N | WN |
| B2.1 | Directional - Wall Mounted | | N | N | WN |
| C2.1 | Department Directory | | N | N | WN |
| D1.1 | Donor Recognition | | N | N | WN |
| E1.1 | Room ID | | N | N | WN |
| E1.2 | Room ID (Number Only) | | N | N | WN |
| E2.1 | Room ID - Insert | | N | N | WN |
| E3.1 | Room ID - Number Only | | N | N | WN |
| E4.1 | FM Tag | | N | N | WN |
| H1.1 | Amenity ID | | N | N | WN |
| H2.1 | Projecting Amenity ID | | N | N | PN |
| S1.1 | Stair ID | | N | N | WN |
| R1.1 | Maximum Occupancy | | N | N | WN |
| R2.1 | Egress Map | | N | N | WN |
| R3.1 | Exit Corridor - Alarm will sound if opened | | N | N | WN |

TOTAL QUANTITIES

| QTY |
|-----|
| 1 |
| 13 |
| 5 |
| 5 |
| 1 |
| 2 |
| 1 |
| 1 |
| 24 |
| 1 |
| 1 |
| 50 |
| 16 |
| 63 |
| 2 |
| 16 |
| 13 |
| 17 |
| 6 |
| 7 |
| 2 |
| 3 |
| 250 |

SIGNAGE & WAYFINDING PROGRAM
UOFT KOFFLER HEALTH & WELLNESS CENTRE

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Drawing
Sign Schedule

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| — | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| -- | Metric |

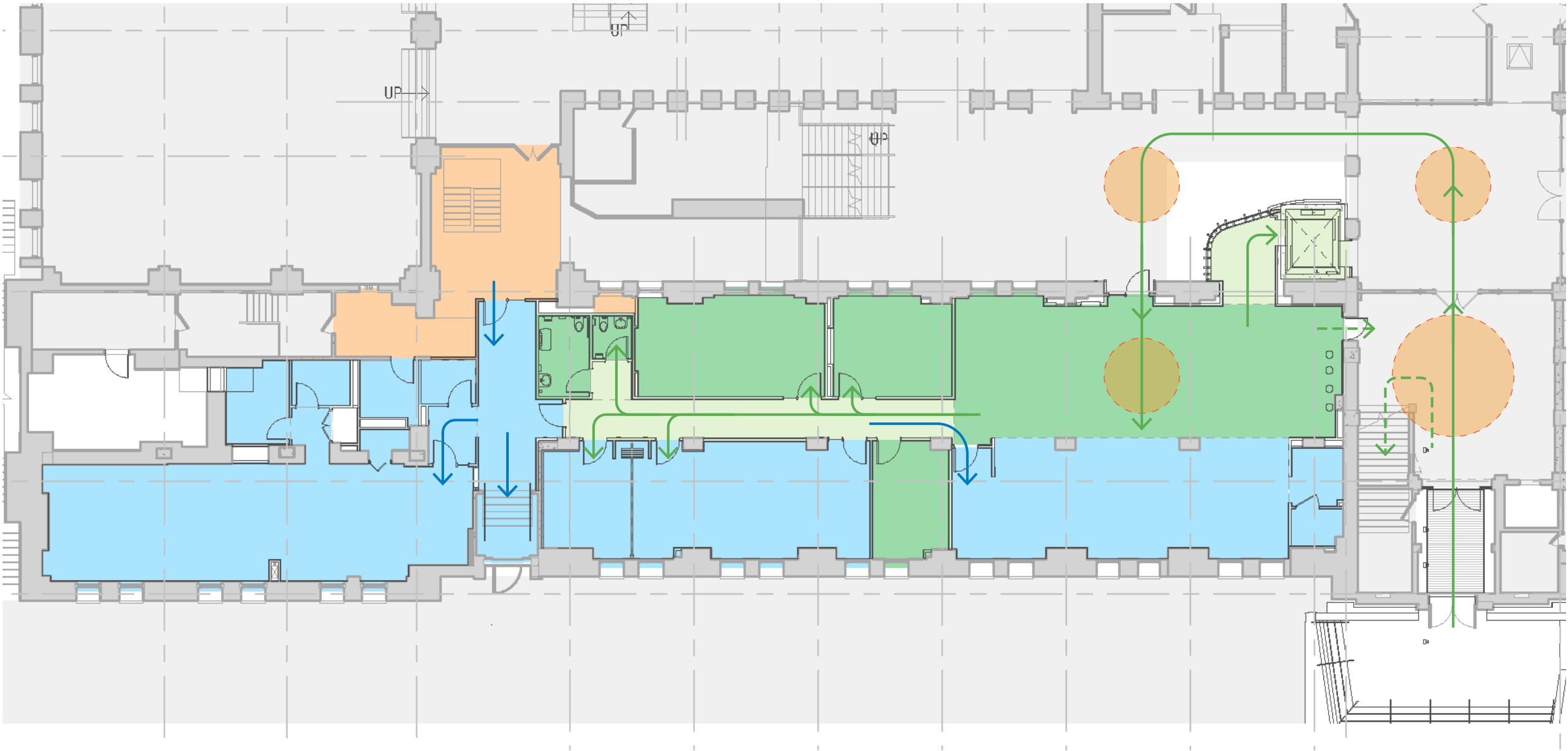
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| Job No. | Project Start Date |
| 0490 | October, 2024 |

Drawing No.
SS-01

| | | |
|------|----|---------|
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CIRCULATION DIAGRAMS

DRAWING LIST



LEVEL 1
Scale 1:200

NOTE: Background plans taken from Issued For Client Review dated 2024-10-16.

| NORTH | LEGEND – FLOW | | | |
|-------|----------------|---------------------|------------------------|----------------|
| | Student Spaces | Student Circulation | Primary Flow | Decision Point |
| | Public Spaces | Staff Spaces | Secondary (Staff) Flow | |

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Drawing

Circulation Plan – Level 1

| Sign Type | Drawn By | Checked By |
|-----------|----------|------------|
| — | EW/SA | NG |

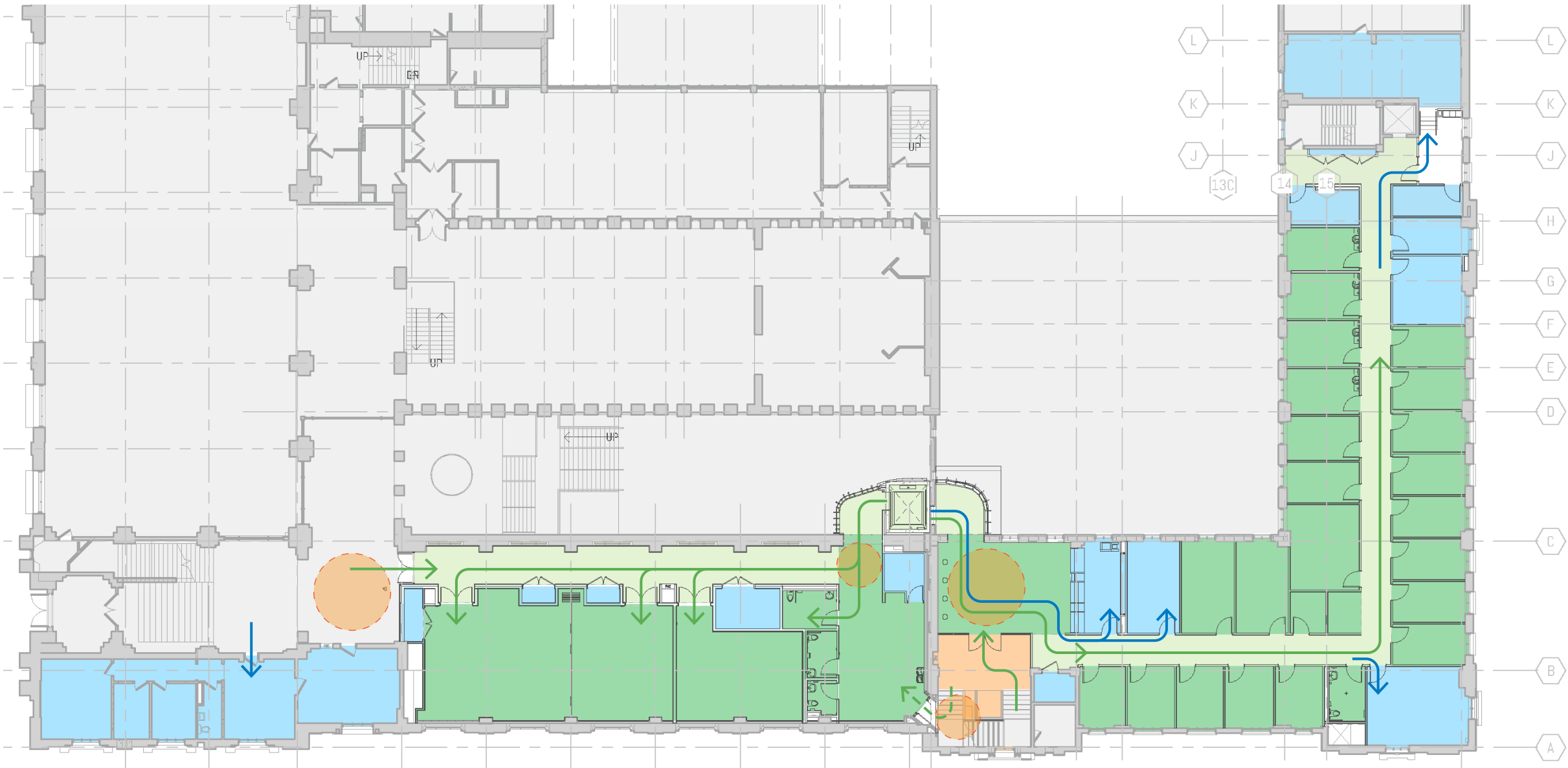
| Scale | Dimensions |
|-------|------------|
| 1:200 | Metric |

| Job No. | Project Start Date |
|---------|--------------------|
| 0490 | October, 2024 |

Drawing No.
CP-L1-01









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DRAWING LIST



LEVEL 2
Scale 1:300

NOTE: Background plans taken from Issued For Client Review dated 2024-10-16.

| NORTH | LEGEND – FLOW | | | | |
|---|--|---|--|--|--|
|  |  Student Spaces |  Student Circulation |  Primary Flow |  Decision Point | |
| |  Public Spaces |  Staff Spaces |  Secondary (Staff) Flow | | |

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Drawing

Circulation Plan – Level 2

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| — | EW/SA | NG |

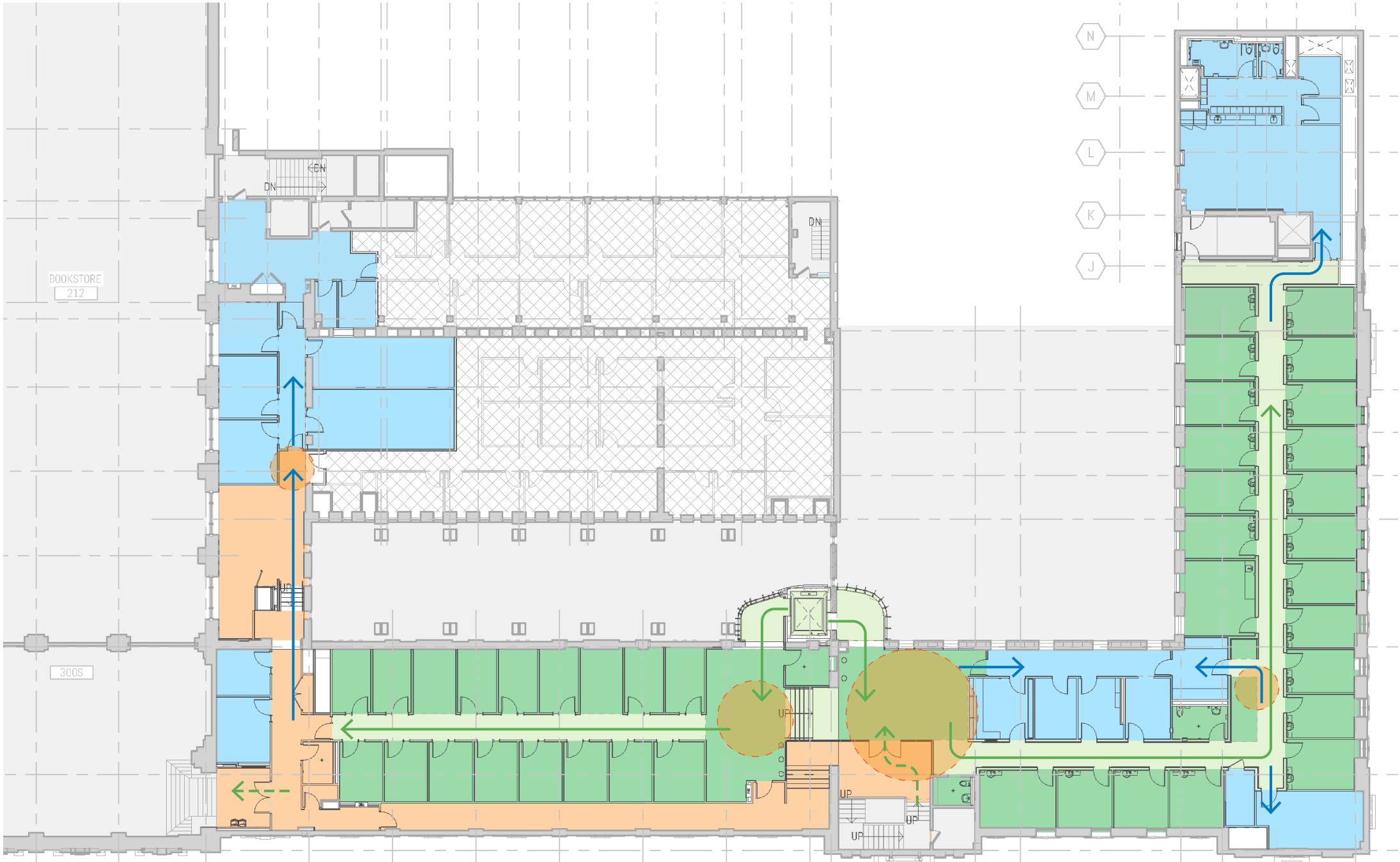
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|-------|------------|
| Scale | Dimensions |
| 1:200 | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
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Drawing No.
CP-L2-01

| | | |
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DRAWING LIST



LEVEL 3
Scale 1:300
NOTE: Background plans taken from Issued For Client Review dated 2024-10-16.

| NORTH | LEGEND – FLOW | | | | | | | |
|-------|---------------|----------------|--|---------------------|--|------------------------|--|----------------|
| | | Student Spaces | | Student Circulation | | Primary Flow | | Decision Point |
| | | Public Spaces | | Staff Spaces | | Secondary (Staff) Flow | | |

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Drawing

Circulation Plan – Level 3

| Sign Type | Drawn By | Checked By |
|-----------|----------|------------|
| — | EW/SA | NG |

| Scale | Dimensions |
|-------|------------|
| 1:300 | Metric |

| Job No. | Project Start Date |
|---------|--------------------|
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Drawing No.
CP-L3-01

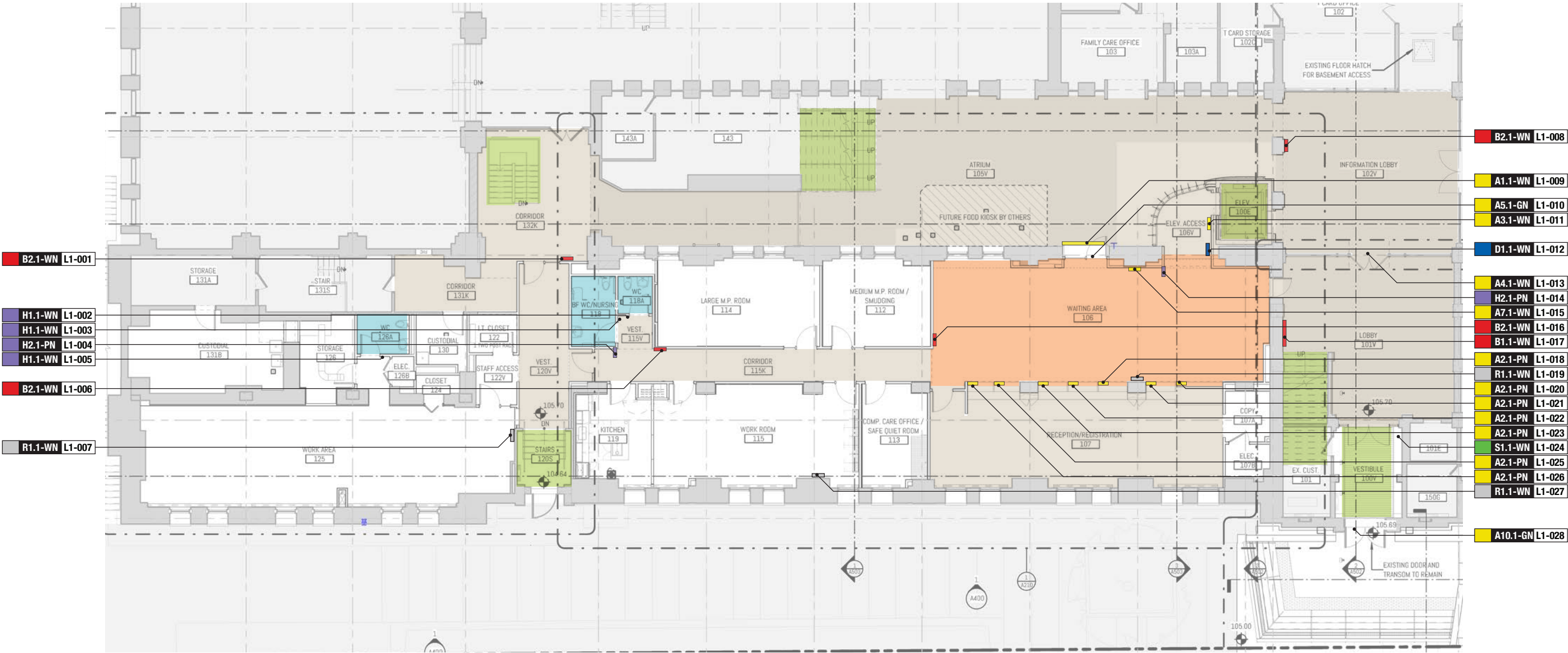
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LOCATION PLAN

DRAWING LIST

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LEVEL 1
Scale 1:200

NOTE: Background plans taken from F&S Review dated 2024-12-13.

| LEGEND – FLOW | |
|---------------|----------------|
| | Identification |
| | Directory |
| | Amenity |
| | Washrooms |
| | Waiting Areas |

NOTE:
All rooms with a door will get a version of typical room ID.

| | | |
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Drawing
Level 1

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| 1:200 | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

Drawing No.
LOC-L1-01

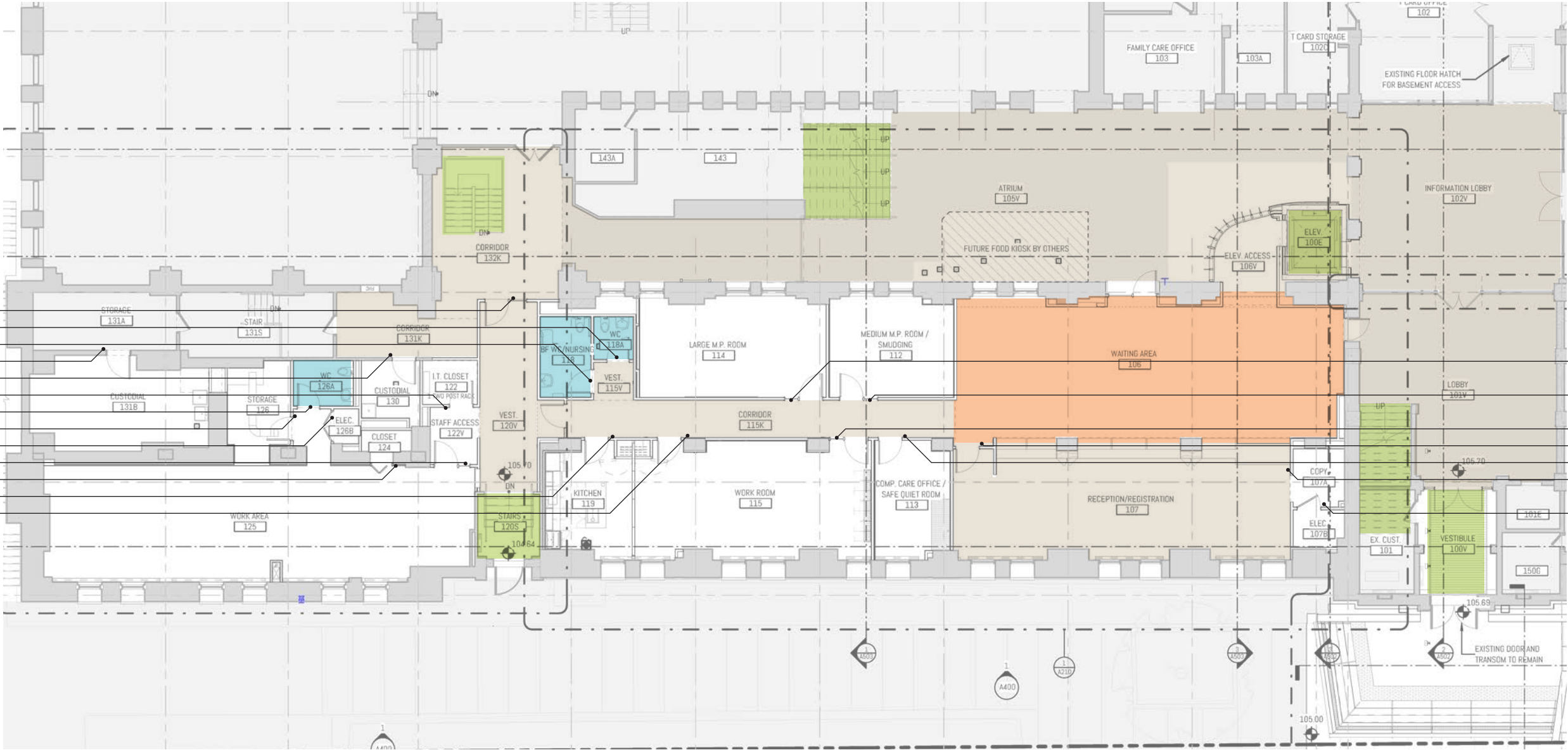
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| | |
|---------|--------|
| E1.1-GN | L1-100 |
| E4.1-WN | L1-101 |
| E4.1-WN | L1-102 |
| E1.1-WN | L1-103 |
| E1.1-WN | L1-104 |
| E3.1-WN | L1-105 |
| E4.1-WN | L1-106 |
| E1.2-DN | L1-107 |
| E1.1-WN | L1-108 |
| E1.1-GN | L1-109 |
| E1.2-WN | L1-110 |
| E1.1-WN | L1-111 |
| E1.1-WN | L1-112 |

| | |
|---------|--------|
| E1.1-GN | L1-113 |
| E1.1-GN | L1-114 |
| E1.1-GN | L1-115 |
| E1.1-WN | L1-116 |
| E4.1-WN | L1-117 |
| E1.1-WN | L1-118 |
| E1.1-WN | L1-119 |



LEVEL 1
Scale 1:200

NOTE: Background plans taken from F&S Review dated 2024-12-13.

| NORTH | LEGEND – FLOW | | | | | |
|-------|----------------|-----------|------------|---------------|--------------------|--|
| | Identification | Directory | Regulatory | Circulation | Stairs / Elevators | |
| | Directional | Amenity | | Waiting Areas | Washrooms | |

NOTE:
All rooms with a door will get a version of typical room ID.

| | | |
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Drawing
Level 1
Room Signs

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| -- | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| 1:200 | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

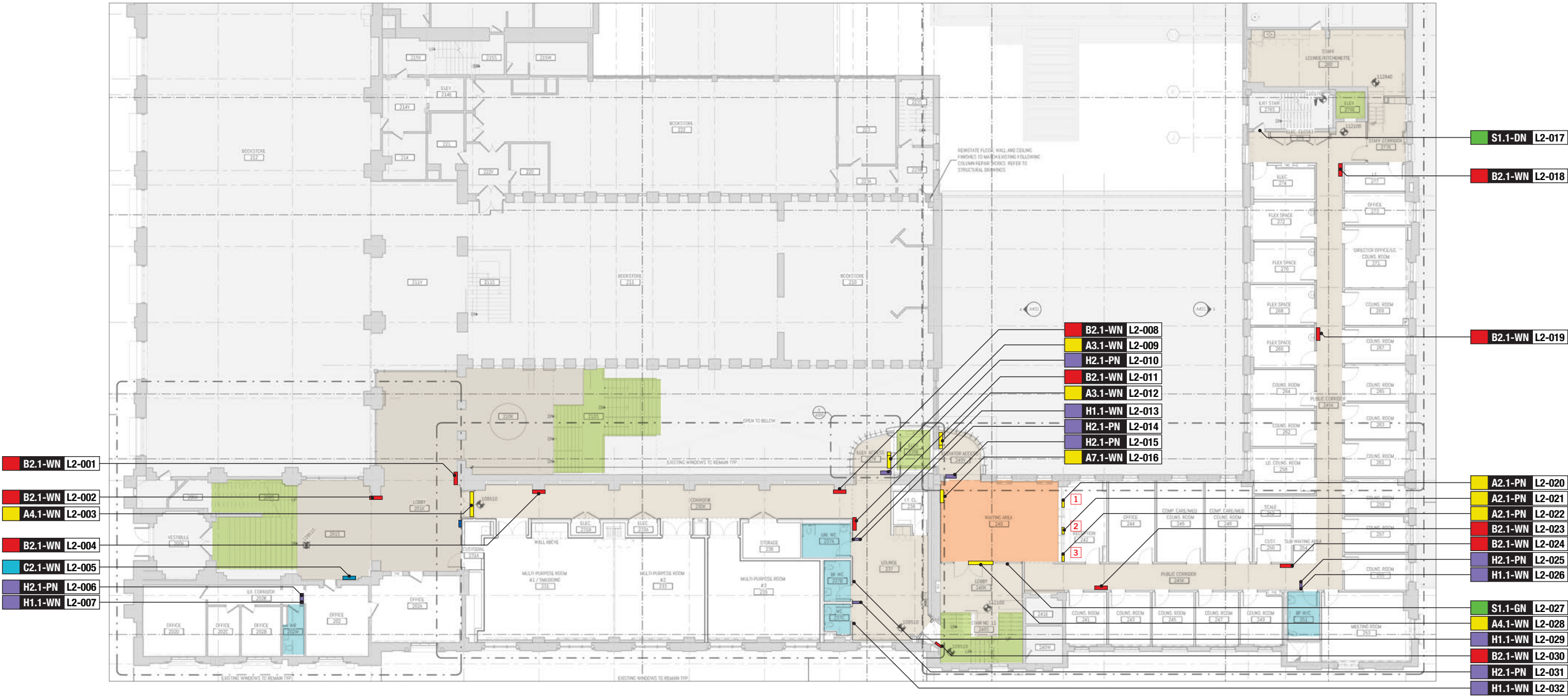
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LOC-L1-02

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DRAWING LIST











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LEVEL 2
Scale 1:200

NOTE: Background plans taken from F&S Review dated 2024-12-13.

| NORTH | | LEGEND – FLOW | | | | | |
|---|--|---|--|---|--|--|--|
|  |  Identification |  Directory |  Regulatory |  Circulation |  Stairs / Elevators | | |
| |  Directional |  Amenity | |  Waiting Areas |  Washrooms | | |

NOTE:
All rooms with a door will get a version of typical room ID.

| | | |
|-----|------------------------|------------|
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| No. | Description | Date |

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Drawing
Level 2

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| -- | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| 1:200 | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

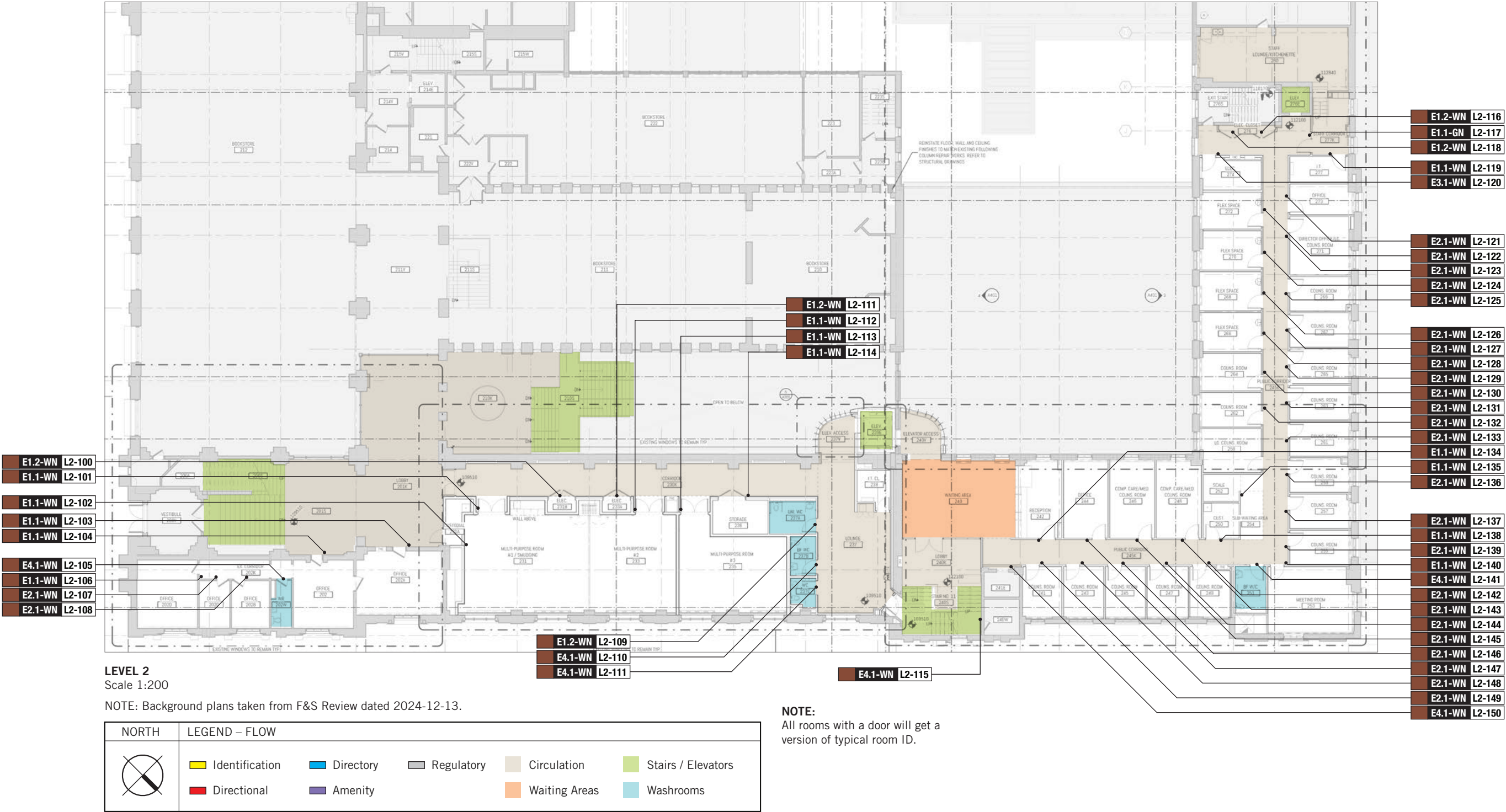
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Drawing
Level 2
Room Signs

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| -- | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| 1:200 | Metric |

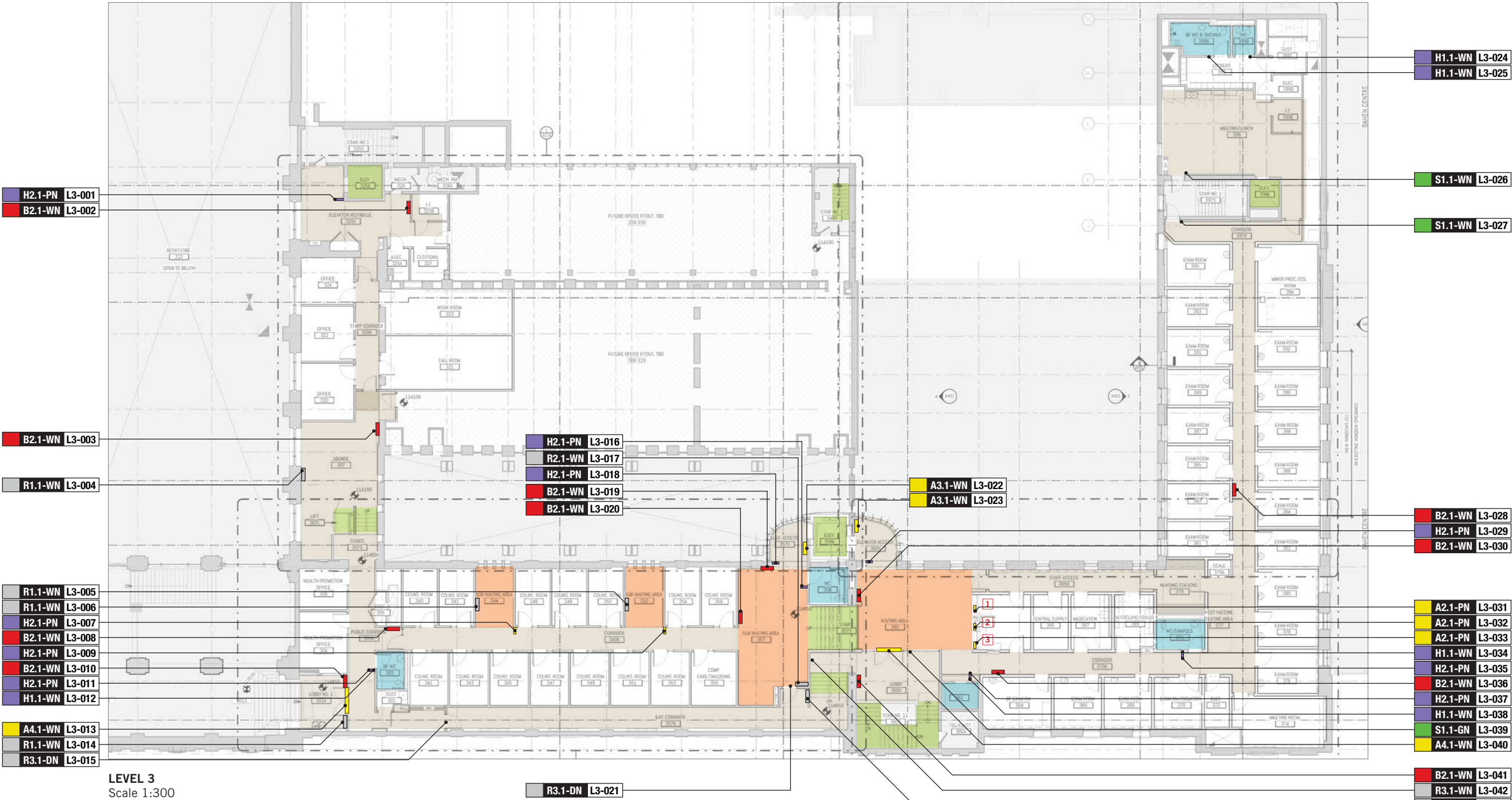
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|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

Drawing No.
LOC-L2-02

DRAWING LIST

SIGNAGE & WAYFINDING PROGRAM
UOFT KOFFLER HEALTH & WELLNESS CENTRE

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|-----|------------------------|------------|
| A | Issued For Information | Jan 31, 25 |
| No. | Description | Date |

Consultant

entro

33 Harbour Square, Suite 202
Toronto, Canada M5J 2G2

Drawing
Level 3

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| -- | EW/SA | NG |

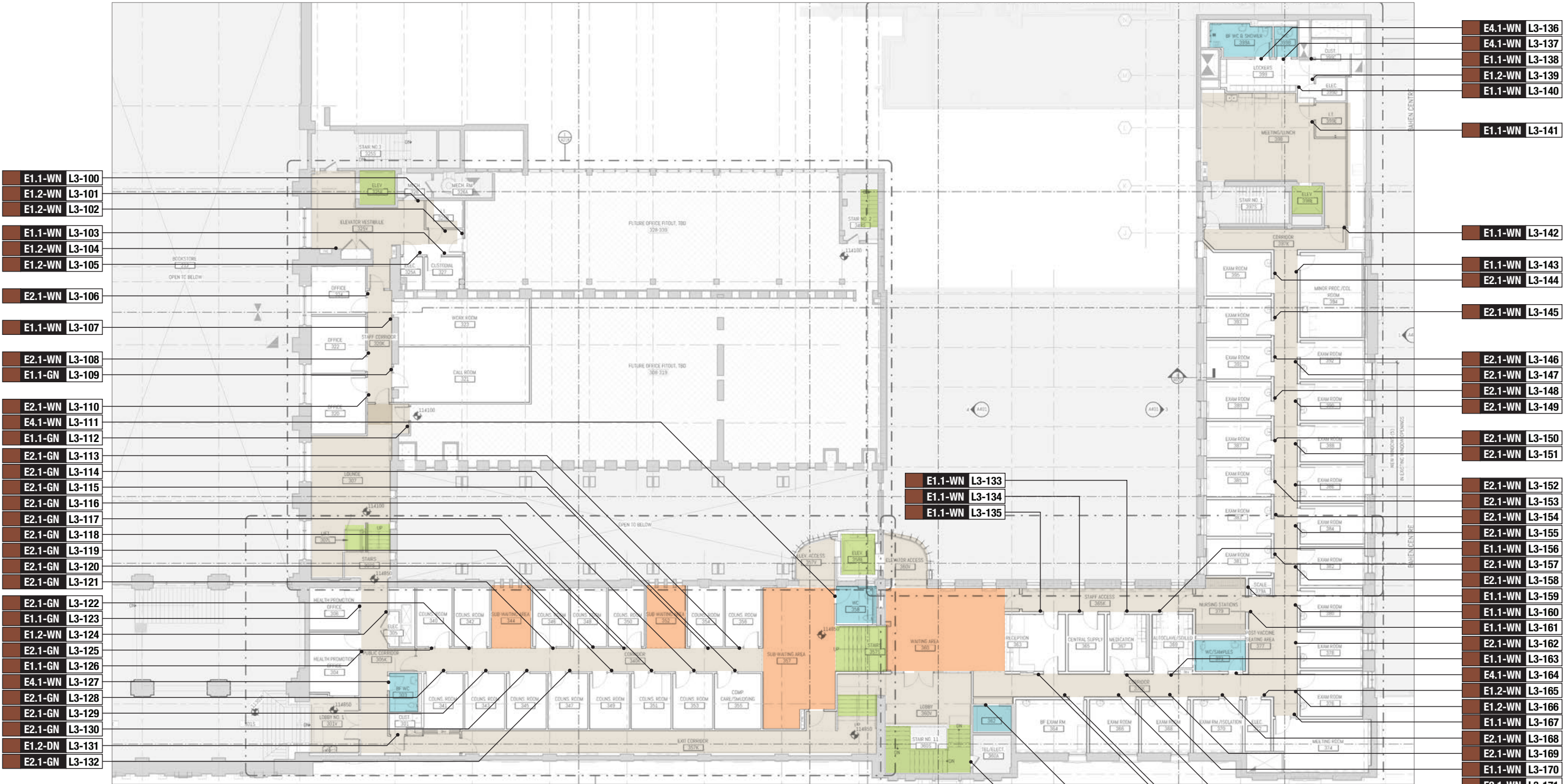
| | |
|-------|------------|
| Scale | Dimensions |
| 1:300 | Metric |

| | |
|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

Drawing No.
LOC-L3-01

| | | |
|------|----|---------|
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DRAWING LIST



LEVEL 3
Scale 1:300

NOTE: Background plans taken from F&S Review dated 2024-12-13.

| LEGEND – FLOW | |
|---------------|--------------------|
| | Identification |
| | Directional |
| | Regulatory |
| | Circulation |
| | Stairs / Elevators |
| | Waiting Areas |
| | Amenity |
| | Washrooms |

NOTE:
All rooms with a door will get a version of typical room ID.

SIGNAGE & WAYFINDING PROGRAM
UOFT KOFFLER HEALTH & WELLNESS CENTRE

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| No. | Description | Date |

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33 Harbour Square, Suite 202
Toronto, Canada M5J 2G2

Drawing
Level 3
Room Signs

| | | |
|-----------|----------|------------|
| Sign Type | Drawn By | Checked By |
| -- | EW/SA | NG |

| | |
|-------|------------|
| Scale | Dimensions |
| 1:300 | Metric |

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|---------|--------------------|
| Job No. | Project Start Date |
| 0490 | October, 2024 |

Drawing No.
LOC-L3-02

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|------|----|---------|
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THANK YOU

PART 1 - GENERAL

1.1. SUPPLIER

1.1.1. Supplier's name and address:

1.1.2. Date Product is released to Owner:

1.2. SECTION NO: _____

1.2.1. Product being released to the Owner:

1.2.2. Quantity of Product used for extent of the Work:

1.2.3. Quantity of Product released to the Owner:

1.3. SIGNATURE

1.3.1. Confirmation that Extra Materials were delivered to Owner in accordance with Section 01 70 00.

Owner's Signature

Owner's Name

Name typed

Date

END OF SECTION

The Definitions which forms part of Standard Construction Document - CCDC 2 - 2020 are hereby amended as follows:

PART 1 - DEFINITIONS

1.1. MODIFIED DEFINITIONS

1.1.1. Delete following definition in its entirety and substitute new definition:

“Consultant

The *Consultant* is the person or entity identified as such in the Agreement. The *Consultant* is ENFORM Architects Inc. The term *Consultant* means the *Consultant* or the *Consultant's* authorized representative. For greater certainty, Entuitive Corporation is the *Consultant's* authorized representative on structural matters, Smith + Andersen is the *Consultant's* authorized representative with respect to mechanical matters and Smith + Andersen is the *Consultant's* authorized representative with respect to electrical matters.”

1.2. NEW DEFINITIONS

1.2.1. Add following new definitions:

“Cash Allowance Disbursement Authorization (CADA)

A *Cash Allowance Disbursement Authorization* is an authorization to the *Contractor* to expend monies from Cash Allowances included in the *Contract Price*.

Day

Day means a calendar day.

Install

Install means completion of following activities, including associated labour, services, plant, *Construction Equipment* required to:

- Remove *Products* from storage and locate for placement,
- Position and adjust *Products* for final placement,
- Affix and anchor *Products* in final placement, in accordance with manufacturers' instructions and *Contract Documents*,
- Commission and adjust *Products* for proper operation.

Make Good, Made Good, Making Good

- *Make Good, Made Good, Making Good* means *repairing, restoring, refurbishing, rehabilitating*, or performing filling operation on any existing components disturbed due to work of this *Contract*, to at least the condition existing at the commencement of the *Work*, in terms of construction integrity, finishes, alignment with existing adjoining surfaces, compatibility of materials, sound attenuation criteria, exfiltration/infiltration requirements, air/vapour barrier and thermal continuity.

Provide

Provide means to *Supply* and *Install*.

Submittals

Submittals are documents or items required by the *Contract Documents* to be provided by the *Contractor*, such as:

- *Shop Drawings*, samples, models, mock-ups to indicate details or characteristics, before the portion of the *Work* that they represent can be incorporated in the *Work*; and

- As-built drawings and manuals to provide instructions to the operation and maintenance of the *Work*.

Supply

Supply means completion of following activities, including associated labour, services, plant, *Construction Equipment* required to:

- Fabricate or purchase *Products*,
- Deliver *Products* to the *Place of the Work*,
- Unload *Products*,
- Store *Products* in accordance with manufacturers' instructions."

END OF SECTION

PART 1 - GENERAL

1.1. REFERENCES

- 1.1.1. Canadian Standards Association (CSA International).
- 1.1.1.1. CAN/CSA-S350-M1980 (2003) - Code of Practice for Safety in Demolition of Structures.
- 1.1.2. Human Resources and Skills Development Canada.
- 1.1.2.1. FC 301 Standard for Construction Operations.
- 1.1.2.2. FC 302 Standard for Welding and Cutting.
- 1.1.3. Parks Canada.
- 1.1.3.1. Standards and Guidelines for the Conservation of Historic Places in Canada, published by Parks Canada (2010).
- 1.1.4. Deutsches Institut für Normung, Germany.
- 1.1.4.1. DIN 4150-3:1999 Structural vibration - Effects of vibration on structures.

1.2. DEFINITIONS

- 1.2.1. Refer to 01 42 16 – Heritage Definitions.

1.3. PERFORMANCE REQUIREMENTS

- 1.3.1. The Contractor is responsible for any damage to or loss of Heritage Materials occurring as a result of site, handling, transport and storage activities.
- 1.3.2. Perform selective demolition as per Section 02 41 00 –Demolition and Salvage, 02 42 20 – Removal and Salvage of Heritage Materials, and in accordance with CAN/CSA-S350-M1980 and FC-301.
- 1.3.3. Ensure materials, equipment and procedures safely support existing structure and construction live loads.
- 1.3.4. Apply methods that minimize the risk of damage to Heritage Materials.
- 1.3.5. Recording, documentation and storage of heritage items must follow a system that ensures a logical sequence in order to facilitate reinstatement of items by others at a later date. Proposed methods are to be submitted to the Consultant for review and approval prior to commencement of any dismantling work.
- 1.3.6. All methods and techniques utilized in the protection of heritage material, or materials that may have an impact on heritage materials, must conform to Heritage Protection Details and requirements of this Section.

1.4. SUBMITTALS AND SHOP DRAWINGS

- 1.4.1. Submit in accordance with Section 01 33 00 – Submittal Procedures, and as specified in related Sections.
- 1.4.2. Submit detailed plans, sections and details of temporary protection assemblies. Show both typical and atypical configurations.
- 1.4.3. Submit Product data specifications for fasteners, waterproofing and soft padding materials used in barrier assemblies.
- 1.4.4. Submit detailed protection measures to be implemented for heritage materials as indicated. Describe additional measures to be implemented to ensure vibration control and protection of heritage fabric.
- 1.4.5. Submit system of protection, crating, and transport and storage for removed heritage materials.

- 1.4.6. Submit plan describing procedures to be followed in the event that undocumented or concealed heritage materials systems are discovered.

1.5. PROCEDURES

- 1.5.1. Submit detailed dismantling procedures indicating tools used in heritage areas
- 1.5.2. Submit plan describing procedures to be followed in the event that undocumented or concealed heritage materials systems are discovered.

1.6. DOCUMENTATION

- 1.6.1. Prior to any work, Contractor, Consultant and Subcontractor shall inspect the worksite and review condition of site, protection requirements, and determine where mock-ups will be prepared.
- 1.6.2. Submit for the Consultant's review elevation drawings (1:50 scale) that identify each heritage element with a unique identification number. The elevation drawings can be annotated photographs. Each item to be dismantled must be clearly visible and annotated for the drawing to be reviewed.
- 1.6.2.1. The above requirement applies to following items if removed:
- 1.6.2.1.1. Exterior wood doors & hardware including transom window,
- 1.6.2.1.2. Exterior stones.
- 1.6.3. Photographs:
- 1.6.3.1. Submit for the Consultant's review, photographic documentation illustrating the condition of the heritage elements identified in Paragraph 1.6.2 prior to commencement of any work on site.
- 1.6.3.1.1. General view of the work.
- 1.6.3.1.2. Detail shots of typical conditions and appearance at commencement of work.
- 1.6.3.1.3. Date of photo and unique heritage identification number described in Paragraph 1.6.2 of this Section must be clearly identified on each photo.
- 1.6.3.1.4. Photograph quality: Well-illuminated, sharply focused, and free of motion blur.
- 1.6.3.1.5. Resolution: Minimum 9 megapixel quality,
- 1.6.3.1.6. Photographs to be on portable digital storage media in uncompressed RAW or JPEG format.
- 1.6.3.1.7. Submit typical photographic sample and digital format to Consultant for review prior to commencement of Work.
- 1.6.3.2. Photographs to serve as reference point of condition for reinstatement should any damage occur during the course of the project.
- 1.6.3.3. Photographic Record: Documentation must be reviewed and accepted by Consultant before work may proceed.

1.7. MOCK-UPS

- 1.7.1. Provide active procedure mock-ups demonstrating the abilities and skill of the personnel intervening on heritage material as specified in related sections. Consultant to be present to perform review process.
- 1.7.2. Erect mock-ups in-situ for protective and shoring measures for each condition containing heritage elements and materials to be protected.

1.8. QUALITY ASSURANCE

- 1.8.1. Perform work in accordance with The Standards and Guidelines for the Conservation of Historic Places in Canada, published by Parks Canada.

- 1.8.2. The Contractor and Consultant will be present on site during procedures to review mock-ups, procedures, and submittals related to the protection, documentation, removal, reinstallation and repairs to Heritage Materials.
- 1.8.3. Accepted mock-ups must be maintained and remain accessible throughout and for the duration of the project. Accepted mock-ups may become part of the final work.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Material grades – general
 - 2.1.1.1. Conform to material grades prescribed in the following paragraphs for protective barriers.
 - 2.1.1.2. Lumber: spruce, pine or fir to CAN/CSA-O141, NLGA #2 grade, S4S, moisture content 19% (S-dry) or less. Where pressure treated lumber is required, treat lumber with Alkaline Copper Quaternary to CSA O80-Series.
 - 2.1.1.3. Plywood: exterior grade softwood plywood to CSA O151, thickness as indicated. Where pressure treated plywood is required, treat plywood with Alkaline Copper Quaternary to CSA O80-Series.
 - 2.1.1.4. Rigid Insulation: extruded polystyrene (XPS) insulation to CAN/ULC-S701.1-17, minimum 25 mm thickness.
 - 2.1.1.5. Acceptable dust, dirt, liquid barriers, including:
 - 2.1.1.5.1. Vapour-permeable sheeting: made with flashspun high-density polyethylene fibers containing flame retardant and ultra-violet stabilizers.
 - 2.1.1.5.2. 6 mil thick clear construction grade polyethylene film.
 - 2.1.1.5.3. Polyethylene fastening tape compatible with sheeting.
 - 2.1.1.6. Acceptable soft padding:
 - 2.1.1.6.1. Compressible polychloroprene rubber, minimum 25 mm.
 - 2.1.1.6.2. Polychloroprene rubber foam sheeting, 13 mm thickness.
 - 2.1.1.6.3. Resilient medium-density closed-cell Polyethylene foam sheeting
 - 2.1.1.6.4. Low-density extruded polystyrene, minimum 25 mm.
 - 2.1.1.7. Accessories:
 - 2.1.1.7.1. Proprietary fasteners: toggle bolts, expansion shields and lag bolts, wedge anchors, and screws, recommended for purpose by manufacturer. Use 300 series stainless steel. Do not use explosive actuated fastening devices on masonry walls.
 - 2.1.1.7.2. Use only low impact and low vibration fasteners, including bolts with nuts and washers, wood screws, liquid adhesives, adhesive strips or tapes and removable, non-residue adhesive strips and tapes.
 - 2.1.1.7.3. No high impact attachment systems are permitted, including spikes, nails, staples, explosive actuated fastening devices and masonry anchoring fastener systems.
 - 2.1.1.7.4. Removable and transparent thermoplastic sealant for exterior use, non-silicone containing.
 - 2.1.1.8. Clear acrylic sheet: transparent, 4.5mm thick; translucent, 4.5mm thick
 - 2.1.1.9. Aluminum tape, pressure-sensitive, fluid-resistant, 38 mm minimum width.

PART 3 - EXECUTION

3.1. PROTECTIVE MEASURES

- 3.1.1. Provide barriers in all locations where exterior masonry may be damaged by normal site activities.
- 3.1.2. Provide shoring or other bracing for any and all conditions where the structural integrity of materials or systems are being affected by associated removals or other procedures described and required in this project.
- 3.1.3. Provisions and procedures for storage of removed items are defined in Section 02 42 20 – Removal and Salvage of Heritage Materials.
- 3.1.4. Anchoring or attachment to Heritage materials:
 - 3.1.4.1. The use of any mechanical fasteners into or onto exposed heritage material is prohibited.
 - 3.1.4.2. Direct attachment of barriers or construction to the exterior stone or other heritage materials is prohibited.

3.2. TEMPORARY PROTECTION

- 3.2.1. Temporary protection to be installed such as to protect covered masonry from precipitation for as long as required.
- 3.2.2. Use padding material to avoid direct contact between wood elements and stones.
- 3.2.3. Fasten vapour-permeable sheeting to wood structure such as to avoid tears and punctures.
- 3.2.4. Install vapour-permeable sheeting such that upper sheets overlap lower sheets in a water-shedding fashion.
- 3.2.5. Fasten all edges of vapour-permeable sheeting such as to prevent wind up-lift and water penetration.

3.3. PREVENTION OF WATER / LIQUID / PARTICULATE DAMAGE

- 3.3.1. Maintain proper water-shedding conditions at all times to ensure that rainwater does not infiltrate inside the building.
- 3.3.2. Provide waterproofing sheeting and wrapping to cover Heritage Materials so that in the event that failed or damaged mechanical equipment, equipment being dismantled and removed, or any other demolition or abatement procedure does not cause liquids and/or allow particulates and/or airborne humidity or airborne particulates to come into contact with the Heritage Materials.
- 3.3.3. Water or any aqueous mixtures may produce significant damage to Heritage Materials. Protect heritage items to remain in place from all contact with water or other aqueous mixture.

3.4. VIBRATIONS AND DISPLACEMENTS

- 3.4.1. Refer also to Section 01 50 00 – Temporary Facilities and Controls.
- 3.4.2. Contractor is responsible to limit vibrations such that direct and adjacent heritage material and structures are not affected.
- 3.4.3. Contractor is responsible to ensure due care is taken and ensure vibration from equipment, tools, and procedures do not impact existing elements.
- 3.4.4. Protect sensitive heritage items from vibrations and sudden movements by combining bracing, rigid paneling and full-service padding as required.
- 3.4.5. If any demolition or construction procedure is observed to be having a negative impact on Heritage Materials, or existing building structure, stop any and all work until the situation is remedied and an effective mitigation is submitted and approved by Owner (University of Toronto).
- 3.4.6. Contractor is responsible to provide all vibration monitoring equipment as required to ensure safety and stability of existing Heritage Materials and building structure.
- 3.4.7. Use of high-impact mechanical demolition tools is prohibited.

3.5. UNKNOWN HERITAGE MATERIALS

- 3.5.1. If undocumented or concealed materials or systems which are potentially heritage in nature are discovered anywhere within the building inside or outside, cease demolition activities in the immediate vicinity, tape off and protect the items, materials, and systems, and alert the Consultant, Contractor and Owner (University of Toronto) immediately. Areas similar in nature under which similarly undocumented or concealed materials or systems could exist shall also be immediately identified by the subcontractor so that advancing dismantling is aware of the potential hidden items.

END OF SECTION

PART 1 - GENERAL

1.1. HERITAGE DEFINITIONS

- 1.1.1. Conservation: All activities involved in the protection and retention of heritage resources. Actions or processes that are aimed at safeguarding the character-defining elements of a heritage building materials, details, and spaces so as to retain its heritage value and extend its physical life. This may involve "Preservation," "Rehabilitation," "Restoration," or a combination of these actions or processes.
- 1.1.2. Demolish: Include labour, materials, and equipment necessary to tear down completely or to remove completely. Refer to the relevant specification sections for the appropriate methodology.
- 1.1.3. Existing to Remain: Include labour, materials, and equipment necessary to protect heritage materials and finishes indicated to remain against soiling and damage during adjacent construction activities. Refer to the relevant specification sections for the appropriate methodology.
- 1.1.4. Mock-up: Include labour, materials, and equipment necessary to demonstrate in the presence of the consultant the methodology, materials, and workmanship required for each intervention described in the specifications. Mock-ups for each intervention are to be done prior to the start of that work.
- 1.1.5. Remove: Include labour, materials, and equipment necessary to remove and legally dispose of items except those indicated to be salvaged, reinstalled, or to remain the Owner's property. Refer to the relevant specification sections for the appropriate methodology.
- 1.1.6. Preserve: Include labour, materials, and equipment necessary to save, protect, and maintain heritage finishes and details utilizing specialized treatments to correct defects, improve appearance, and stabilize materials in order to prevent decay or deterioration.
- 1.1.7. Refurbish: Include labour, materials, and equipment necessary to make an existing finish, material, or equipment, appear, function, and operate like new. Refer to the relevant specification sections for the appropriate methodology.
- 1.1.8. Repair: Include labour, materials, and equipment necessary to replace or correct broken, damaged or faulty components or elements, or to make minor alterations or renovations to it in order to maintain its operating efficiency. Refer to the relevant specification sections for the appropriate methodology.
- 1.1.9. Replace: Include labour, materials, and equipment necessary to remove existing materials which can no longer perform their proper function and their replacement with as exact a substitute as possible (i.e. the replacement of damaged marble tile with new that match the existing in material, pattern and exposure).
- 1.1.10. Replicate: Include labour, materials, and equipment necessary to reproduce an exact copy of an existing building component. A replica may be produced as a substitute for a missing or irretrievably damaged heritage element based on physical or documentary evidence. Refer to the relevant specification sections for the appropriate methodology.
- 1.1.11. Restore: Include labour, materials, and equipment necessary to restore which is defined as the action or process of accurately revealing, recovering or representing the state of a historic space, material, or component, as it appeared at a particular period in its history while protecting its heritage value. Refer to the relevant specification sections for the appropriate methodology.
- 1.1.12. Salvage: Include labour, materials, and equipment necessary to save dismantled material for reuse, reinstallation, re-fabrication. Refer to the relevant specification sections for the appropriate methodology.

PART 2 - PRODUCTS

2.1. NOT USED

2.1.1. Not Used.

PART 3 - EXECUTION

3.1. NOT USED

3.1.1. Not Used.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide demolition and salvage including but not limited to following:
 - 1.2.1.1. selective demolition to accommodate alterations.
 - 1.2.1.2. new openings.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Alteration and repair requirements: Section 01 70 00, Execution and Closeout Requirements.
 - 1.2.2.2. Demolition and removal of mechanical equipment services designated for removal on Drawings and as required by Work. Disconnecting and capping prior to authorizing removal: Division 20, Mechanical General Requirements, Division 21, Fire Suppression and Division 23 Heating, Ventilating and Air Conditioning.
 - 1.2.2.3. Demolition and removal of electrical equipment services designated for removal on Drawings and as required by Work. Disconnecting and capping prior to authorizing removal: Division 26, Electrical and Division 28, Electronic Safety and Security.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. OBC: Ontario Building Code.
 - 1.3.1.2. PCB: Polychlorinated Biphenyls.
- 1.3.2. Definitions:
 - 1.3.2.1. Hand Demolition: Systematic demolition of structures by workers using hand-held tools.
 - 1.3.2.2. Mechanical Demolition: Systematic demolition of structures using powered equipment.
 - 1.3.2.3. Systematic Demolition: Methodical dismantling of structure piece by piece, usually carried out in reverse order of construction.

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Pre-Demolition Meeting:
 - 1.4.1.1. Prior to start of work, arrange for site meeting of all parties associated with work of this Section. Presided over by Consultant, meeting shall include Contractor, demolition Subcontractor, testing company's representative and structural engineer.
 - 1.4.1.2. Review Specification for work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, inspection of construction to be demolished, methods to be used, sequence and quality control, Project staffing, restrictions due to environmental protection requirements and other matters affecting demolition, to permit compliance with intent of this Section. Review structural load limitations of existing structures. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays. Review and finalize protection requirements.
- 1.4.2. Scheduling:

- 1.4.2.1. Phase selective demolition as indicated on Drawings to accommodate new construction.

1.5. SUBMITTALS

- 1.5.1. Plan of Action:
- 1.5.1.1. Submit in accordance with Section 01 30 00.
- 1.5.1.2. Submit "Plan of Action" immediately after award of Contract for review by Consultant.
- 1.5.1.3. Coordinate demolition times, security requirements and access with Owner.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
- 1.6.1.1. De-Installers:
- 1.6.1.1.1. Employ for this work, a demolition company having 5 years Canadian experience in this type of work satisfactory to Consultant. If requested, submit proof of experience.
- 1.6.1.2. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario to undertake general review of Project during demolition, prepare plan of action, identify pre tensioned and post tensioned members and engineer temporary shoring, bracing. Inspect and review this work during demolition, fabrication and erection of shoring and bracing. In particular inspect where demolition extends below level of footing of any adjacent building and occurs within angle of repose of soil, drawing from bottom of such footing. Provide site administration and inspection of work of this Section.

1.7. SITE CONDITIONS

- 1.7.1. Ambient Conditions:
- 1.7.1.1. Demolition performed on this Project in areas which may be partially occupied. Take care and provisions for protection of workers on site and occupants during progress of work.
- 1.7.1.2. Maintain Access Road to Buildings: Do not disturb existing temporary fencing. Maintain construction traffic reasonable distance away from fence line. Repair damage which is result of Work of this Contract.
- 1.7.1.3. Do not close or obstruct roads, streets, sidewalks, passageways without permits. Do not place or store materials in streets or passageways. Conduct operations with minimum interference with roads, streets, driveways and passageways.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Description:
- 2.1.1.1. Regulatory Requirements:
- 2.1.1.1.1. Conform to The Occupational Health and Safety Act and Regulation for Construction Projects.
- 2.1.1.1.2. Conform to OBC, especially Division C, Part 1, Article 1.2.2.3 as applicable.
- 2.1.1.1.3. Conform to Fire Code, Regulation under Fire Marshal Act, especially Part 8.
- 2.1.1.1.4. Conform to requirements of Section 01 50 00 in particular, Article on engineering requirements for Temporary Construction.
- 2.1.2. Provide materials necessary for temporary bracing and shoring. On completion, remove temporary materials from site.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Preliminary Survey:
 - 3.1.1.1. Before commencing demolition operations, examine site and when requested, provide engineering survey to determine type of construction, condition of structure and site conditions. Assess strength and stability of damaged or deteriorated structures.
 - 3.1.1.2. Assess potential effect of removal of any part or parts on remainder of structure before such part(s) are removed.
 - 3.1.1.3. Assess effects of demolition on adjacent properties and consider need for underpinning, shoring and/or bracing.
 - 3.1.1.4. Investigate for following conditions:
 - 3.1.1.4.1. load-bearing walls and floors.
 - 3.1.1.4.2. structure suspended from another.
 - 3.1.1.4.3. cantilevered construction.
 - 3.1.1.4.4. presence of prestressed or post-tensioned elements.
 - 3.1.1.4.5. presence of hazardous materials.
 - 3.1.1.5. After determining demolition methods, determine area of possible vibration. Carefully inspect beyond those adjacent areas. List potential damage areas and photograph each for record purposes before starting work.
- 3.1.2. Existing Services:
 - 3.1.2.1. Notify Municipality to cut-off, remove and cap Municipal services. Verify services are cut off and properly capped before commencing associated or effected demolition. Cap and cover catch basins outside the building during the work of this Section. Do not allow demolition debris into the drains.
 - 3.1.2.2. Provide and maintain temporary services required during demolition to satisfaction of authorities having jurisdiction, fire departments and utility companies.
 - 3.1.2.3. Verify prior to commencement work of this Section that disconnection and capping of mechanical services have been carried out under Divisions 20, 21, 22 and 23 in accordance with requirements of local authority having jurisdiction. Make sure Natural gas supply lines are removed by Gas Company or by qualified tradesmen in accordance with Gas Company instructions. Removal and disposal of other existing underground services and mechanical equipment shall be by Divisions 20, 21, 22 and 23.
 - 3.1.2.4. Before commencing demolition, contact Electrical Department of local authority and tour site with them. Disconnect and seal electrical power lines and communications cables entering buildings to be demolished. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions:
 - 3.2.1.1. Post danger signs conspicuously around property. If requested, provide a watchman for patrolling site when work is not in progress to prevent public entering danger zone and to maintain barricades.
 - 3.2.1.2. Provide fire extinguishers acceptable to fire prevention authorities in locations and of type suitable to enable personnel to deal with fire occurring during progress of work.

3.3. APPLICATION

- 3.3.1. Restrictions:
 - 3.3.1.1. Following methods of demolition will not be permitted in work of this Contract:
 - 3.3.1.1.1. Use of rapid progress failure methods (explosives).
 - 3.3.1.1.2. Mechanical method of demolition whereby wrecking is accomplished by smashing walls or floors with heavy weight suspended by cable from boom or hoist or where masonry walls are collapsed using power shovel, tractor or other mechanical contrivance.
- 3.3.2. Demolition action plans may indicate only general scope of work to be demolished and removed. It is Contractor's sole responsibility to determine exact extent of demolition required. Contractor may not rely solely on Drawings to limit scope of selective demolition work required. Review site conditions and assess exact scope of demolition and removal.
- 3.3.3. Examine and review existing conditions prior to starting demolition. Initially perform demolition only in selected and designated test areas prior to proceeding full scale demolition work. Review technique for demolition in test areas from Consultant. Only after review has occurred, proceed in other areas.
- 3.3.4. Do not stack materials and debris in building to extent that overloading of any part of structure will occur.
- 3.3.5. At end of each Day's work leave work in safe condition ensuring no parts of structure are in danger of collapsing.
- 3.3.6. Demolition:
 - 3.3.6.1. Ensure demolition work is supervised by structural engineer licensed to practice in Province of Ontario at all times.
 - 3.3.6.2. Demolish structure and remove materials from site. Use hand tools or pneumatic or hydraulic equipment. Adhere to manufacturer's recommendations in use of handheld tools while conforming to the Occupational Health and Safety Act requirements. Lower demolition materials and debris through chutes. Do not create falling materials hazard.
 - 3.3.6.3. Investigate nature and condition of suspended concrete slabs, condition and position of reinforcement. Consult professional engineer qualified to practice in Ontario and qualified with this type of construction for method and sequence of demolition if structure is of post-tensioned construction to avoid uncontrollable failure.
 - 3.3.6.4. Do not demolish spray or trowel-applied friable materials, materials suspected of containing PCBs or other hazardous materials. Where such materials are encountered notify Consultant immediately. Do not proceed until written instructions have been received from Consultant.
 - 3.3.6.5. Remove mechanical and electrical items indicated to be removed.
 - 3.3.6.6. Demolition shall proceed safely in systematic manner from roof to grade, as specified herein, and as necessary to accommodate remedial work indicated. Ensure work on each floor level is complete before commencing work on supporting structure and safety of its supports are impaired. Parts of building which would otherwise collapse prematurely shall be securely shored. Walls and piers shall not be undermined.
 - 3.3.6.7. Neatly cut openings and holes plumb, square and true to dimensions required. Use cutting methods least likely to damage remaining or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3.3.6.8. Separate attached structures by hand demolition prior to general demolition. Separation may be carried out floor by floor in advance of demolition at each level. Demolish masonry and concrete walls in small sections. Remove and lower structural members and other heavy objects with safe and suitable equipment.

- 3.3.6.9. Demolish and remove interior partitions, walls, ceilings, flooring down to concrete substrate, except those specified and/or indicated to remain.
- 3.3.6.10. Keep work wetted down to minimize dust.
- 3.3.6.11. Minimize noise. Avoid use of noisy machinery outside working hours.
- 3.3.6.12. Provide enclosed chutes for disposal of debris from heights more than 1 storey.
- 3.3.6.13. Provide protection around floor and/or roof openings.
- 3.3.6.14. Upon completion of demolition work, level and clear site or prevent access to excavations by means of fences or hoardings.
- 3.3.6.15. Maintain safety of site by shoring against collapse below-grade-structures and excavations resulting from demolition. Where required, provide structural supports for adjacent structures.
- 3.3.6.16. Protect from weather parts of adjoining structures not previously exposed.
- 3.3.6.17. Firestopping and Smoke Seal: In event work of this Section impacts on integrity of fire separations, ensure trade performing firestopping is notified.
- 3.3.7. Building Services:
 - 3.3.7.1. Arrange with Owner to disconnect existing building services. Cut-off and cap existing building services under Owner's supervision. Provide caps to abandoned services.
 - 3.3.7.2. Prevent demolition debris from entering building drains.
- 3.3.8. Except as indicated on Drawings or designated on site by Consultant, materials forming permanent part of structure being demolished shall become property of this Section. Remove from site.
- 3.3.9. Coordinate with Divisions 20, 21, 22, 23, 26, 27 and 28 respectively for removal, relocation and reinstallation of mechanical and electrical items.
- 3.3.10. In event of unexpected discovery of buried fuel or other tanks, do no further work and immediately report discovery, orally and in writing to Consultant. Consultant will authorize remedial work, if any, in writing. Do such remedial work, as addition to Contract.
- 3.3.11. Remove electrical equipment scheduled for removal on Drawings and as required by Work.
- 3.3.12. Remove sewer and water lines to extent indicated on Drawing and cap to prevent leakage.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections:
 - 3.4.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.

3.5. CLEANING

- 3.5.1. Waste Management:
 - 3.5.1.1. Clear away dirt, rubbish and loose litter resulting from work of this Section, minimum daily. Keep dust to a minimum. When necessary and practical demolition works shall be sprayed periodically with water to reduce dust. Wet down debris from time to time to control dust. Maintain roadways, lanes and street sidewalks in the vicinity of the premises safe and clear.
 - 3.5.1.2. Selling or burning of materials on site is not permitted.
 - 3.5.1.3. Conform to requirements of authorities having jurisdiction regarding disposal of waste materials.
 - 3.5.1.4. Materials prohibited from municipality waste management facilities shall be removed from site and dispose of at recycling companies specializing in recyclable materials.

- 3.5.1.5. Any additional materials prohibited from waste management facilities shall be removed from site and dispose of to requirements of authorities having jurisdiction without any additional cost to Owner.

3.6. PROTECTION

- 3.6.1. Do not interfere with use and activities of occupants where applicable and adjacent buildings. Maintain free and safe passage to and from buildings. Maintain integrity of existing fire exits.
- 3.6.2. Protect existing adjacent work against damages which might occur from falling debris or other causes due to work of this Section.
- 3.6.3. Provide, erect and maintain required hoarding, sidewalk sheds if applicable, catch platforms, lights and other protection around site before commencing work. Maintain such areas free of snow, ice, mud, water and debris. Lighting levels shall be equal to that prior to erection.
- 3.6.4. Provide flagmen where necessary or appropriate to provide effective and safe access to site to vehicular traffic and protection to pedestrian traffic.
- 3.6.5. Ensure scaffolds, ladders, equipment and other such equipment are not accessible to public. Protect with adequate fencing or remove and dismantle at end of each Day or when no longer required.
- 3.6.6. Where necessary to seal fire exits of adjoining or adjacent buildings, provide other exits in compliance with applicable fire safety and building regulations.
- 3.6.7. Where demolition operations prevent normal access to adjacent properties, provide and maintain suitable alternative access.
- 3.6.8. If at any time safety of adjacent buildings appear to be endangered, cease operations and notify Consultant; take precautions to support buildings; do not resume operations until permission is granted by Consultant.
- 3.6.9. If Consultant considers additional bracing and shoring necessary to safeguard and prevent such movement or settlement, install bracing or shoring upon Consultant's orders. Failure to comply promptly with such request, additional bracing or shoring may be placed by Consultant at Contractor's expense.
- 3.6.10. Take precautions to guard against movement, settlement or collapse of adjacent services, sidewalks, driveways, or trees. Be liable for such movement, settlement or collapse caused by failure to take necessary precautions. Repair promptly such damage when ordered.
- 3.6.11. Erect and maintain partitions as required to prevent spread of dust, fumes and smoke to other parts of building. Maintain fire exits from site. On completion, remove partitions and Make Good surfaces to match adjacent surfaces of building.
- 3.6.12. Before starting demolition, ensure required dust-tight partitions have been installed where necessary.

END OF SECTION

PART 1 - GENERAL**1.1. GENERAL INSTRUCTIONS****1.2. SUMMARY**

1.2.1.1. Section includes:

1.2.1.2. This Section includes requirements for careful removal and salvage, and reconditioning of building components identified for storage on site and subsequent reinstallation forming a part of Project.

1.2.1.3. Refer to "H" series drawings for location and extent of removal.

1.3. RELATED REQUIREMENTS

1.3.1. Section 01 35 91 – Heritage Protective Measures

1.3.2. Section 01 42 16 – Heritage Definitions

1.3.3. Section 02 41 10 –Demolition and Salvage.

1.4. REFERENCES

1.4.1. Parks Canada

1.4.1.1. Standards and Guidelines for the Conservation of Historic Places in Canada (latest edition).

1.5. PERFORMANCE REQUIREMENTS

1.5.1. Contractor is responsible for any damage to or loss of Historic Materials occurring as a result of site, handling, transport, or storage activities.

1.5.2. Ensure materials, equipment and procedures do not affect the existing structure.

1.5.3. Apply methods that minimize the risk of damage to Historic Materials.

1.5.4. Recording, documentation and storage of historic material must follow a system that insures a logical sequence in order to facilitate reinstatement of items by others at a later date.

1.5.5. All procedural methods and techniques to be utilized in the detachment, removal, transport, storage, protection, and reinstallation of historic materials must match the standard trade techniques for the said procedures.

1.5.6. All heritage materials cannot be removed from site prior to submittal and Consultant review of documentation.

1.6. QUALITY ASSURANCE

1.6.1. Contractor: a company with minimum five (5) years successful performance in heritage conservation work similar to that specified for this Project.

1.6.2. Workers Abilities:

1.6.2.1. Documentation, removal and identification of Heritage Materials shall be performed by personnel displaying appropriate abilities as demonstrated through procedural mock-ups.

1.6.2.2. Workers performing removals shall be specialized in historic installation and removal techniques related to the type of Heritage Material to be removed.

1.6.2.3. Only accepted procedures and the personnel that performed them during the mock-ups may be utilized to do that procedure throughout the duration of the work.

1.6.2.4. Loading, transport and storage of removed heritage materials shall be performed by workers specializing in the transport of fragile heritage materials.

1.6.2.5. No approved specialized workers shall be replaced during the progress of the work without written acceptance by the Heritage Consultant.

1.6.3. Heritage Consultant:

1.6.3.1. Work shall be reviewed by the Heritage Consultant.

1.6.3.2. Heritage Consultant reserves the right to reject workers who do not demonstrate appropriate abilities or experience.

1.7. SUBMITTALS

1.7.1. Submittals shall conform to Section 01 33 00 – Submittal Procedures.

1.7.2. Submit documentation per Section 01 35 91 – Heritage Protective Measures.

1.7.3. Shop Drawings:

1.7.3.1. Submit shop drawings of each type of crate or container required for transportation and storage of Heritage Materials.

1.7.4. Procedures:

1.7.4.1. Submit documents, schedules and work plans, samples, mock-ups, methods and tools used to remove Heritage Materials listed in this Section in accordance with Section 01 33 00 – Submittal Procedures. Provide separate procedure for each item below:

1.7.4.1.1. Removal of heritage wood doors and transom.

1.7.4.1.2. Removal of exterior stone blocks, or portions thereof.

1.7.4.2. Submit procedures for protection, packing and crating of each type of Heritage Material to be removed as listed above.

1.7.5. Mock-ups:

1.7.5.1. Provide mock-ups demonstrating the abilities and skill of the personnel performing the required documentation, removal, identification, crating, transport and storage methods and techniques for each type of Heritage Material to be salvaged. Heritage Consultant shall be present to perform review process.

1.7.5.2. Prior to removal of Heritage Materials and in the presence of the Heritage Consultant, each team designated to perform sensitive removal activities must perform sample removals of each type required.

1.8. EXISTING CONDITIONS

1.8.1. Before starting work, verify existing conditions and variations from original contract documents and notify Heritage Consultant of any discrepancy.

1.9. SCHEDULING

1.9.1. Coordinate removal and salvage of Heritage materials with general and selective demolition work described in Section 02 41 10 – Demolition and Salvage.

1.9.2. Removal and salvage of Heritage materials must be completed prior to any demolition work in each defined location.

1.9.3. Submit coordinated schedule of activities, showing dates and estimated duration to Contractor not later than 7 days before beginning of removal and salvage work.

1.10. STORAGE OF REMOVED ITEMS FOR REUSE

1.10.1. Heritage Materials shall be stored on or off-site, off of the ground and in a dry location.

1.11. PRE-CONSTRUCTION CONFERENCE

- 1.11.1. One (1) week prior to scheduled start of work of this Section, the representatives of the following entities shall meet at the project site: Project Construction Manager, Heritage Consultant, Subcontractor and representatives of other entities directly concerned with Work of this Section. This meeting will be coordinated through the Project Construction Manager.
- 1.11.2. Attendees shall review all pertinent details and specifications, noting any potential problems and making any changes, deletions or additions as deemed necessary. The Conference will include but not be limited to the following:
 - 1.11.2.1. Verify Project requirements.
 - 1.11.2.2. Coordination with other trades.
 - 1.11.2.3. Scheduling.
 - 1.11.2.4. Additional items relating to the Work.
- 1.11.3. Attendees shall also inspect the worksite and review condition of site and substrates, protection requirements, determine where mock-ups will be prepared.
- 1.11.4. Minutes will be taken of the meeting, including agreement or disagreement on matters of significance. If meeting ends with substantial disagreement, it will be determined how disagreements will be resolved and a date will be set for a reconvened meeting. A copy of the minutes will be furnished to all attendees.

1.12. MOCK-UPS

- 1.12.1. Construct mock-ups demonstrating the abilities and skill of the workers performing the work and the tools and materials required to perform the work.
- 1.12.2. Heritage Consultant shall be present to perform review process. Advise Heritage Consultant minimum 7 days prior to beginning of mock-up preparation.
- 1.12.3. Each type of work or procedure specified in Part 3 of this Section requires a mock-up. Heritage Consultant reserves the right to have additional mock-ups prepared to suit Project conditions.
- 1.12.4. As indicated, only the workers that perform the mock-ups may be utilized to do that work or procedure throughout the duration of the work.
- 1.12.5. When multiple teams of workers are to perform a certain type of work, every team shall prepare required mock-ups to ensure consistent results for the entire work specified in this Section.

1.13. CLEANING

- 1.13.1. At completion, remove tools and rubbish and leave area clean and ready for inspection.
- 1.13.2. Where required, install heritage protections as indicated when directed by Heritage Consultant.

PART 2 - PRODUCTS

2.1. SALVAGED ITEMS

- 2.1.1. Refer to Drawings for location and extent of salvage items.
- 2.1.2. Confirm extent of salvage on site with Heritage Consultant once scaffolding is fully erected around the building.
- 2.1.3. Confirm with Owner's Representative additional items that appear salvageable prior to disposal.

2.2. EQUIPMENT AND TOOLS

- 2.2.1. Flush-cutting grinders capable of fitting 5 and 12 inch diamond cutting blades for masonry. Grinders must have variable speed.
- 2.2.2. Diamond cutting blades to be continuous edged.

2.2.3. A flexible shaft rotary tool. Suggested supplier: Suhner (Tel. 706-235-8046), Rotostar Flexible Shaft Machine. Rotostar Kit, part no. 11014301, FSM accessory, part no. 5789102, Angle cutting head accessory for 14 inch collete, part no. W110.

2.2.4. Small diameter cutting blades: Suggested supplier: Ogden Tools Inc, Attn Gordon, Tel 819-876-7733; 3 3/8 inch diamond cutting blade, turbo-style, part no. 807.

PART 3 - EXECUTION

3.1. SALVAGE

3.1.1. Remove and handle salvageable items from site to minimize damage and to ensure that usability is maintained.

3.1.2. Clean, decontaminate, or remediate hazardous substances (lead based paint, asbestos dust, PCB residue, and similar substances) from salvaged materials so they are safe for reuse.

3.1.3. Place materials on palettes or wrap in protective film to ensure that loose pieces and projections do not cause injury to personnel, and that salvaged items remain as complete units.

3.1.4. Clean items of construction or building debris, or materials that are not a part of salvaged work before delivering to Owner.

3.2. DOCUMENTATION

3.2.1. Submit documentation per Section 01 35 91 – Heritage Protective Measures prior to removing any Heritage Materials.

3.3. MASONRY SALVAGE

3.3.1. Remove masonry items in accordance with the following procedures:

3.3.2. Carefully remove mortar, grout and any epoxies found in the joints using hand tools only. Use only approved methods and tools, as per approved mock-ups.

3.3.3. Carefully remove each item to be salvaged starting from the top of the wall and working downwards. Follow removal and documentation methods as per approved mock-ups.

3.3.4. Remove excess grout and mortar.

3.3.5. Stack neatly on-site for reuse.

3.4. HERITAGE WOOD DOOR SALVAGE

3.4.1. Carefully dislodge and separate wood trim from substrates using appropriate tools that will not damage wood trim or other surrounding heritage material. Use procedures successfully tested and approved during mock-up preparation.

3.4.2. Pry trim evenly to minimize risk of breaking; all trim must be removed intact.

3.4.3. Carefully remove nails and discard.

3.4.4. Keep trim from individual windows together as a group; record and identify all pieces on their concealed back side using approved method.

3.5. PACKING, HANDLING AND STORAGE

3.5.1. Wrap individual heritage wood pieces with heavy craft paper and pack in groups as recorded. Wrap each group with Polyethylene foam sheeting and identify each group as required and approved by Heritage Consultant.

3.5.2. Construct crates with lumber and plywood to suit trim. Crates shall be designed to be lifted and handled by no more than two persons and to be stored in horizontal position with trim laying flat. Line crates with 25 mm thick polystyrene foam to avoid impact damage.

3.5.3. Crate packed wood and clearly label and identify each crate.

- 3.5.4. Handle crates with care; do not drop or damage packing and crating during transport.
- 3.5.5. Transport crates to Contractor's storage area off Site. Storage area shall be indoors and locked with temperature and humidity in range described in article 1.10 Storage of Removed Items for Reuse.
- 3.5.6. Crates must be stored off ground and supported to avoid sagging. Place Inventory Forms and crate identification so they are readily accessible.
- 3.5.7. Avoid stacking crates unless specifically approved by Heritage Consultant.

END OF SECTION

SECTION 03 01 37
CONCRETE RESTORATION

| SPECIFICATION REVISION LOG | | |
|----------------------------|------------|-------------------|
| REVISION NUMBER | DATE | ISSUED FOR |
| 01 | 2024-10-04 | PROGRESS ISSUANCE |
| 02 | 2024-11-01 | PROGRESS ISSUANCE |
| 03 | 2024-11-15 | BUILDING PERMIT |
| 04 | 2025-01-31 | ISSUED FOR BID |
| | | |
| | | |
| | | |
| | | |

PART 1 - GENERAL

1.1. WORK INCLUDED

- 1.1.1. Comply with General Requirements and all documents referred to therein.
- 1.1.2. Provide all labour, materials, products, supervision, and equipment to complete the concrete restoration work indicated on the drawings and specified herein.
- 1.1.3. Perform localized removals of deteriorated concrete and prepare the surfaces of sound concrete to receive new concrete repair material.
- 1.1.4. Repair of concrete internal reinforcement and installation of supplemental reinforcing steel.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Section 03 10 00 – Concrete Forming
- 1.2.2. Section 03 20 00 – Concrete Reinforcement
- 1.2.3. Section 03 30 00 – Cast-in-Place Concrete

1.3. REFERENCE STANDARDS, CODES AND ACTS

- 1.3.1. Conform to Ontario Regulation 332/12 (The Building Code) as amended by all subsequent Ontario Regulations issued to the date of this specification and applicable acts of authorities having jurisdiction.
- 1.3.2. CSA A23.1/ CSA A23.2 Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- 1.3.3. ASTM A82/A82M Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
- 1.3.4. ASTM C150 Standard Specification for Portland Cement

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|---------|---|---|
| 1.3.5. | ASTM C1059 | Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete |
| 1.3.6. | CSA-G30.18 | Carbon Steel Bars for Concrete Reinforcement |
| 1.3.7. | CSA-W59-03 | Welded Steel Construction (Metal Arc Welding). |
| 1.3.8. | ASTM C1059-99 | Standard Specification for Steel Wire, Plain, for Concrete Reinforcement |
| 1.3.9. | CSA-A3000 | Cementitious Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete. |
| 1.3.10. | CSA-A3001 | Cementitious Materials for Use in Concrete. |
| 1.3.11. | CSA-S413 | Parking Structures |
| 1.3.12. | CSA-S448.1:10 | Repairs of Reinforced Concrete in Buildings and Parking Structures |
| 1.3.13. | ICRI 310.2R | Selecting and Specifying Concrete Surfaces Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repairs. |
| 1.3.14. | Where there are differences between the specifications and drawings and the codes, standards, or acts, the most stringent shall govern. | |
| 1.3.15. | Standards referenced by the Standards noted above are to apply even if they are not included in the list. Where such reference is made, it shall be to the latest edition and revision published. | |
- 1.4. TOLERANCES**
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| 1.4.1. | Perform placing operations so that completed work will be within the tolerances set out in CSA A23.1 and as listed below: |
| 1.4.1.1. | Variations in building lines which results in the extension of building elements over lot lines or restriction lines will not be permitted. |
| 1.4.2. | These tolerances are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly. |

1.5. PERFORMANCE CRITERIA

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- 1.5.1. For the duration of the warranty period, the concrete repairs performed under this contract shall not:
 - 1.5.1.1. Spall, scale, or crack excessively.
 - 1.5.1.2. Debond from existing substrate.
 - 1.5.1.3. Delaminate due to reinforcing steel corrosion.

1.6. SUBMITTALS FOR REVIEW

- 1.6.1. Product Data: Product description, application procedures, and precautions in use or application of Products.
- 1.6.2. Submit all mix designs, Product specifications, and Manufacturer's recommendations for review by the Consultant, a minimum of two weeks prior to placement.
- 1.6.3. Submit details of proposed methods of concrete curing and provisions for weather protection to the Consultant for review of a minimum of two weeks prior to placement.
- 1.6.4. Do not commence concrete placement until submittal review process is complete and all products and methodologies are accepted by the Consultant.

1.7. SUBMITTALS FOR INFORMATION

- 1.7.1. Qualification Statement: Installer qualifications, including previous projects.
- 1.7.2. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.8. QUALITY ASSURANCE

- 1.8.1. This article includes statements that require quality applicable to the whole section.
- 1.8.2. Installer Qualifications: Company specializing in performing the work of this section with:
 - 1.8.2.1. Minimum three (3) years documented experience and approved by the manufacturer.
 - 1.8.2.2. Successful completion of at least three (3) projects of similar scope and complexity within past five (5) years.
- 1.8.3. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- 1.8.4. Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience approved by the manufacturer.
- 1.8.5. Perform concrete Work in accordance with CSA-A23.1/A23.2.
- 1.8.6. Perform concrete restoration work in accordance with ICRI 310.2R-2013, CSA 448.1.1:10 (R2020).

1.9. WARRANTY

- 1.9.1. The warranty shall cover the repair of deteriorated concrete as a result of faulty materials and/or workmanship for a period of two (2) years from the date of Substantial Performance of the work.

1.10. DELIVERY, STORAGE, AND PROTECTION

- 1.10.1. Protect materials from moisture absorption and damage; reject damaged containers.
- 1.10.2. Store sand to prevent inclusion of foreign matter.
- 1.10.3. Comply with instructions for storage, shelf-life limitations, and handling outlined by product manufacturers.
- 1.10.4. Do not overload structure.

1.11. ENVIRONMENTAL REQUIREMENTS

- 1.11.1. Do not apply repair materials during inclement or freezing weather, or if such conditions are anticipated within material curing period.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Either Ready-Mix or Bag-Mix materials may be permitted depending on the application, unless the specific material is specified on the drawings or herein. Specifications for both alternatives are provided below.

2.2. CONCRETE MATERIALS

- 2.2.1. Concrete to meet the requirements specified by CSA-A23.1.
- 2.2.2. Portland cement: Type: CSA-A3001, Type GU.
- 2.2.3. Aggregate: CSA-A23.1.
- 2.2.4. Water: Potable, clean, and free from deleterious amounts of acids, alkali, and organic matter and to CSA-A23.1.
- 2.2.5. Air entraining: CSA-A3001
- 2.2.6. Chemical admixtures: CSA-A3001
- 2.2.7. Pozzolanic mineral admixtures: CSA-A3001
- 2.2.8. Curing materials: CSA-A23.1
- 2.2.9. Blended hydraulic cementing materials: CSA-A362
- 2.2.10. Supplementary cementing materials: CSA-A23.5
- 2.2.11. Superplasticizing admixtures: CSA-A3001
- 2.2.12. *Calcium Chloride is NOT permitted.

2.3. STRUCTURAL CONCRETE AND/OR SLAB DELAMINATION REPAIR (READY-MIX):

- 2.3.1. Concrete to meet the requirements specified by CSA-A23.1.

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| 2.3.2. | Properties | |
| 2.3.3. | 28 day compressive strength: | 35 MPa |
| 2.3.4. | Air content: | 6-9% |
| 2.3.5. | Aggregate size: | 10 mm |
| 2.3.6. | Maximum slump: | 50 mm +/- 20 mm (prior to plasticizer) 125 mm +/- 25 mm (after plasticizer) |
| 2.3.7. | Water/cementing materials ratio: | 0.40 maximum |
| 2.3.8. | Cement: | Type GU |
| 2.3.9. | Silica Fume: | Type U |
| 2.3.10. | Fly Ash: | Type F |
| 2.3.11. | Water: Potable, clean and free from deleterious amounts of acids, alkali, and organic matter | |
| 2.3.12. | Coulomb: | 1500 (maximum) |
| 2.3.13. | *Calcium chloride is NOT permitted | |
| 2.3.14. | The mix design remains the responsibility of the contractor. | |
| 2.3.15. | The concrete must be placed within 2 hours of batching. | |

2.4. NON-STRUCTURAL AND/OR SLAB ON GRADE CONCRETE REPAIRS

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| 2.4.1. | Portland cement: Normal Weight Portland Cement Concrete CAN/CSA A23.1 C2 exposure class as follows: | |
| 2.4.2. | Minimum compressive strength at 28 days | 32 MPa |
| 2.4.3. | Maximum water/cement ratio by mass | 0.40 |
| 2.4.4. | Total Percent of Air Content | 6 to 9% |
| 2.4.5. | Cement | Type 10 |
| 2.4.6. | Aggregate | 20 mm MAX. |
| 2.4.7. | Water: Potable, clean, and free from deleterious amounts of acids, alkali, and organic matter. | |

2.5. CONCRETE SLAB DELAMINATION PATCH REPAIR (BAG-MIX):

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| 2.5.1. | Acceptable patch materials: | |
| 2.5.1.1. | MAPEI; Product: Planitop 18 | |
| 2.5.1.2. | SIKA; Product: SikaTop® 111 Plus | |
| 2.5.1.3. | SIKA; Product: SikaQuick 1000 | |
| 2.5.1.4. | SIKA; Product: SikaQuick 2500 | |
| 2.5.1.5. | SIKA/King; Product: MS-S6-SCC | |
| 2.5.1.6. | SIKA/King; Product: MS-S10 | |
| 2.5.1.7. | Euclid Chemical; Product: Versaspeed 100 | |

- 2.5.1.8. Euclid Chemical: Product: Versaspeed LS100
- 2.5.1.9. BASF; Product: MasterEmaco T 1060 Repair Mortar
- 2.5.1.10. BASF; Product: MasterEmaco T 1061 Repair Mortar
- 2.5.1.11. BASF; Product: MasterEmaco T 1060EX Repair Mortar
- 2.5.1.12. BASF; Product: MasterEmaco T 1061EX Repair Mortar
- 2.5.1.13. Or Approved Alternative

2.6. VERTICAL/OVERHEAD CONCRETE DELAMINATION PATCH REPAIR (BAG-MIX):

- 2.6.1. Acceptable patch materials:
 - 2.6.1.1. MAPEI; Product: Planitop X
 - 2.6.1.2. MAPEI; Product: Planitop 23
 - 2.6.1.3. SIKA; Product: SikaTop® 123 Plus
 - 2.6.1.4. BASF; Product: MasterEmaco N400
 - 2.6.1.5. BASF; Product: MasterEmaco N425
 - 2.6.1.6. Euclid Chemical: Product: EucoRepair V100
 - 2.6.1.7. Or Approved Equivalent
- 2.6.2. Acceptable patch materials for concrete columns, beams, soffits, and vertical surfaces where gravity fed within formwork:
 - 2.6.2.1. SIKA/King; Product: MS-S6-SCC
 - 2.6.2.2. SIKA/King; Product: MS-S10-SCC
 - 2.6.2.3. SIKA/King; Product: RS-S10-SCC
 - 2.6.2.4. SIKA; Product: SikaGrout 212 HP
 - 2.6.2.5. Or Approved Equivalent

2.7. PATCH REPAIR MATERIAL ALTERNATES (BAG-MIX)

- 2.7.1. Patching Compound: Premixed Cementitious concrete patching mix, color to match existing concrete.
- 2.7.2. Properties of alternate patching compounds are to meet the following Standard Test Method Results:
 - 2.7.3. Bond Strength: ASTM C882/C882M, 18.6 MPa.
 - 2.7.4. Tensile Strength: ASTM D638, 45 MPa.
 - 2.7.5. Elongation: ASTM D638, 2 percent at 7 days at 21°C.
 - 2.7.6. Flexural Strength: ASTM D790, 45 MPa.
 - 2.7.7. Compressive Strength: ASTM D695, 55 MPa.
 - 2.7.8. Thermal Compatibility: ASTM C884/C884M.

2.8. BONDING AGENTS

- 2.8.1. Sand-Cement Slurry Bonding Agent: 1:1 cement sand mixture with maximum W/C ratio of 0.4. Mix cement/sand grout to CSA-A23.1/A23.2 and manufacturer's instructions for purpose intended.
- 2.8.2. Acrylic latex bonding agent: 1:2 cement sand mixture with latex agent to ASTM C1059.
- 2.8.2.1. Latex: ASTM C1059 Type II.
- 2.8.2.2. Latex: Polyvinyl acetate emulsion, dispersed in water while mixing, non-coagulant in mix, water resistant when cured.
- 2.8.3. Refer to pre-packaged concrete repair material for compatible with a bonding agent. Where pre-package material recommends the use of a bonding agent, the prescribed bonding agent is to be used.

2.9. CONCRETE CRACK REPAIR

- 2.9.1. Unless noted on the Drawings, for fine cracks on horizontal surfaces up to 1.6 mm in width:
 - 2.9.1.1. BASF; MasterSeal 630 Penetrating Sealer, or approved alternative.
- 2.9.2. Unless noted on the Drawings, For cracks on vertical or horizontal surfaces 1.6 mm to 3 mm in width:
 - 2.9.2.1. SIKa; Sikadur Crack Fix, or approved alternative.

2.10. THIN CONCRCTE TOPPING MATERIALS (BAG MIX)

- 2.10.1. Acceptable topping materials:
 - 2.10.1.1. SIKa; Product: SikaTop® 122 Plus.
- 2.10.2. Acceptable bonding agent:
 - 2.10.2.1. SIKa; Product: SikaTop® Armatec 110 EpoCem.
- 2.10.3. Consult with manufacturer's representative to visit site and review suitability of topping with respect to in-situ conditions.
- 2.10.4. Alternate materials may be considered if the Contractor has evidence of success with the construction of thin bonded concrete toppings in similar applications with other materials.

2.11. MIXING CEMENTITIOUS MATERIALS

- 2.11.1. Mix cementitious patch material to CSA-A23.1/A23.2 and manufacturer's written instructions for purpose intended.
- 2.11.2. Use only compatible admixtures as specified and approved by the manufacturer.
- 2.11.3. Calcium chloride is not permitted.
- 2.11.4. Air Entraining, Antifreeze, Bonding, and Other Additives: Not permitted.

2.12. REINFORCEMENT MATERIALS

- 2.12.1. Reinforcing Steel, Deformed: CAN/CSA-G30.18, billet steel, Grade 400R regular bars.
- 2.12.2. Supports for Concrete Reinforcement: Rebar Support Chairs and Ties: Plastic or plastic coated.

- 2.12.3. Zinc plated tie wire anchors (where specified), manufactured by Tapcon, or approved equivalent.
- 2.12.4. 20 Gauge Galvanized Tie Wire (where specified).
- 2.12.5. Protective Coatings - Zinc-Rich Touch-Up Paint:
- 2.12.6. Provide Zinc-Rich Touch-Up Paint on reinforcing (where specified). Product: Galvafruid manufactured by W. R. Meadows Limited or Zinc Clad 5 manufactured by Sherwin-Williams Company or approved equivalent.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verify existing conditions before commencing work.
- 3.1.2. Verify that surfaces are ready to receive work.
- 3.1.3. Beginning of installation means acceptance of existing surfaces.

3.2. PREPARATION

- 3.2.1. All concrete and steel surfaces to be in contact with new concrete are to be abrasively blasted prior to casting of new concrete.
- 3.2.2. Clean concrete surfaces of dirt, laitance, debris, grease, and oil prior to placement of concrete.
- 3.2.3. Surface preparation for all bag-mix concrete patching materials to meet the manufacturer's recommendations or the requirements of this specification, whichever are more stringent.
- 3.2.4. Remove any existing wearing surface or water protection membranes from suspended slabs, ramps or other areas specified to be repaired.
- 3.2.5. Determine by visual inspection, chain dragging, and hammer sounding the areas of deteriorated concrete such as spalls, delamination, and unsound concrete which may adversely affect the structure or the proper functioning of the moisture protection system. Mark these areas with paint.
- 3.2.6. Determine by visual inspection and hammer sounding the areas of deteriorated and delaminated soffits, and vertical surfaces, to be repaired. Mark these areas with paint.
- 3.2.7. Notify the Consultant to review and comment on the areas identified for repair. Adjust areas based on Consultant's comments until agreement is reached.
- 3.2.8. Clean surfaces to be repaired; remove loose and foreign matter which could interfere with application of sealers and coatings.

3.3. CONCRETE WORK AT EXISTING STRUCTURE

- 3.3.1. Prior to undertaking any work in or adjacent to the existing structure, verify that conditions are as indicated on the contract documents. If they are not, do not proceed until the Consultant has given instructions.
- 3.3.2. Protect and support existing services that may interfere with work in the existing structure.

3.4. TEMPORARY SHORING

- 3.4.1. Design, provide and maintain, if necessary, sufficient temporary shoring to safely support the suspended slabs and their applied loads until the repairs are complete.

- 3.4.2. Submit shoring shop drawings stamped by a Professional Engineer practicing in Ontario for review by the Consultant prior to commencing any concrete demolition work. Shoring engineer to perform periodic site review of installed shoring and provide field review reports to the Consultant confirming they have visited site and are satisfied with the installed shoring including any and all shoring modifications needed to suit site conditions not identified on the shoring shop drawings.

3.5. SAWCUTTING

- 3.5.1. The perimeter of all areas of repair shall be sawcut to 13 mm deep with the following stipulations:
- 3.5.1.1. Sawcut overrun at corners and at intersections is not permitted.
- 3.5.1.2. Prior to sawcutting and to prevent damage to the existing reinforcing steel, the Contractor shall determine the actual amount of concrete cover over the embedded reinforcing steel.
- 3.5.1.3. Where insufficient concrete cover exists over the reinforcing steel to permit the 13 mm deep sawcut, perimeter removal to a vertical edge, using Owner-approved methods, is permitted in these areas only.
- 3.5.1.4. FEATHER EDGES ARE NOT PERMITTED at concrete patches.

3.6. REPAIR OF CRACKS

- 3.6.1. Seal cracks 1.6 mm or less in width with penetrating sealer. Apply one or more coats as required for coverage; follow the Manufacturer's written instructions.
- 3.6.2. Repair cracks over 1.6 mm but less than 3 mm in width with epoxy adhesive and gel mortar:
- 3.6.2.1. Remove loose and deteriorated concrete back to a point at which sound material is reached.
- 3.6.2.2. Apply epoxy adhesive in accordance with the Manufacturer's written instructions.
- 3.6.2.3. Fill remaining voids with gel mortar, applied in accordance with the Manufacturer's written instructions. Finish flush with adjacent surfaces.

3.7. REPAIRS TO DETERIORATED AND DELAMINATED CONCRETE SLAB SURFACES

- 3.7.1. Remove loose and deteriorated concrete back to a point at which sound material is reached. Minimum concrete patch surfaces profile to be CSP 6. Undercut surfaces to form key with new material.
- 3.7.2. Remove sound concrete to the extent shown on the drawing(s). If deteriorated concrete is encountered, remove concrete back to a point at which sound material is reached.
- 3.7.3. Remove concrete a minimum of 25mm around and below exposed portions of reinforcing bars. Extent concrete removals a minimum of 150mm beyond the actual delaminated area.
- 3.7.4. Perform concrete removals in conformance to ICRI 310.2R-2013.
- 3.7.5. Abrasive blast (sandblast or wire brush) rusted or corroded reinforcing bars to expose sound, clean metal.
- 3.7.6. Before proceeding with the repair work, ensure that agreement on the areas to be repaired has been obtained from the Consultant.

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- 3.7.7. Excess or unnecessary concrete removal to be at no extra cost.
- 3.7.8. Upon completion of all concrete removals, mechanically abrade repair patches by particle blasting until both the concrete substrate and exposed reinforcing steel are free of all cement paste, rust, loose and fractured concrete, and bond inhibiting materials. Notify consultant for review upon complete.
- 3.7.9. Lightly wet concrete substrate to be patched to provide saturate surface dry (SSD) conditions for a period not less than twenty-four hours prior to patching or in accordance with manufacturer's requirements.
- 3.7.10. Coat exposed reinforcing bars with corrosion inhibitor.
- 3.7.11. Where reinforcing steel is uncovered or where reinforcement is corroded, continue concrete removal until 25 mm clearance around all exposed reinforcement is achieved and widen repair area until 75mm of non-corroded reinforcing steel is revealed.
- 3.7.12. Where directed by the Consultant, add or splice-in reinforcing bars.
- 3.7.13. Fill voids with patching mix; finish flush with adjacent surfaces.
- 3.7.14. Finish exposed surfaces to match adjacent original/existing concrete in color and texture. Refer to Drawings for any textured finishes requirements.
- 3.7.15. Do not allow traffic onto new placed concrete areas or remove shoring until 75% of the specified 28-day strength has been achieved. Perform compressive strength cylinder testing as required.
- 3.7.16. At all times during the work, protect exposed concrete, exposed masonry and other exposed members from staining or becoming coated with concrete leakage due to continuing concreting operations. Members which become coated may be classed as defective by the Consultant.
- 3.7.17. Wet cure new ready mixed concrete at 10°C for a minimum of 7 days. Cure pre-packaged repair materials as per manufacturers published instructions.
- 3.7.18. Cure in accordance with CSA A23.1.
- 3.8. REPAIRS TO DETERIORATED AND DELAMINATED CONCRETE COLUMNS**
- 3.8.1. Proceed as in Item **3.6 Clauses .1 through .16** inclusive and:
- 3.8.2. Form areas where new concrete is to be poured using gravity feed method or pressure grout.
- 3.8.3. Mixing Pre-Package Concrete Repair Materials:
- 3.8.3.1. Materials must be mixed in a Concrete Drum Mixer.
- 3.9. REPAIRS TO DETERIORATED AND DELAMINATED CONCRETE SOFFITS, VERTICAL SURFACES AND BEAMS**
- 3.9.1. Remove and reinstall existing mechanical or electrical services and fixtures as required to perform the work.
- 3.9.2. Proceed as in Item **3.6 Clauses .1 through .16** inclusive and:
- 3.9.3. Along the line of each major crack or spall, remove loose concrete and delaminated areas, expose the bottom reinforcement in each direction and notify the Consultant for review.

- 3.9.4. For vertical surfaces and soffits where concrete patch depth is less than 25 mm, install to the Manufacturer's instructions zinc plated tie wire anchors. Maximum centre-to-centre spacing in each direction is 200 mm MAX or as indicated on drawings.
- 3.9.5. Tie tie wire anchor heads together with 20 gauge galvanized wire.
- 3.9.6. Fill cavities in soffit and cracks with approved patching compound. Apply latex bonding agent to cavity surfaces prior to filling cavities. Trowel to a uniform finish to match adjacent existing surfaces. Cure in accordance with the Manufacturer's printed instructions.

3.10. THROUGH-SLAB CONCRETE REPAIRS

- 3.10.1. Where soffit delamination coincides with topside delamination the concrete shall be repaired as a through-slab concrete repair, or as indicated on drawings.
- 3.10.2. Where soffit delamination is greater than 0.37 m² these areas shall be repaired as through-slab repair.
- 3.10.3. Proceed as in Item **3.6 Clauses .1 through .16** inclusive and:
- 3.10.4. Form areas where new concrete is to be poured.
- 3.10.5. At a minimum comply with the following:
 - 3.10.5.1. Brush a bond coat onto the clean concrete surface to be repaired.
 - 3.10.5.2. While bond coat is still tacky, fill the area to be repaired with concrete. Vibrate as necessary to ensure that entire area is filled with consolidated concrete. Trowel smooth flush to the existing surrounding concrete.
 - 3.10.5.3. Wet cure new ready mixed concrete at minimum 10°C for a minimum of 7 days. Cure pre-packaged repair materials as per manufacturer's published instructions.

3.11. BONDING AGENTS

- 3.11.1. Apply bonding agent to CSA-A23.1/A23.2 and manufacturer's instructions.
- 3.11.2. Brush a bond coat of cement slurry bonding agent onto the clean concrete surface to be repaired and cover all surfaces of exposed reinforcing.
- 3.11.3. While the cement slurry bonding agent is still tacky, fill the cavities with a bonded concrete and finish to match adjacent surfaces. Comply with the procedures described herein and employ such other procedures as may be required such that the concrete infill is bonded to the existing concrete to withstand a stress not less than 1.05 MPa.
- 3.11.4. For pre-packaged bonding agents, follow manufacturer's written instruction and confirm compatibility with proposed concrete product.

3.12. HOT WEATHER CONCRETING

- 3.12.1. When rate of moisture evaporation exceeds 1.0 kg/m² per hour, employ the following measures in addition to the requirements of A23.1-04.
 - 3.12.1.1. Use ice as mixing water to lower the concrete temperature to an appropriate temperature as required by the more stringent of CSA A23.1-09/A23.2-09 and CSA-A3001-08.
 - 3.12.1.2. Dispatch ready-mix trucks and organize work to keep mixing time to a minimum. Minimize exposure of mixing trucks to the hot sun while waiting.
 - 3.12.1.3. Provide adequate personnel and organize work to keep placing time to a minimum.

- 3.12.1.4. Place concrete in layers thin enough and areas small enough so that the time interval for placing is reduced and compaction will ensure complete union of adjacent portions.
- 3.12.1.5. With formed concrete, reliance shall not be placed on the forms alone to provide curing. Spray formwork with water to keep it tight and free from cracking.

3.13. COLD WEATHER CONCRETING

- 3.13.1. When temperatures are forecast to go below 4°C, within 24 hours of the concrete repair, provide on hand and ready for use all equipment necessary for adequate cold weather protection and curing before concrete placement is begun, as required by the more stringent of CSA A23.1-09/A23.2-09 and CSA-A3001-08.
- 3.13.2. When fresh concrete is to be cast against existing concrete, prevent the loss of heat by extending the protection for the fresh concrete at least 600 mm over the existing. Existing concrete must be preheated to a temperature of at least 10°C prior to casting new concrete against it, by providing insulation or heated temporary enclosures for a period of 24 hours prior to the repair.
- 3.13.3. When ambient temperatures go below 4°C, the area of concrete repair work must be insulated, or enclosed within heated protective housing, tie rods, reinforcement, or metal which projects from the concrete being protected, to keep the area of the concrete repair above 4°C for a period of 48 hours following completion of the repair.
- 3.13.4. Maintain housing, enclosures, and supplementary heat in place for the entire period of protection, except for sections that may be temporarily removed as required to permit placing additional forms or concrete provided the uncovered concrete is not permitted to freeze.
- 3.13.5. Locate heating units to avoid heating concrete locally or drying it excessively. Avoid high temperature and dry heating within enclosures.
- 3.13.6. Take particular care to maintain edges and corners of concrete at the required temperature owing to their greater vulnerability to freezing.
- 3.13.7. Provide sufficient insulation, and heat as necessary, to prevent freezing of frost susceptible soil which lies against structural elements; in particular protect soil beneath footings and behind foundation walls until the building is completed.
- 3.13.8. The application of de-icing salts on completed work is not permitted

3.14. BONDED CONCRETE TOPPINGS

- 3.14.1. Areas to receive new bonded topping slab to be shot blast to remove all remnants of existing toppings and/or waterproofing system, followed by pressure washing to remove all dirt, dust, and/or debris of any kind. Joints and cracks in the structural slab are to be filled and patched with cementitious material as required to meet substrate requirements as per manufacturer's instructions for the new bonded topping system.
- 3.14.2. Apply the bonding agent(s) and the topping(s) in conformance with the manufacturer's written instructions.
- 3.14.3. Place the concrete floor topping(s) to required slopes, thicknesses, lines, and levels.

- 3.14.4. Verify the continuity of slopes to drains by surveying and by performing physical drainage tests witnessed by the consultant prior to the installation of the traffic topping. Any areas of ponding on the bonded concrete topping discovered through drainage tests are to be repaired using the Topping Slab Replacement material and re-tested until all areas of ponding have been eliminated.

3.15. CONCRETE FINISHING

- 3.15.1. Provide formed concrete surfaces to be left exposed with smooth rubbed finish.
- 3.15.2. Finish concrete topside surfaces to meet substrate requirements for waterproofing traffic topping or roughness profile specified on the drawings, per manufacturer's instructions, and as per the requirements of specification Section 07 18 00.
- 3.15.3. In areas with floor drains, pitch surfaces uniformly to drains at sloped indicated on the drawings.

3.16. CURING AND PROTECTION

- 3.16.1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical damage.
- 3.16.2. Maintain concrete with minimal moisture loss at relatively constant temperature for the period necessary for hydration of cement and hardening of the concrete.
- 3.16.3. Cure bag-mix concrete patching materials in conformance with the manufacturer's instructions.
- 3.16.4. Cure bonded concrete surfaces in conformance with manufacturer's instructions, and per CSA A23.1 requirements for 7-day wet curing for durability by the use of poly-sheets, or Hydracure/Ultracure blankets kept constantly wet for 7 days.

3.17. CLEANING

- 3.17.1. Close off areas in which work is being performed to pedestrian and vehicular traffic.
- 3.17.2. Protect adjacent and underlying surfaces from damage.
- 3.17.3. Install temporary dams and containment devices to collect runoff water.
- 3.17.4. Clean existing concrete surfaces to remove dirt, hydrocarbons, grease, oil, environmental pollutants, and residues.
- 3.17.5. Sandblasting and the use of non-proprietary acids is prohibited.
- 3.17.6. Do not damage existing surfaces. Leave surfaces uniform in appearance.
- 3.17.7. Wet surfaces with clean water.

3.18. INSPECTION AND TESTING

- 3.18.1. To conform to CSA A23.2.
- 3.18.2. Inspection and testing agency to be designated by the consultant and paid for by the owner.
- 3.18.3. Testing shall include:
- 3.18.3.1. Compression tests on concrete: 1 cylinder at 3 days, 1 cylinder at 7 days, and two cylinders at 28 days.
- 3.18.3.2. Air and slump tests to be completed on each batch of ready-mix concrete delivered.

- 3.18.4. Contractor to provide labour to assist the testing agency as well as a storage area for site cured specimens.
- 3.18.5. If requested by the consultant, bond tests may be completed. Failure to achieve a minimum tensile bond of 0.7 MPa will result in failure of the patch and the concrete will be removed and replaced at the cost of the Contractor.
- 3.18.6. Contractor is to pay for additional testing as follows:
- 3.18.6.1. Additional standby time required due to late delivery by concrete supplier.
- 3.18.6.2. Additional slump and/or air tests if the first tests indicate that the concrete properties are out of spec and the Contractor wishes to modify the mix and retest for acceptance. All modifications are to be approved by the Consultant.
- 3.18.7. If the Contractor fails to notify the testing agency in the event of a concrete pour cancellation, the Contractor shall bear the cost of the cancellation fee, if applicable.

3.19. FIELD QUALITY CONTROL

- 3.19.1. The Consultant shall evaluate the patch material by completing a chain-drag or hammer sounding of the surfaces. Detection of a hollow sound shall be reason to suspect inadequate bond and the contractor shall remove and replace defective patches.

END OF SECTION 03 03 30

SECTION 03 10 00
CONCRETE FORMING

| SPECIFICATION REVISION LOG | | |
|----------------------------|------------|-------------------|
| REVISION NUMBER | DATE | ISSUED FOR |
| 01 | 2024-10-04 | PROGRESS ISSUANCE |
| 02 | 2024-11-01 | PROGRESS ISSUANCE |
| 03 | 2024-11-15 | BUILDING PERMIT |
| 04 | 2025-01-31 | ISSUED FOR BID |
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PART 1 - GENERAL

1.1. DEFINITIONS

- 1.1.1. The following Definitions shall apply in this Specification:
- 1.1.2. Contract Documents
 - 1.1.2.1. The Contract Documents consist of the Drawings, Specifications and Reports which form part of the agreed Contract.
- 1.1.3. Consultant
 - 1.1.3.1. The Consultant is the Architect, SEOR, persons or entities engaged by the Owner. The term Consultant means the Consultant or the Consultant's authorized representative.
- 1.1.4. Contractor
 - 1.1.4.1. The term Contractor is defined to include any of the following: Construction Manager, General Contractor, Structural Steel Erector, Structural Steel Fabricator, Subcontractor or Supplier.
- 1.1.5. Owner
 - 1.1.5.1. The Owner is the person or entity identified as such in the Contract. The term Owner means the Owner or the Owner's authorized agent or representative but does not include the Consultant.
- 1.1.6. SEOR
 - 1.1.6.1. The SEOR is defined as the Structural Engineer of Record for the Contract.

1.2. WORK INCLUDED

- 1.2.1. Comply with Division 1 - General Requirements and all documents referred to therein.
- 1.2.2. Provide all labour, materials, plant and equipment to complete the concrete formwork and falsework indicated in the Contract Documents, including the installation of cast in inserts and assemblies as therein.

1.3. SECTION INCLUDES

- 1.3.1. This Section includes: concrete formwork, falsework, bearing assemblies, water storage tanks (watertight construction), underpinning, work at existing structures, void forms, and qualification requirements.

1.4. RELATED WORK SPECIFIED ELSEWHERE

- 1.4.1. Section 03 20 00 - Concrete Reinforcement: Concrete Reinforcement.
- 1.4.2. Section 03 30 00 - Cast-in-Place Concrete: Cast-in-Place Concrete.
- 1.4.3. Section 05 12 00 - Structural Steel: Anchor assemblies, bolts and the like to be cast into concrete.

1.5. REFERENCE STANDARDS, CODES, AND ACTS

- 1.5.1. Conform to the requirements of the local building code identified on the Structural General Notes as amended by all subsequent Regulations issued to the date of this specification and applicable acts of authorities having jurisdiction.
- 1.5.2. All references to the Standards and publications noted below shall be to the edition referenced in the local building code identified on the Structural General Notes, or to the edition referenced in the latest published editions or revisions of all Standards published by the Canadian Standards Association issued to the date of this Specification, whichever is the later edition or revision.
- 1.5.3. All references noted below, which are not referenced by the local building code or the Standards published by the Canadian Standards Association, shall be to the latest edition and revision published to the date of this Specification.
- 1.5.4. Standards and publications referenced by the Standards noted below shall apply even if they are not included in the list. Where such reference is made, it shall be to that latest edition and revision published to the date of this Specification.
- 1.5.5. Where there are differences between the Contract Documents and the codes, standards or acts, the most stringent shall govern.
- 1.5.6. AASHTO HB - Standard Specifications for Highway Bridges.
- 1.5.7. CAN/CSA O86 - Engineering Design in Wood.
- 1.5.8. CAN/CSA S269.3 - Concrete Formwork.
- 1.5.9. CSA A23.1/A23.2 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
- 1.5.10. CSA O325 - Construction Sheathing (Adopted NIST PS 2-18, with Canadian Deviations).
- 1.5.11. CSA S269.1 - Falsework and Formwork.

1.6. TOLERANCES

- 1.6.1. Perform forming operations and place hardware so that finished concrete will be within the tolerances set out in CSA A23.1/A23.2
- 1.6.2. Variations in building lines which result in extension of the building over lot lines or restriction lines will not be permitted.
- 1.6.3. These tolerances are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.

1.7. QUALIFICATIONS

- 1.7.1. The formwork, falsework, and reshoring shall be designed by a qualified professional engineer licensed by the authority having jurisdiction with a minimum of 5 years Canadian experience in the design of such temporary construction Work.

1.8. DESIGN

- 1.8.1. Formwork, falsework, and Reshoring.
- 1.8.1.1. The Contractor shall design formwork, falsework, and reshoring to safely support vertical and lateral loads until they can be supported by the structure.
- 1.8.1.2. The Contractor shall design formwork, falsework, and reshoring for the effects of post-tensioning and shall ensure the design is coordinated with the post-tensioning designer.
- 1.8.1.3. Design formwork to the requirements of CAN/CSA S269.3..
- 1.8.1.4. Design falsework to the requirements of CSA S269.1.
- 1.8.2. Reshores in the lower storeys shall be capable of safely carrying the full weight of the concrete, falsework, formwork, and all construction live loads posted to them prior to the removal of the first storey of shores supported by the ground or slab-on-grade.
- 1.8.3. After reshores are removed from the first storey, the design and provision of reshores may be based on the assumption that each shored or reshored flexural member shares load in relation to its achieved strength, provided the flexural member has attained at least 70% of its specified 28 day strength.
- 1.8.4. Bearing Assemblies
- 1.8.4.1. Design bearing assemblies so that they conform to the configurations shown on the Drawings and can safely transmit the loads and permit the movements indicated.
- 1.8.5. Neoprene Bearing Pads
- 1.8.5.1. Design bearing pads of a suitable shape and material that can safely transmit the forces indicated in the Contract Documents while permitting rotation and movements specified in the Contract Documents.
- 1.8.6. Sliding Movement Joint Bearings
- 1.8.6.1. Design bearings to safely transmit the range of movements and loads indicated in the Contract Documents at a bearing stress not exceeding 14 MPa, and such that the maximum static or dynamic co-efficient of friction shall not be greater than 0.06 at a bearing stress of 10 MPa.
- 1.8.6.2. Design bearings to provide a range of movements of plus or minus 25 mm in any direction, unless noted otherwise in the Contract Documents.

1.9. SUBMITTALS

- 1.9.1. Shop Drawings for Formwork, Falsework, and Reshoring
- 1.9.1.1. The structural Drawings shall not be reproduced, in whole or in part, for use as shop drawings.
- 1.9.1.2. Provide adequate space on all shop drawings immediately above the drawing title block for the Consultant's Shop Drawing review stamp. Where requested by the Consultant, the stamp is to be inserted by this section directly into the shop drawing prior to submission. The stamp shall be positioned in the same location on each shop drawing, and in no case shall the allocated space be less than 63 mm x 75 mm. Request the details of these

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- requirements from the Consultant no less than 2 weeks before the commencement of shop drawings.
- 1.9.1.3. Well in advance of construction, submit to the Consultant shop drawings showing the complete design and detailing of the slab formwork, falsework, and reshoring systems stamped by a qualified professional engineer licensed by the authority having jurisdiction.
- 1.9.1.4. As a minimum, the shop drawings shall show the following:
- 1.9.1.4.1. All design assumptions including references to the relevant codes, standards and sets, design loads, assumed concrete placing rate and the like.
- 1.9.1.4.2. Layout of formwork panels and shores;
- 1.9.1.4.3. Formwork details related to stripping and reshoring;
- 1.9.1.4.4. Camber;
- 1.9.1.4.5. Sequence for installing reshores;
- 1.9.1.4.6. Stripping schedule;
- 1.9.1.4.7. Number of slabs reshored at any given time;
- 1.9.1.4.8. Method, sequence, and schedule of construction, materials, arrangement of joints, form ties, shores, liners and locations of temporary embedded parts in architectural form concrete elements; and
- 1.9.2. Construction Joints
- 1.9.2.1. Well in advance of construction, submit to the Consultant shop drawings showing the location of all horizontal and vertical construction joints in the structure. Drawings shall include plans, wall elevations and additional sections and details (as necessary) which clearly indicate the proposed location of the joints. Drawings shall include dimensions for all construction joints to reference grid lines and elevations.
- 1.9.2.2. Drawings shall include any specific provisions or requirements where the elements are noted to be poured monolithically on the Contract Documents.
- 1.9.3. Honeycombed Concrete
- 1.9.3.1. Submit a proposed method statement for the repair of honeycombed concrete, including a list of suitable products, for the following depths of honeycombing;
- 1.9.3.1.1. Less than 20 mm;
- 1.9.3.1.2. 20 mm to 60 mm; and
- 1.9.3.1.3. Greater than 60 mm.
- 1.9.4. Lift Drawings
- 1.9.4.1. Submit lift drawings of the structure showing, all cast-in or embedded items, openings, recesses and sleeving required by the Work of all Specification Sections, for the Consultant's review. Drawings shall be submitted a minimum of 30 days prior to the commencement of the reinforcement detailing of the area outlined on the lift drawings.
- 1.9.4.2. All embedded items, openings, sleeves and chases are not necessarily shown on the structural Drawings nor are their sizes or locations shown on the Drawings. Refer to architectural, mechanical and electrical Drawings and Specifications and the detailed shop drawings prepared for the Work of all Specification Sections for openings and sleeving requirements not shown, located and dimensioned on the structural Drawings.
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- 1.9.4.3. Openings, sleeves, chases embedded items and the like shall be fully dimensioned from grid lines in plan and floor levels in elevation. Information including sizes, dimensions, locations, elevations etc. shall be drawn to scale on a set of structural drawings.
 - 1.9.4.4. Openings and embedded items required for all aspects of the Work shall be shown and coordinated on a single set of lift drawings.
 - 1.9.4.5. Lift drawings are to be reviewed by the Contractor, prior to submission to the Consultant.
 - 1.9.4.6. The Contractor's review stamp shall be affixed to all lift drawings that are submitted for review.
 - 1.9.5. Bearing Assemblies
 - 1.9.5.1. Submit shop drawings and technical specifications for the bearing assemblies, neoprene bearing pads, and sliding movement joint bearing assemblies to the Consultant for review. Drawings shall bear the seal and signature of a qualified professional engineer licensed by the authority having jurisdiction.
 - 1.9.6. Underpinning Details
 - 1.9.6.1. Well in advance of construction, submit for the Consultant's review complete details of the design and installation of shoring and bracing prepared, sealed, and signed by a qualified professional engineer licensed in by the authority having jurisdiction.
 - 1.9.7. As-Built Drawings
 - 1.9.7.1. Mark on a complete set of final drawings any changes, additions or deletions that occur during construction as a result of the Contractor's Work, change orders, or for any other reason.
 - 1.9.7.2. For all shop drawings marked "Reviewed as Noted" or "Revise and Resubmit", update and submit a record set of these drawings at the completion of the structural Work. Ensure that these drawings reflect the changes and are coordinated with the final drawings noted above.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Formwork
 - 2.1.1.1. Formwork lumber: Conform to CAN/CSA O86 and CSA O325.
 - 2.1.1.2. Falsework materials: Conform to CSA S269.1.
 - 2.1.1.3. Sheathings for exposed surfaces: New, Douglas Fir plywood not less than 19 mm thick, concrete form grade, sanded one side, conforming to CSA O325.
 - 2.1.1.4. Preformed Steel Forms: Minimum 1.6 mm (16 gauge) matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
 - 2.1.1.5. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of the wet concrete mix until initial set.
 - 2.1.1.6. Corners: Chamfered as required architecturally, in maximum lengths possible.
 - 2.1.2. Sliding Bearings: as manufactured and supplied by Sorbtex (R.J Searce Assoc., Burlington), or by Goodco or an equivalent approved by the Consultant consisting of a bottom plate of Teflon bonded to an elastomer backing and a top plate of stainless steel bonded to a steel backing.
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- 2.1.3. Neoprene Bearing Pads: Molded or cut from a sheet of high-grade, neoprene synthetic rubber compound of durometer hardness indicated in the Contract Documents and conforming to AASHTO HB.
 - 2.1.4. Waterstops
 - 2.1.4.1. Construction and Control Joints: Provide polyvinyl Chloride (PVC) waterstop Type 7 (internal type) or Base Seal Type 61 (external type) as manufactured by CPD Construction Products or an equivalent approved by the Consultant.
 - 2.1.4.1.1. Construction Joints: Provide polyvinyl Chloride (PVC) waterstop Type GSK580 (internal type) as manufactured by Sika or Base Seal Type GSK776 (external type) as manufactured by Sika or an active bentonite/butyl-rubber based waterstop Type RX-101 by Cetco or an equivalent approved by the Consultant.
 - 2.1.4.1.2. Control Joints: Provide polyvinyl Chloride (PVC) waterstop Type 5 (internal type) as manufactured by CPD Construction Products or polyvinyl Chloride (PVC) waterstop Base Seal Type GSK923 (external type) as manufactured by Sika or an equivalent approved by the Consultant.
 - 2.1.4.2. Construction and Control Joints: Provide bentonite waterstop RX-101 as manufactured by ETCO.
 - 2.1.4.3. Movement Joints: Provide polyvinyl Chloride (PVC) waterstop Type 7C (internal type) or Baseal Type 62 (external type) as manufactured by CPD Construction Products or an equivalent approved by the Consultant.
 - 2.1.5. Movement Joint Filler: Asphalt Fiber Movement Joint Filler by CPD Construction Products or approved equivalent.
 - 2.1.6. Dovetail anchor slots: Minimum 0.8 mm (22 gauge) galvanized steel with insulation filled slots.
 - 2.1.7. Flashing Reglets: Minimum 0.8 mm (22 gauge) thick galvanized steel with alignment splines for joints.
 - 2.1.8. Form Spacers: (Stay-in-place form spacers exposed to weather, earth, or moisture shall not be made of wood, and shall be corrosion and decay resistant.)

PART 3 - EXECUTION

3.1. PRE-CONSTRUCTION CONFERENCE

- 3.1.1. At least 60 days prior to the commencing of concrete construction, the Contractor shall hold a pre-construction meeting to review the requirements of the project.
 - 3.1.1.1. The Contractor shall ensure responsible representatives of every party that is involved in the concrete Work attend the conference, including but not limited to the following:
 - 3.1.1.1.1. The Contractor
 - 3.1.1.1.2. Subcontractor responsible for Concrete Forming
 - 3.1.1.1.3. Concrete Supplier
 - 3.1.1.1.4. Reinforcement Fabricator/Placer
 - 3.1.1.1.5. All Inspection and Testing Agencies
 - 3.1.1.1.6. Consultant
 - 3.1.1.1.7. The Owner's Representative

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- 3.1.1.2. Minutes of the meeting shall be recorded and distributed to all parties within 5 days of the meeting.

3.2. CONCRETE WORK AT EXISTING STRUCTURE

- 3.2.1. Prior to undertaking any Work in or adjacent to the existing structure, verify that conditions are as indicated on the Contract Documents. If they are not, do not proceed until the Consultant has given instructions.
- 3.2.2. Protect and support existing services that may interfere with Work in the existing structure.

3.3. EARTH FORMS

- 3.3.1. Earth forms are only permitted where shown on the Contract Documents.
- 3.3.2. Hand trim sides and bottom of earth forms. Remove loose soil and water prior to placing concrete.

3.4. FORMWORK

- 3.4.1. General
- 3.4.1.1. Erect, support, brace, and maintain formwork to safely support vertical and lateral loads until they can be supported by the structure.
- 3.4.1.2. All falsework erection shall be supervised by the professional engineer responsible for its design.
- 3.4.1.3. All formwork shall be inspected by the Contractor and the professional engineer responsible for its design, prior to the concrete pour to ensure that they have been erected in conformance with the formwork shop drawings.
- 3.4.1.4. Align joints in formwork and make water-tight. Keep form joints to a minimum.
- 3.4.1.5. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing prior to concreting.
- 3.4.2. Construction
- 3.4.2.1. Form footing sides unless footings are shown to be placed against undisturbed soil or rock in the Contract Documents or unless excavation is left with vertical sides against which the concrete can be directly cast.
- 3.4.2.2. Mark building, grid or other lines on forms to permit the accurate positioning of dowels into concrete elements above and all other reinforcing steel.
- 3.4.2.3. Construct templates and supports to rigidly fix reinforcing dowels in the forms prior to concreting.
- 3.4.2.4. Set anchor rods, templates, steel connection units, hardware, and/or other inserts into the forms and secure them rigidly so that they do not become displaced during concreting.
- 3.4.2.5. Where concrete is poured against structural steel beams causing unbalanced horizontal pressures, provide sufficient horizontal support to resist such pressures and to prevent deflection of the steel beams.
- 3.4.2.6. Application of Form Release Agent
- 3.4.2.6.1. Apply form release agent in accordance with the manufacturer's recommendations.
- 3.4.2.6.2. Apply prior to placement of reinforcement, anchoring devices, and embedded items.

3.4.2.6.3. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings, which are affected by the agent. Soak inside surface of untreated forms with clean water and keep surfaces covered prior to placement of concrete

3.4.3. Sleeves, Recesses and Formed Openings

3.4.3.1. Form sleeves, recesses and openings in accordance with reviewed sleeving drawings, except where such items are specified to be formed or sleeved by the appropriate Section in the Contract Documents.

3.4.3.2. No sleeves, recesses, or openings through structural members shall be formed without the Consultant's approval.

3.4.3.3. During cold weather, protect members from damage due to water freezing in confined areas, recesses, sleeves or formed 'openings'.

3.5. STRIPPING OF FORMS AND RESHORING

3.5.1. Where forms are stripped from horizontal or sloping members including sloped columns before concrete has reached its specified strength, reshore the members so that they can safely support their own load plus construction loads. In addition, ensure that the stripped member is of sufficient strength to safely carry its own weight over the area stripped out at any instant, together with any superimposed construction loads.

3.5.1.1. Install reshores so that they are supported on members which can safely support the reshore load.

3.5.1.2. As a guide, under the curing conditions specified in the Contract Documents, 70% of the 28 day strength should be attained 7 days after concreting in normal weather and 14 days after concreting in "Cold Weather".

3.5.1.3. Base decision to strip forms upon satisfactory results of 7 day concrete cylinder tests and on Site curing conditions or on in situ tests.

3.5.1.4. Stripping and reshoring shall proceed simultaneously so as not to leave an area greater than 80 sqm unsupported by either formwork or reshoring at any instant. Install reshores tight to construction above and below so that they will not significantly shorten under load, but take care not to preload the construction below or raise the construction above by over-tightening.

3.5.1.5. Maintain reshoring or formwork in place for a minimum of 28 days or for such longer time as may be required to ensure that the concrete has reached its specified 28 day strength.

3.5.1.6. Side forms for vertical members may be stripped as soon as the concrete is sufficiently strong to stand unsupported and safely resist imposed loads.

3.5.1.7. Prior to pouring the concrete elements directly supported above, remove sonotube forms to such an extent to allow the Consultant to review the quality of any exposed column surface. Provide necessary protection to the exposed surfaces upon completion of review.

3.6. CONSTRUCTION JOINTS

3.6.1. Obtain approval from the Consultant for location and details of construction joints not shown on the Contract Documents.

3.7. MOVEMENT JOINTS

3.7.1. Construct movement joints at the locations indicated in the Documents and in accordance with the details shown in the Contract Documents.

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- 3.7.2. Construct clean movement joints free of foreign material, likely to impair the proper operation of the joint.
 - 3.7.3. Provide a non-extruding joint filler in movement joints for the full area between adjacent concrete members. Anchor the filler material to one of the adjacent members or between concrete members and adjacent members of other materials.
 - 3.7.4. Where shown in the Contract Documents, provide waterstops in movement joints.

3.8. WATERSTOPS

- 3.8.1. Install waterstops in accordance with the manufacturer's requirements, to provide continuous water seal. Do not distort or pierce waterstop. Do not displace reinforcement when installing waterstops. Tie waterstops rigidly in place.
- 3.8.2. Splice waterstops in accordance with the manufacturer's requirements.
- 3.8.3. Where waterstops are noted to be installed adjacent to existing Work, prepare existing surfaces to receive waterstop in accordance with manufacturer's recommendations.

3.9. WATER STORAGE TANKS (WATER TIGHT CONSTRUCTION)

- 3.9.1. Conform with the requirements of this Section and the following for the construction of the walls and base slabs of the water storage tanks.
- 3.9.2. Provide waterstops of the type specified in this Specification embedded in the concrete across joints as shown on the Drawings and fully continuous for the extent of the joint. Conform to printed instructions of manufacturer of the waterstop. Take suitable precautions and means to support and protect the waterstops during the progress of the Work and repair or replace any waterstop damage. Store waterstops in accordance with the manufacturer's requirements. Protect waterstops, once installed, in accordance with manufacturer's requirements.
- 3.9.3. Splice waterstops in accordance with the manufacturers printed recommendations.
- 3.9.4. Only butt joints only of the ends of two identical waterstop sections may be made while the material is in place in the forms.
- 3.9.5. Prior to placement in the forms, prefabricate all joints in waterstop involving more than 2 ends to be jointed together including flat L, T and X intersections, and all joints which involve an angle cut, alignment change, or the joining of two discontinuous waterstop sections allowing not less than 450 mm long strips of waterstop material beyond the joint. Upon being inspected and reviewed, install such prefabricated waterstop joint assemblies in the forms and butt weld the ends of the 450 mm strips to the straight run portions of waterstop in place in the forms.
- 3.9.6. Setting waterstops: In order to eliminate faulty installation that may result in joint leakage, take care in the correct positioning of the waterstops during installation. Support the waterstops during the progress of the Work to ensure the proper embedment in the concrete. Equally divide the symmetrical halves of the waterstops between the concrete pours at the joints. The centre axis of the waterstops shall coincide with the joint openings at the plane of installation of the waterstop. Ensure maximum density and imperviousness of the concrete by thoroughly working it in the vicinity of all joints.
- 3.9.7. Placement of concrete around waterstops: Take care in placing concrete around waterstops by careful working, routing, and vibrating to ensure that all air and rock pockets have been eliminated.
- 3.9.8. Inspect all field joints in waterstops for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the

material to water pressure at any point. Replace defective joints with material which will pass said inspection.

3.9.9. Remove faulty material from the Site.

3.9.10. The following defects represent a partial list of defects which shall be grounds for rejection:

3.9.10.1. Offsets at joints greater than 1 mm or 15 percent of material thickness at any joint, whichever is less.

3.9.10.2. Exterior crack at welded joint in outer surface due to incomplete bond, which is deeper than 1 mm or 15 percent of material thickness at any joint, whichever is less.

3.9.10.3. Any combination of offset or exterior crack which will result in a net reduction in the cross-section of the waterstop in excess of 1 mm or 15 percent of material thickness at any joint, whichever is less.

3.9.10.4. Misalignment of joint which results in a longitudinal misalignment of the waterstop in excess of 12 mm in 3 m.

3.9.10.5. Porosity in the welded joint as evidenced by visual inspection.

3.9.10.6. Bubbles or inadequate bonding which can be detected with a pen-knife test. (If, while prodding the entire joint on each side with the point of a pen-knife, the knife breaks through the outer portions of the weld into a bubble, the joint shall be considered defective).

3.9.10.7. Nail holes in the middle $\frac{2}{3}$ of the waterstop material.

3.9.10.8. Dirt, oil, grease, paint or other foreign material on the waterstop.

3.10. BEARING ASSEMBLIES, NEOPRENE BEARING PADS, AND SLIDING MOVEMENT JOINT BEARINGS.

3.10.1. Remove laitance from the top surface of the bearing ledge and finish with a steel trowel to a dense level surface, to the elevations shown in the Contract Documents.

3.10.2. Place the bearings in the location required, ensure that they are solidly bedded on the ledge, are set level, and are secured in position.

3.11. QUALITY CONTROL

3.11.1. Implement a system of quality control to ensure that the minimum standards specified in the Contract Documents are attained.

3.11.2. Bring to the attention of the Consultant any defects in the Work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.

3.11.3. The Consultant's general review during construction and inspection and testing by independent inspection and testing companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of its contractual responsibility.

3.11.4. Notification

3.11.5. Prior to commencing significant segments of the Work, give the Consultant and independent inspection and testing companies appropriate notification so as to afford them reasonable opportunity to review the Work. Failure to meet this requirement may be cause for the Consultant to classify the Work as defective.

3.12. INSPECTION AND TESTING

- 3.12.1. The Owner or Consultant will appoint an independent inspection and testing companies to make inspections or perform tests as the Consultant directs. The independent inspection and testing companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct.

3.13. DEFECTIVE MATERIALS AND WORK

- 3.13.1. Where evidence exists that defective Work has occurred or that Work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength, made and the like, in order to help determine whether the Work must be corrected or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the Work may be acceptable.
- 3.13.2. All testing shall be conducted in accordance with the requirements of the Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- 3.13.3. Materials or Work which fail to meet the requirements Specified in the Contract Documents may be rejected by the Consultant whenever found at any time prior to the Total Performance of the Work regardless of previous inspection. If rejected, defective materials or Work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 03 10 00

**SECTION 03 20 00
CONCRETE REINFORCEMENT**

| SPECIFICATION REVISION LOG | | |
|----------------------------|------------|-------------------|
| REVISION NUMBER | DATE | ISSUED FOR |
| 01 | 2024-10-04 | PROGRESS ISSUANCE |
| 02 | 2024-11-01 | PROGRESS ISSUANCE |
| 03 | 2024-11-15 | BUILDING PERMIT |
| 04 | 2025-01-31 | ISSUED FOR BID |
| | | |
| | | |
| | | |
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PART 1 - GENERAL

1.1. DEFINITIONS

- 1.1.1. The following Definitions shall apply in this Specification
- 1.1.2. Contract Documents
- 1.1.2.1. The Contract Documents consist of the Drawings, Specifications and Reports which form part of the agreed Contract.
- 1.1.3. Consultant
- 1.1.3.1. The Consultant is the Architect, SER, persons or entities engaged by the Owner. The term Consultant means the Consultant or the Consultant's authorized representative.
- 1.1.4. Contractor
- 1.1.4.1. The term Contractor is defined to include any of the following: Construction Manager, General Contractor, Structural Steel Erector, Structural Steel Fabricator, Subcontractor or Supplier.
- 1.1.5. Owner
- 1.1.5.1. The Owner is the person or entity identified as such in the Contract. The term Owner means the Owner or the Owner's authorized agent or representative, but does not include the Consultant.

1.2. WORK INCLUDED

- 1.2.1. Comply with Division 1 - General Requirements and all documents referred to therein.
- 1.2.2. Provide all labour, materials, plant and equipment to complete the steel reinforcement Work indicated in the Contract Documents and specified in this Section.

1.3. SECTION INCLUDESS

- 1.3.1. This Section includes: Concrete reinforcing, masonry walls, mechanical splices, and submittals.

1.4. RELATED WORK SPECIFIED ELSEWHERE

- 1.4.1. Section 04 04 15 - Masonry Anchorage and Reinforcement: Reinforcement for masonry.

1.5. REFERENCE STANDARDS, CODES, AND ACTS

- 1.5.1. Conform to the requirements of the local building code identified on the Structural General Notes as amended by all subsequent Regulations issued to the date of this Specification and applicable acts of authorities having jurisdiction.
- 1.5.2. All references to the Standards and publications noted below shall be to the edition referenced in the local building code identified on the Structural General Notes, or to the edition referenced in the latest published editions or revisions of all Standards published by the Canadian Standards Association issued to the date of this Specification, whichever is the later edition or revision.
- 1.5.3. All references noted below, which are not referenced by the local building code or the Standards published by the Canadian Standards Association, shall be to the latest edition and revision published to the date of this Specification.
- 1.5.4. Standards and publications referenced by the Standards noted below are to apply even if they are not included in the list. Where such reference is made, it shall be to that latest edition and revision published to the date of this Specification.
- 1.5.5. Where there are differences between the Contract Documents and the codes, standards, or acts, the most stringent shall govern.
- 1.5.6. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- 1.5.7. CSA A23.1/A23.2 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
- 1.5.8. CSA A23.3 - Design of Concrete Structures.
- 1.5.9. CSA G30.18 - Carbon Steel Bars for Concrete Reinforcement.
- 1.5.10. CSA S304 - Design of Masonry Structures.
- 1.5.11. CSA S413 - Parking Structures.
- 1.5.12. CSA W186 - Welding of Reinforcing Bars in Reinforced Concrete Construction.
- 1.5.13. RSIC Manual of Standard Practice - Manual of Standard Practice.

1.6. QUALIFICATIONS

- 1.6.1. The Contractor shall ensure that those responsible for welding reinforcement shall be certified by the Canadian Welding Bureau under the requirements of CSA W186.

1.7. SUBMITTALS

- 1.7.1. Shop Drawings for Reinforcement
- 1.7.1.1. The structural Drawings shall not be reproduced, in whole or in part, for use as shop drawings.
- 1.7.1.2. Prepare reinforcement shop drawings and bar lists taking into account all openings and recesses shown on the architectural, structural, mechanical and electrical Drawings, and on the sleeving shop drawings prepared by all other Sections.
- 1.7.1.3. Prepare shop drawings to a minimum scale of 1:50 or larger as deemed necessary by the Contractor. Shop drawings shall be clear and complete and shall allow placement of reinforcement without reference to the Contract Documents.
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- 1.7.1.4. Provide adequate space on all shop drawings immediately above the drawings title block for the Consultant's shop drawing review stamp. Where requested by the Consultant, the stamp is to be inserted by this section directly into the shop drawing prior to submission. The stamp shall be positioned in the same location on each shop drawing, and in no case shall the allocated space be less than 63 mm x 75 mm. Request the details of these requirements from the Consultant no less than 2 weeks before the commencement of shop drawings.
- 1.7.1.5. Detail concrete reinforcement in accordance with the Contract Documents, CSA A23.1/A23.2, and detailing standards in RSIC Manual of Standard Practice.
- 1.7.1.6. Detail reinforcement for masonry in accordance with the Contract Documents, CSA A23.1/A23.2, CSA S304, and detailing standards in RSIC Manual of Standard Practice.
- 1.7.1.7. Where applicable detail reinforcement in accordance with CSA S413.
- 1.7.1.8. As a minimum, the shop drawings shall show the following:
- 1.7.1.8.1. Bar sizes, spacing, lap lengths, location and quantities of reinforcement and welded wire fabric.
- 1.7.1.8.2. Mechanical splices.
- 1.7.1.8.3. Bar spacing requirements and provisions for spacers where required.
- 1.7.1.8.4. Locations where reinforcement is considered to be bundled, as defined by CSA A23.1/A23.2.
- 1.7.1.8.5. Identification of each bar with a code mark corresponding to the bar lists.
- 1.7.1.8.6. Detail sections to fully illustrate placement of concrete reinforcement at areas such as openings, change of levels, spandrel elements, stairs, and wherever else required.
- 1.7.1.8.7. Large scale detail concrete sections at areas of steel concentrations such as at intersections of beams and columns, column splices, and wherever else required.
- 1.7.1.8.8. Placing sequence for areas with multiple layers of reinforcement.
- 1.7.1.8.9. Minimum clearances between reinforcement and minimum concrete cover.
- 1.7.1.8.10. Location, number and type of support accessories, including support bars suitably sized and spaced to rigidly support the weight of reinforcement and imposed loads during construction. Where 10M top bars and welded wire fabric are shown in the Contract Documents, provide adequate supports to ensure that these bars are not bent or displaced prior to or during the concreting operation.
- 1.7.1.8.11. Location and embedment of dowels.
- 1.7.1.8.12. Location of joint reinforcement in masonry walls.
- 1.7.1.8.13. Large-scale detail masonry sections at areas of steel concentrations such as at intersections of walls, beams, and pilasters and wherever else required.
- 1.7.1.8.14. Detail sections to fully illustrate placement of masonry reinforcement at areas such as openings, at support of precast slabs, masonry beams and lintels, and wherever else required.
- 1.7.1.9. Provide dowels for reinforced masonry walls (load bearing or non load bearing) from slabs and walls. Coordinate location of walls with architectural Drawings.
- 1.7.1.10. Submit code marks or symbols used on reinforcement of each manufacturer so that the Consultant may identify grades and sizes of reinforcement.
- 1.7.2. Certificates
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- 1.7.2.1. Reinforcement from Canadian Manufacture: Provide the Consultant with a certified copy of the mill test reports for reinforcing steel showing physical and chemical analysis. For weldable reinforcement, include verification of its weldability. Reports to be submitted a minimum of 4 weeks prior to commencing fabrication.
- 1.7.3. As-Built Drawings
- 1.7.4. Mark on a complete set of final drawings any changes, additions, or deletions that occur during construction as a result of the Contractor's Work, change orders, or for any other reason.
- 1.7.5. For all shop drawings marked "Reviewed as Noted" or "Revise and Resubmit", update and submit a record set of these drawings at the completion of the structural Work. Ensure that these drawings reflect the changes and are coordinated with the final drawings noted above.

1.8. TOLERANCES

- 1.8.1. Perform fabrication and setting so that completed Work will be within the tolerances set out in CSA A23.1/A23.2 .
- 1.8.2. These tolerances are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.

PART 2 - MATERIALS

2.1. REINFORCEMENT

- 2.1.1. Reinforcing Steel, Deformed: Canadian manufacture to CSA G30.18, billet steel, Grade 400W, weldable and regular bars. Finish types: unfinished.
- 2.1.2. Welded Steel Wire Reinforcement, Plain: ASTM A185, in flat sheets. Finish types: unfinished.

2.2. MECHANICAL SPLICES

- 2.2.1. Mechanical Tension Splices: Type 2 mechanical splices, per CSA A23.3, LENTON COUPLERS, complete with bar end protectors and coupler end protectors, as supplied by Erico Canada Inc or an equivalent approved by the Consultant.
- 2.2.2. Mechanical Compression Splices: BAR-LOCK mechanical coupler system manufactured by Dayton/Richmond Concrete Accessories or an equivalent approved by the Consultant.

2.3. ACCESSORIES

- 2.3.1. Minimum gauge as required for support of stability of steel reinforcement during reinforcement placement and concreting operation.
- 2.3.2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapour barrier puncture.
- 2.3.3. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size, and shape as required.
- 2.3.4. Special Bar Supports for Reinforced Concrete Cast Against Soil/Rock: Use precast concrete supports for exposed concrete beams and soffits and concrete cast against soil/rock. Precast concrete supports shall be made of concrete quality, class and strength at least equal to that specified in the Contract Documents for the member in which they are used.

PART 3 - EXECUTION

3.1. FABRICATION

- 3.1.1. Fabricate reinforcement in accordance with:
 - 3.1.1.1. CSA A23.1/A23.2.
 - 3.1.1.2. RSIC Manual of Standard Practice.
 - 3.1.1.3. CSA W186 for welded reinforcement.
- 3.1.2. Locate reinforcement splices not indicated on the Drawings, at point of minimum stress. Review location of splices with the Consultant. Stagger splices to minimize cross sectional area at any one point in beams and walls.
- 3.1.3. Unless noted otherwise in the Contract Documents, bend reinforcement once only and at room temperature of 18°C, do not straighten or rebend reinforcement and do not field bend reinforcement. Do not use bars with kinks or bends not shown on the Drawings. Replace bars which develop cracks or splits.

3.2. PLACEMENT

- 3.2.1. Prior to placing concrete, place support and secure reinforcement against displacement to CSA A23.1/A23.2 and as indicated on reviewed placing drawings.
- 3.2.2. Do not displace or damage vapour barrier during reinforcement placement.
- 3.2.3. Accommodate placement of formed openings.
- 3.2.4. Maintain concrete cover as noted on the Contract Documents.
- 3.2.5. Provide splices only where shown on the Contract Documents or reviewed shop drawings. No other splices will be permitted without approval of the Consultant.
- 3.2.6. Lap ends and sides of welded wire fabric as noted on the Drawings, but in no case less than 300 mm.
- 3.2.7. Additional Requirements for Mechanical Splicing of Reinforcement
 - 3.2.7.1. Tension Splices
 - 3.2.7.1.1. Unless noted otherwise in the Contract Documents, mechanical tension splices shall develop 120% of the specified yield strength, but not less than 110% of the actual yield strength, of the reinforcement being spliced or of the smaller bar if the bars spliced are of different sizes.
 - 3.2.7.1.2. In each concrete member, unless otherwise indicated in the Contract Documents, mechanical tension splices in adjacent bars shall be staggered by at least 750 mm
 - 3.2.7.2. Compression Splices
 - 3.2.7.2.1. Non End-Bearing Mechanical Splices
 - 3.2.7.2.1.1. Unless noted otherwise in the Contract Documents, mechanical compression splices shall develop 120% of the specified tensile yield strength, but not less than 110% of the actual tensile yield strength of the reinforcement being spliced or of the smaller bar, if the bars spliced are of different sizes.
 - 3.2.7.2.1.2. In each concrete member, stagger splices of adjacent bars by at least 750 mm.
 - 3.2.7.2.2. End-Bearing Splices

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- 3.2.7.2.2.1. End bearing splices shall develop the ultimate compressive strength of the reinforcing bars spliced.
 - 3.2.7.2.2.2. Accurately saw cut the end bearing surfaces of all bars to be spliced 90 degrees to the axis of the bar with a tolerance of 1.5 degrees.
 - 3.2.7.2.2.3. In setting the bars, rotate until the angle between bearing surfaces is at a minimum, but not more than 3 degrees of full bearing.
 - 3.2.7.2.2.4. In each concrete member, stagger splices in adjacent bars by 750 mm but not less than 20 bar diameters.

3.3. QUALITY CONTROL

- 3.3.1. Provide a system of quality control to ensure that the minimum standards specified in the Contract Documents are attained.
- 3.3.2. Bring to the attention of the Consultant any defects in the Work or departures from the Contract Documents which may occur during Construction. The Consultant will decide upon corrective action and give recommendations in writing.
- 3.3.3. The Consultant's general review during construction and inspection and testing by the independent inspection and testing companies are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of its contractual responsibilities with respect to quality control.
- 3.3.4. Prior to commencing significant segments of the Work, give the Consultant and independent inspection and testing companies appropriate notification so as to afford them reasonable opportunity to review the Work. Failure to meet this requirement may be cause for the Consultant to classify the Work as defective.

3.4. INSPECTION AND TESTING

- 3.4.1. The Owner or Consultant will appoint the independent inspection and testing companies to make inspections or perform tests as the Consultant directs. The independent inspection and testing companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct.
- 3.4.2. When defects are revealed, the Consultant may request, at the Contractor's expense, additional inspection or testing to ascertain the full extent of the defect.
- 3.4.3. Tests of reinforcing steel by independent inspection and testing companies.
 - 3.4.3.1. A series of specimens for each grade and size of reinforcing steel contained in any 100 tonnes for concrete reinforcement and 10 tonnes for masonry reinforcement may be tested. A series of tests will include two bars for each test required of each size and grade of steel used. Reinforcing steel tests will be made in accordance with CSA Standards G30 Series.
 - 3.4.3.2. Nondestructive tests may be made on welded reinforcement.
 - 3.4.3.3. Tension tests to destruction may be performed on approximately 5% of mechanical splices.

3.5. DEFECTIVE MATERIALS AND WORK

- 3.5.1. Where evidence exists that defective Work exists or that Work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength made, and the like, in order to help determine whether the Work must be replaced. Tests, inspections or surveys or

calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the Work may be acceptable.

3.5.2. All testing shall be conducted in accordance with the requirements of the Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.

3.5.3. Materials or Work which fails to meet the requirements specified in the Contract Documents may be rejected by the Consultant whenever found at any time prior to the Total Performance of the Work regardless of previous inspection. If rejected, defective materials or Work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 03 20 00

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE**

| SPECIFICATION REVISION LOG | | |
|----------------------------|------------|-------------------|
| REVISION NUMBER | DATE | ISSUED FOR |
| 01 | 2024-10-04 | PROGRESS ISSUANCE |
| 02 | 2024-11-01 | PROGRESS ISSUANCE |
| 03 | 2024-11-15 | BUILDING PERMIT |
| 04 | 2025-01-31 | ISSUED FOR BID |
| | | |
| | | |
| | | |
| | | |

PART 1 - GENERAL

1.1. DEFINITIONS

1.1.1. The following Definitions shall apply in this Specification:

1.1.2. Contract Documents

1.1.2.1. The Contract Documents consist of the Drawings, Specifications and Reports which form part of the agreed Contract.

1.1.3. Consultant

1.1.3.1. The Consultant is the Architect, SER, persons or entities engaged by the Owner. The term Consultant means the Consultant or the Consultant's authorized representative.

1.1.4. Contractor

1.1.4.1. The term Contractor is defined to include any of the following: Construction Manager, General Contractor, Structural Steel Erector, Structural Steel Fabricator, Subcontractor or Supplier.

1.1.5. Owner

1.1.5.1. The Owner is the person or entity identified as such in the Contract. The term Owner means the Owner or the Owner's authorized agent or representative but does not include the Consultant.

1.2. WORK INCLUDED

1.2.1. Comply with Division 1 - General Requirements and all documents referred to therein.

1.2.2. Provide all labour, materials, plant and equipment to complete the cast-in-place concrete Work indicated on the Drawings and specified in this Section.

1.3. SECTION INCLUDES

1.3.1. This Section includes cast-in-place concrete, including: lightweight concrete, toppings, HVSCM concrete, concrete mix design requirements, and qualification requirements.

1.4. RELATED WORK SPECIFIED ELSEWHERE

- 1.4.1. Section 03 10 00 - Concrete Forming: Forms and accessories for formwork.
- 1.4.2. Section 03 20 00 - Concrete Reinforcement
- 1.4.3. Section 05 12 00 - Structural Steel.
- 1.4.4. Section 31 23 00 - Excavation and Fill:
 - 1.4.4.1. Backfilling below base course, beneath slabs, and behind walls.
 - 1.4.4.2. Fill under slab-on-grade including moisture barrier.
- 1.4.5. Section 04 20 00 - Engineered Masonry: Grouting beneath base plates bearing on masonry.

1.5. REFERENCE STANDARDS, CODES, AND ACTS

- 1.5.1. Conform to the requirements of the local building code identified on the Structural General Notes as amended by all subsequent Regulations issued to the date of this Specification and applicable acts of authorities having jurisdiction.
- 1.5.2. All references to the Standards and publications noted below shall be to the edition referenced in the local building code identified on the Structural General Notes, or to the edition referenced in the latest published editions or revisions of all Standards published by the Canadian Standards Association issued to the date of this Specification, whichever is the later edition or revision.
- 1.5.3. All references noted below, which are not referenced by the local building code or the Standards published by the Canadian Standards Association, shall be to the latest edition and revision published to the date of this Specification.
- 1.5.4. Standards and publications referenced by the Standards noted below are to apply even if they are not included in the list. Where such reference is made, it shall be to that latest edition and revision published to the date of this Specification.
- 1.5.5. Where there are differences between the Specifications and Drawings and the codes, standards or acts, the most stringent shall govern.
- 1.5.6. ACI 228.1 - In-Place Methods to Estimate Concrete Strength.
- 1.5.7. ASTM C900 - Standard Test Method for Pullout Strength of Hardened Concrete.
- 1.5.8. ASTM C1202 - Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
- 1.5.9. CSA A23.1/A23.2 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
- 1.5.10. CSA A3000 - Cementitious Materials Compendium.
- 1.5.11. CSA A3001 - Cementitious Materials for use in Concrete.
- 1.5.12. ISO 228-1 - Pipe threads where pressure-tight joints are not made on the threads -- Part 1: Dimensions, tolerances and designation.

1.6. TOLERANCES

- 1.6.1. Perform placing operations so that completed Work will be within the tolerances set out in CSA A23.1 and as listed below.
- 1.6.2. Variations in building lines which result in extension of the building over lot lines or restriction lines will not be permitted.

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- 1.6.3. These tolerances are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.

1.7. QUALIFICATIONS

- 1.7.1. The 'foreperson' or 'lead hand' supervising the placement, consolidation, finishing and curing of the concrete shall be certified under an industry recognized concrete finishing program, such as the ACI Concrete Flatwork Finisher/Technician Certification Program.
- 1.7.2. The concrete supplier shall be certified by Concrete Ontario and shall hold a current "Certificate of Ready Mixed (or Mobile Mix) Concrete Production Facilities" as issued by Concrete Ontario.
- 1.7.3. Where concrete toppings are specified in the Contract Documents, the Contractor shall ensure that the concrete flooring contractor assumes responsibility for all aspects of the topping construction. This will include, but is not limited to the base course or substrate preparation, review of concrete mix design, concrete supply, bonding agents, placing, finishing and curing etc.

1.8. CONCRETE MIX DESIGN

- 1.8.1. Design of Concrete Mixes
- 1.8.1.1. Concrete mixes are to be designed in accordance with the Performance Alternative outlined in CSA A23.1/A23.2. The mixes shall be designed such that they will be homogeneous, uniformly workable, readily placeable into corners and angles of forms and around reinforcement by the methods of placing and consolidation employed on the Work, but without permitting materials to segregate or without permitting excessive free water to collect on the surface. The concrete, when hardened, shall have the qualities specified in the Contract Documents and in the concrete mix design.
- 1.8.1.2. When designing the concrete mixes, the Contractor shall ensure that the supplier is cognizant of the curing requirements outlined in the Contract Documents and CSA A23.1/A23.2. If a particular concrete mix requires curing in addition to that specified, the Contractor shall be responsible for providing this additional curing.
- 1.8.1.3. Specified Strength: As called for on Drawings. Where walls are integral with columns of different specified strengths, cast walls and columns with concrete of the higher specified strength.
- 1.8.1.4. Modulus of Elasticity (E): For each concrete mix design, the Modulus of Elasticity, shall not to be less than $(3,300(f'c)^{0.5} + 6,900) \times (Yc/2,300)^{1.5}$ MPa.
- 1.8.1.5. Fly Ash: The use of fly ash in concrete that will be exposed to view or in concrete that will be exposed to freeze-thaw cycles or de-icing chemicals is subject to review and acceptance by the Consultant.
- 1.8.1.6. Use of calcium chloride shall not be permitted.
- 1.8.1.7. The Contractor shall coordinate the mix designs for suitability with concrete pumping.
- 1.8.1.8. The Contractor shall design concrete mixes so they maintain their workability based on assumed minimum discharge and placing rates.
- 1.8.2. Lightweight Concrete
- 1.8.2.1. Design mix to meet criteria given at point of discharge into forms and to comply with requirements of the Underwriters' Laboratories of Canada when lightweight concrete topping is used as fire rated hour separation.
- 1.8.2.2. Demonstrate the following by previous performance, and on Site tests:
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- 1.8.2.2.1. Segregation, loss of fines, moisture and the like, shall not occur during methods of conveying and placing to be employed on site.
 - 1.8.2.2.2. Concrete shall not break down or be otherwise adversely affected by high frequency vibration.
 - 1.8.2.2.3. Concrete shall be finishable with a machine steel trowel to a smooth hard surface suitable to receive resilient flooring.
 - 1.8.2.2.4. Design of concrete in conjunction with water content, placing, finishing, curing and protection to be used on Site shall be such as to minimize shrinkage.
 - 1.8.3. Toppings
 - 1.8.3.1. Design mix in accordance with requirements of Contract Documents and provisions of CSA A23.1/A23.2.

1.9. SAMPLES AND ASSISTANCE

- 1.9.1. Concrete Test Cylinders
- 1.9.1.1. Supply materials for concrete test cylinders, the cost of which shall be paid for by the Contractor.
- 1.9.1.2. Cooperate in the execution of the concrete quality testing program. Furnish concrete required, protect specimens against injury and loss, and assist in the sampling and storage of specimens, as required.
- 1.9.1.3. Sample concrete, cast cylinders and store in accordance with CSA A23.1/A23.2 where directed by the Consultant.
- 1.9.1.4. For all concrete compressive strength tests, 100 mm x 200 mm cylinders shall be used.
- 1.9.1.5. In accordance with requirements of CSA A23.1/A23.2, provide storage facilities with continuous power supply for a Site storage container for test cylinders.
- 1.9.1.6. Provide sufficient field curing storage facilities so that cylinders representing the various areas can be safely stored in locations representing the curing conditions for those areas. Move the field cured cylinder storage facilities from area to area as the Work progresses.
- 1.9.2. Pullout Tests
- 1.9.2.1. If requested by the Consultant, install pullouts to the requirements of the inspection and testing company.
- 1.9.2.2. Installation of pullouts shall comply with the requirements of ASTM C900 and ACI 228.1.
- 1.9.3. Maturity Tests
- 1.9.3.1. If pull-out tests are required, maturity meters shall be used to determine when pullout tests can be made.
- 1.9.3.2. Installation, equipment and procedures shall comply with ACI 228.1.
- 1.9.4. Substrate (Soil/Rock) Inspection
- 1.9.4.1. Assist the geotechnical Consultant in making their inspections or tests.

1.10. SUBMITTALS

- 1.10.1. Surveys
 - 1.10.1.1. Submit surveys in accordance with Section 03 10 00 - Concrete Forming.
 - 1.10.2. Certificates
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- 1.10.2.1. The Contractor shall ensure that the concrete supplier submits a current "Certificate of Ready Mixed (or Mobile Mix) Concrete Production Facilities," as issued by Concrete Ontario.
 - 1.10.2.2. Prior to beginning Work and when any change in materials or source of supply is proposed, provide the following certificates prepared by an independent inspection company;
 - 1.10.2.2.1. Certification that all raw materials used in the production of concrete proposed for the Work comply with the requirements of the Specifications and CSA A23.1/A23.2.
 - 1.10.2.2.2. Certification that compressive strength, slump, entrained air content, and other specified properties will be met, using the proposed mixes.
 - 1.10.2.2.3. Certification that classes of exposure C-1, A-1 and C-XL will meet the 56-day limits specified in CSA A23.1 for the rapid chloride permeability test, using the proposed mixes.
 - 1.10.2.2.4. Certification that the chloride ion content in the concrete, before exposure, shall not exceed 0.06% by mass of the cementing materials.
 - 1.10.2.3. The Contractor shall ensure that the concrete supplier submits representative chloride permeability test data distributed over a period of 56 days for concrete exposure classes C-1, A-1 and C-XL with and without calcium nitrite corrosion inhibitor or any other admixture containing ionic salts.
 - 1.10.2.4. The Contractor shall ensure that the concrete supplier submits their most current "Concrete Mix Design Statistical Analysis" records for the proposed concrete plant. These records shall indicate the concrete supplier's average strength, standard deviation, coefficient of variation and target strength, as per the requirements of CSA A23.1 and Concrete Ontario.
 - 1.10.3. Concrete Mix Designs
 - 1.10.3.1. Well in advance of the supply of concrete to the project submit, using the standard Concrete Ontario form for Concrete Mix Design Submissions, all concrete mix designs for review. The mix designs shall include, as a minimum the following information:
 - 1.10.3.1.1. Concrete strength;
 - 1.10.3.1.2. Exposure class;
 - 1.10.3.1.3. Water-cement ratio;
 - 1.10.3.1.4. Maximum aggregate size;
 - 1.10.3.1.5. Maximum Supplementary Cementing Materials (SCM) replacement;
 - 1.10.3.1.6. Additional durability and architectural requirements;
 - 1.10.3.1.7. Slump range;
 - 1.10.3.1.8. Plastic air range;
 - 1.10.3.1.9. Method of placement;
 - 1.10.3.1.10. Dosage of corrosion inhibitor;
 - 1.10.3.1.11. Class of HVSCM (1 or 2);
 - 1.10.3.1.12. Other specific information regarding the source and type of all materials being proposed;
 - 1.10.3.1.13. Assumed minimum discharge and placing rates.
 - 1.10.3.2. Describe in detail on the mix design summary, the location(s) where each mix is to be placed in the structure.
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- 1.10.4. Concrete Quality Plan
 - 1.10.4.1. At least four weeks prior to the supply of concrete to the project, submit a complete "Concrete Quality Plan", in the format provided by Concrete Ontario.
 - 1.10.5. HVSCM Concrete
 - 1.10.5.1. For concrete with HVSCM such as fly-ash, slag and silica fume, submit documentation providing the actual reduction of Portland cement from the base mix to the actual HVSCM mix for all concrete – see below for further information. The Contractor shall ensure that the information shall be submitted in a letter signed by the concrete supplier/manufacturer or professional engineer acting on their behalf.
 - 1.10.5.1.1. The reduction in Portland cement from Base Mix to Actual SCM Mix (as a percentage of Base Mix), where Base Mix is defined below. This can be submitted as a total reduction of Portland cement for all the concrete mixes used on the project.
 - 1.10.5.1.2. Portland cement content of Base Mix (kg/cub. m) = Design strength values in MPa at 28 days x K
where K = 10 for non-air-entrained concrete, or K = 12.5 for air-entrained concrete.
 - 1.10.5.1.3. Portland cement reduction = (Portland cement content of Base Mix – Portland cement content of Actual SCM Mix) / Portland cement content of Base Mix.
 - 1.10.5.2. Submit documentation of where the concrete constituents were extracted, processed and manufactured. State method of transportation (rail, water or road).
 - 1.10.6. Curing Procedures
 - 1.10.6.1. At least four weeks prior to implementation in the field, submit a detailed description of the procedures which will be employed to cure the structure.
 - 1.10.6.2. As a minimum, the procedures shall indicate:
 - 1.10.6.2.1. The method for protecting the concrete from evaporation of surface moisture from the fresh concrete;
 - 1.10.6.2.2. The type of curing method to be used;
 - 1.10.6.2.3. Details of how various surfaces will be cured (slabs, walls, columns, ramps etc.)
 - 1.10.6.2.4. How the surface will be kept moist, and the quality control requirements for keeping the surface moist;
 - 1.10.6.2.5. The time of initiation and duration of curing;
 - 1.10.6.2.6. Provisions to address potential problems such as high winds and hot and cold weather;
 - 1.10.6.2.7. The limitations of access, if any, to the surfaces being cured; and
 - 1.10.6.2.8. A Quality assurance/Quality control program detailing how the curing program will be implemented, monitored and documented.
 - 1.10.6.3. Submit a 300 mm x 300 mm sample of each type of material (absorptive mat, fabric, plastic film, waterproof paper etc.) which will be used to cure the concrete.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Concrete: Normal density concrete with an air-dry density between 2350 and 2450 kg/cub. m. Conform to CSA A23.1.
 - 2.1.2. Cement Type: GU General Use Portland Cement.
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- 2.1.3. Supplementary Cementing Materials: Conform to CSA A3001 Fly Ash, Type F, CI, CH, Ground Blast Furnace Slag, Type S, and Silica Fume, Type SF.
 - 2.1.4. Water: Clean, potable and not detrimental to concrete.
 - 2.1.5. Nominal Size of Coarse Aggregate: 20 mm, except as noted below.
 - 2.1.5.1. Use pea gravel (5 mm to 10 mm) where concentration of reinforcement requires the use of a smaller diameter aggregate.
 - 2.1.5.2. Use 10 mm (maximum) aggregate in toppings that are less than or equal to 75 mm in thickness, and 20 mm aggregate in toppings greater than 75 mm in thickness.
 - 2.1.6. Admixtures: Conform to CSA A23.1.
 - 2.1.6.1. Corrosion Inhibitor Admixture: Calcium nitrite based corrosion inhibitor, such as "DCI" or "DCI(S)" by W.R. Grace & Co. (or approved equivalent), shall be added at the rate of 10.1 litres per cubic metre of concrete, to all concrete designated Exposure Class 'C-1', unless noted otherwise in the Contract Documents. The corrosion inhibitor shall contain 30 ± 3 percent of calcium nitrite by weight. The selection of "DCI" or "DCI(S)" (or approved equivalent) shall be as directed by the admixture supplier, based on anticipated placing and curing conditions and the specific concrete mix design selected.
 - 2.1.7. Shrinkage Control Fibres: "Dramix" steel fibres by Bekaert or approved equivalent, 60/1.05.
 - 2.1.8. Bonding Agent: Use Sika Sikdur 32 epoxy bonding agent for all bonded topping installations.
 - 2.1.9. Curing Compound: Conform to CSA A23.1.
 - 2.1.10. Grout Beneath Base Plates: Non-shrink flowable grout in-Pakt by King Construction Products or approved equivalent, having a compressive strength at 28 days of at least 35 MPa. Where grout is exposed to view or weather, use non-ferrous grout.
 - 2.1.11. HVSCM Concrete
 - 2.1.11.1. Cement Type: General Use Portland Cement (Type GU).
 - 2.1.11.2. Compressive Strength: Achieved at 56 days.
 - 2.1.11.3. Supplementary Cementing Materials (SCMs)
 - 2.1.11.3.1. Supplementary cementing materials fly-ash, granulated blast furnace slag or silica fume, shall comply with the requirements of CSA A23.1 and CSA A3001.
 - 2.1.12. Water Storage Tanks/Water Tight Construction
 - 2.1.12.1. Cement: Type LH low heat of hydration Portland Cement in accordance with CSA A3000. Alternative use of supplementary cementing materials and chemical admixtures is subject to review by the Consultant.
 - 2.1.12.2. Air Entrainment: 6% plus or minus 1%.
 - 2.1.12.3. Compressive Strength: 28 MPa minimum at 28 days.
 - 2.1.13. Unshrinkable Fill
 - 2.1.13.1. Cement type-General Use GU Portland
 - 2.1.13.2. Minimum 24 hour strength: 0.07 MPa
 - 2.1.13.3. Maximum 28 day strength: 0.4 MPa
 - 2.1.13.4. Class of exposure: Not Applicable
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- 2.1.13.5. Size of coarse aggregate: 20 mm to 40 mm
 - 2.1.13.6. Slump at point of discharge: 150 mm to 200 mm
 - 2.1.13.7. Calcium chloride or pozzolanic mineral admixtures shall not be used. Air entraining admixtures may be added if desired by the Contractor.

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Ensure minimum concrete discharge and placing rates are maintained to avoid unexpected cold joints from forming in the structure.

3.2. EXAMINATION

- 3.2.1. Verify lines, levels, and dimensions before proceeding with the Work of this section.

3.3. PRE POUR MEETING

- 3.3.1. Prior to the initial supply of concrete to the project, the Contractor must schedule a "pre-pour meeting" as outlined in the concrete supplier's concrete quality plan.

3.4. FOOTINGS

- 3.4.1. During cold weather conditions, carefully protect footing bases from freezing.
- 3.4.2. Found footings and underpinning on naturally consolidated undisturbed soil capable of safely supporting the allowable bearing capacity shown on the Drawings within acceptable limits of settlement.
- 3.4.3. Founding elevations shown in the Contract Documents are based upon the geotechnical investigation.
- 3.4.4. Founding elevations and allowable bearing capacities must be verified by the geotechnical Consultant before footing concrete is placed.
- 3.4.5. If, upon excavating to the elevations shown in the Contract Documents, the required bearing capacities are not achieved, or if they are achieved at a higher elevation, inform the Consultant who will provide instructions as to how to proceed.
- 3.4.6. Record actual footing founding elevations.
- 3.4.7. Construct footings in a particular area commencing from the lowest footing elevation and proceeding to the higher elevations.
- 3.4.8. Remove water, disturbed soil and foreign matter from footing excavations before placing concrete. Do not permit the soil at founding elevations to soften due to the presence of water in the excavations or construction activity.
- 3.4.9. Remove water, loose rock and foreign matter from footing excavations before placing concrete.
- 3.4.10. Provide a 75 mm skim slab beneath all footings, where identified in the geotechnical report. Skim slab shall be placed after all loose material, foreign matter and water has been removed from the excavation and after the geotechnical engineer has inspected the soil at the founding elevation.
- 3.4.11. During cold weather, prevent soil adjacent to and beneath all footings from freezing. Do not pour footings on frozen soil or soil which has been allowed to freeze. If the soil at founding elevations is frozen or was frozen and thawed, remove affected material and found footings on unaffected soil with the required characteristics at no extra cost to the Owner.

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- 3.4.12. During cold weather, prevent rock adjacent to and beneath all footings from freezing.
 - 3.4.13. Where excavations for mechanical or electrical services, pits, adjacent foundations and the like encroach upon a 7 in 10 slope noted above between corners of footings and bottom corners of excavations, lower footings a suitable amount so as not to exceed the slope noted above at no extra cost to the Owner.

3.5. CONSTRUCTION JOINTS

- 3.5.1. Obtain approval from the Consultant for location and details of construction joints not shown on the structural Drawings.
- 3.5.2. Provided proper placing, curing and protection means and methods are employed by the Contractor, the maximum length/height of concrete pours shall be as follows
- 3.5.3. The maximum length of a suspended concrete slab pour shall be 40 m.
- 3.5.4. The maximum length of a concrete slab on steel deck pour shall be 30 m.
- 3.5.5. The maximum length of a slab-on-grade pour shall be 30 m.
- 3.5.6. The maximum length of a concrete foundation wall pour shall be 15 m.
- 3.5.7. The maximum height of a concrete pour shall be 4.5 m.
- 3.5.8. If the construction joints (including joints around temporary openings) will be exposed in its permanent condition, such as in a Parking Garage, the joints must be caulked as outlined in this Specification.
- 3.5.9. Do not place concrete on a sub-grade that has been frozen and thawed until the sub-grade has been reviewed by the geotechnical Consultant and approved. If, in the geotechnical consultant's opinion, the safe bearing capacity of the sub-grade has been reduced to below 25 kPa, remove the affected materials and replace with compacted granular fill at no additional cost to the Owner.

3.6. SLABS-ON-GRADE

- 3.6.1. General
 - 3.6.1.1. Do not place concrete slab-on-grade until the specified sub-floor material has been placed, inspected and approved.
 - 3.6.1.2. Do not place concrete on a frozen sub-grade, or on one that contains frozen materials.
 - 3.6.1.3. Do not place concrete on a sub-grade that has been frozen and thawed until the sub-grade has been reviewed by the geotechnical Consultant and approved. If, in the geotechnical consultant's opinion, the safe bearing capacity of the sub-grade has been reduced to below 25 kPa, remove the affected materials and replace with compacted granular fill at no additional cost to the Owner.
 - 3.6.1.4. Place clear crushed stone over the sub-base, to depths indicated in the Contract Documents. Thoroughly roll and consolidate to the lines and levels required, with a maximum surface variation of +/- 10 mm.
 - 3.6.1.5. Upon approval of the placement of the sub-floor material and setting of reinforcement, place and consolidate concrete and finish and cure as specified in this Section.
 - 3.6.1.6. Place a bond breaker, minimum 3 mm of Masonite, between edges of slab-on-grade and abutting surfaces. Where slab-on-grade is exposed to de-icing chemicals, provide an approved sealant at the joint between the slab-on-grade and abutting surfaces.
 - 3.6.1.7. Saw-cut slabs-on-grade as shown in the Contract Document, or to the Consultant's approval.
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- 3.6.1.8. Carry out cutting in accordance with recommendations contained in CSA A23.1.
 - 3.6.1.9. Mask edges of saw-cuts as required to prevent concrete floors from becoming stained.
 - 3.6.1.10. Construction joints may be provided in slabs-on-grade so that pours on any one day may be kept to reasonable sizes. Locate construction joints to the Consultant's approval.

3.7. UNSHRINKABLE FILL

- 3.7.1. Unshrinkable fill is intended for use locally in place of granular backfill below slabs-on-grade or within excavations where compaction of granular material is difficult to achieve. It is not intended for use below footings or around foundation walls, tunnels, laterally loaded caissons, etc., where vertical and/or lateral structural bearing capacities are required. Obtain written approval from the Consultant prior to using unshrinkable fill.
- 3.7.2. The unshrinkable fill material shall flow into the excavation so that it fills the entire space. Care shall be taken to ensure that no air is entrapped beneath horizontal projections or in other locations within the excavation.
- 3.7.3. Where bracing, shoring and/or sheeting is used to support the sides of the excavation or to prevent movements that could damage other services or adjacent pavements, this support system shall be removed as backfilling proceeds.

3.8. UNDERPINNING

- 3.8.1. Install underpinning in the locations shown in the Contract Documents and in the sequences indicated in the Contract Documents so that the stability of the underpinned structure, the underpinning, and the sides of excavations are maintained at all times.

3.9. CONCRETE WORK AT EXISTING STRUCTURE

- 3.9.1. Before proceeding with any Work in or adjacent to the existing structure, verify that conditions are as indicated on the Drawings. If they are not, advise the Consultant of discrepancies and do not proceed until the Consultant has given instructions.
- 3.9.2. Prior to proceeding with the Work, determine the exact founding elevations of existing footings adjacent to the new Work. Report these findings to the Consultant before proceeding further.
- 3.9.3. Where openings are shown to be cut into the existing structure in the Contract Documents, drill at corners and saw cut remainder such that saw cuts do not extend into structure to be retained. Overcutting may require major structural strengthening, the cost of which shall be borne by the Contractor.

3.10. PLACING CONCRETE

- 3.10.1. Place all concrete in accordance with CSA A23.1, the concrete supplier's requirements and as specified in this Section.
 - 3.10.2. Immediately before placing concrete, clean forms and reinforcement of foreign matter.
 - 3.10.3. Discharge concrete into forms in accordance with the time frames specified in CSA A23.1.
 - 3.10.4. Prior to pouring the concrete elements directly supported above, remove sonotube forms to such an extent to allow the Consultant to review the quality of any exposed column surface. Provide necessary protection to the exposed surfaces upon completion of review.
 - 3.10.5. Place concrete on steel deck floors in a manner that avoids piling up of concrete. Do not drop concrete directly from buckets, but employ suitable means of distribution. Wet down deck during hot weather prior to concreting.
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- 3.10.6. Remove concrete spilled onto forms around hoisting equipment before depositing concrete in these areas.
 - 3.10.7. Pumping Concrete
 - 3.10.7.1. Pumping or pneumatic placing of concrete shall only be used if the velocity of discharge is reduced to a point where no separation or scattering of the concrete occurs, and the consistency of the mix has been designed to allow such a system with no adverse effects on the quality of concrete.
 - 3.10.7.2. The shotcrete process shall be deemed as being in contravention of the above clause.
 - 3.10.7.3. Excess grout or mortar used to lubricate pipelines, or washout water, must not be discharged into the forms.
 - 3.10.8. Shotcrete
 - 3.10.8.1. The use of shotcrete to construct any part of the Work shall be at the sole discretion of the Consultant.

3.11. CURING CONCRETE

- 3.11.1. Cure all concrete in accordance with CSA A23.1, the concrete supplier's requirements and as specified in this Section.
- 3.11.2. HVSCM Concrete
 - 3.11.2.1. Cure all HVSCM concrete in accordance with the requirements of CSA A23.1. Wet curing shall commence immediately after placement and finishing of concrete.
- 3.11.3. C-XL Concrete
 - 3.11.3.1. All C-XL (extended service life concrete) shall be wet cured at a temperature of at least 10°C for a period of seven consecutive days and for a time necessary to attain 70% of the specified compressive strength, whichever is greater. Wet curing shall commence immediately after placement and finishing of concrete.
- 3.11.4. Wet Curing
 - 3.11.4.1. The following provisions apply to the Parking Garages, Ramp, and Podium Slabs.
 - 3.11.4.2. Basic Curing Period - the concrete shall be protected from premature drying and extremes of temperatures, and shall be wet cured at a temperature of at least 10°C for a period of three (3) consecutive days. Wet curing shall commence immediately after placement and finishing of the concrete.
 - 3.11.4.3. Additional Curing for Durability - Immediately following the Basic Curing Period, continue to wet cure the concrete (at a minimum temperature of 10°C for an additional four (4) consecutive days or until the concrete reaches 70% of its 28 day compressive strength, whichever is greater.
 - 3.11.4.4. Wet curing is to be achieved using one or more of the techniques outlined in CSA A23.1.
 - 3.11.4.5. If an absorptive mat or fabric material is used, it is imperative that it be kept continuously wet, by means of sprinklers, soaker hoses, a layer of polyethylene sheeting above, or another acceptable means.
 - 3.11.4.6. The use of curing compounds shall not be permitted in these areas.

3.12. PROTECTION

- 3.12.1. Protect all concrete in accordance with CSA A23.1, the concrete supplier's requirements and as specified in this Section; to prevent freshly deposited concrete from adverse conditions such as high winds, precipitation, freezing, being exposed to abnormally high

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- temperatures or temperature differentials, premature drying, and moisture loss, for a period of time necessary to develop the specified properties of the concrete.
- 3.12.2. The Contractor shall ensure that care is taken in concrete mix design and sequencing of concrete Work to avoid damage, to concrete that is aged between early and final concrete setting time, due to external vibrations from blasting, pile drilling, or other similar sources.
- 3.12.3. Cold Weather Concreting
- 3.12.3.1. Between the 15th of October of any year and the 15th of April of the following year, or when the temperature is at or below 5°C or anticipated to fall below 5°C within 24 hours of placing concrete, provide on hand and ready for use all equipment necessary for adequate cold weather protection and curing before concrete placement is begun.
- 3.12.3.2. When fresh concrete is to be cast against existing concrete, prevent the loss of heat by extending the protection for the fresh concrete over the existing concrete.
- 3.12.3.3. Insulate, or enclose within the protective housing, tie rods, reinforcement or metal which projects from the concrete being protected.
- 3.12.3.4. Construct enclosures tight and safe for wind and snow loadings.
- 3.12.3.5. Maintain housing, enclosures and supplementary heat in place for entire period of protection, except that sections may be temporarily removed as required to permit placing additional forms or concrete provided the uncovered concrete is not permitted to freeze. Make up time lost from the required period of protection at the required temperature before protection is discontinued and removed. Protection is not to be completely removed until the concrete has cooled to within the temperature differential limits specified in CSA A23.1.
- 3.12.3.6. Locate heating units to avoid heating concrete locally or drying it excessively. Avoid high temperature and dry heating within enclosures.
- 3.12.3.7. Take particular care to maintain edges and corners of concrete at the required temperature owing to their greater vulnerability to freezing.
- 3.12.3.8. Provide sufficient insulation, and heat as necessary, to prevent freezing of frost susceptible soil which lies against structural elements; in particular protect soil beneath footings and behind foundation walls until the building is completed.
- 3.12.4. Hot Weather Concreting
- 3.12.4.1. When the rate of moisture evaporation exceeds 0.5 kg/sqm per hour or when the temperature is greater than or equal to 27°C, employ the following measures in addition to the requirements of CSA A23.1:
- 3.12.4.1.1. Use ice as mixing water, or an approved equivalent temperature reducing or set retarding admixture to lower the concrete temperature.
- 3.12.4.1.2. Dispatch ready-mix trucks and organize Work to keep mixing time to a minimum. Minimize exposure of mixing trucks to the hot sun while waiting. Water shall be made available to spray the exterior of the drum while the truck is waiting to discharge its concrete.
- 3.12.4.1.3. Provide adequate personnel and organize Work to keep placing time to a minimum.
- 3.12.4.1.4. Place concrete in layers thin enough and areas small enough so that the time interval for placing is reduced and compaction will ensure complete union of adjacent portions.
- 3.12.4.1.5. With formed concrete, reliance shall not be placed on the forms alone to provide curing. Spray formwork with water to keep it tight and free from cracking.
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3.12.5. Protection of Completed Work

3.12.5.1. At all times during the Work, protect exposed concrete, exposed masonry and other exposed members from staining or becoming coated with concrete leakage due to continuing concreting operations. Members which become coated may be classed as defective by the Consultant.

3.12.5.2. Protect exposed members from staining due to rusting of reinforcement projecting beyond construction joints.

3.12.5.3. Take suitable measures to prevent spalling and cracking damage occurring to the structure due to water freezing in expansion joints, small holes, slots, depressions and take suitable measures to prevent damage occurring to foundations and the like due to frost action in the soil or backfill.

3.12.5.4. The application of de-icing salts on completed Work is not permitted.

3.13. TOPPINGS

3.13.1. General

3.13.1.1. Conform to CSA A23.1 and the requirements noted below, unless noted otherwise in the Contract Documents.

3.13.1.2. Set screeds and bulkheads rigidly and accurately to prevent displacement during concreting.

3.13.1.3. Special provisions for bonded and unbonded toppings:

3.13.1.3.1. The maximum pour size for bonded and unbonded toppings is to be limited to 100 sqm.

3.13.1.3.2. Maintain a one to one length to width aspect ratio for all pours, where extent and geometry of topping permits.

3.13.1.3.3. Toppings are to be poured in a "checker board" pattern to minimize the effects of shrinkage. Adjacent sections of topping shall be poured no sooner than 3 days after the adjoining section was poured.

3.13.1.3.4. Ensure temperature of base course is 10°C minimum prior to pouring toppings.

3.13.1.3.5. Provide hot and cold weather protection for toppings in accordance with CSA A23.1.

3.13.2. Monolithic Toppings

3.13.2.1. Monolithic toppings are constructed by applying a concrete mixture to a "freshly" poured base course that has lost all slump and bleed water, prior to its final set. Alternatively, monolithic toppings can be poured with the main base course to a final thickness equal to the thickness of the base course plus the thickness of the topping.

3.13.2.2. Where monolithic toppings are specified in the Contract Documents, place reinforcement and maintain cover requirements based on the thickness of the base slab only. Provide additional layer of reinforcement in monolithic toppings where noted on the Contract Documents.

3.13.3. Bonded Toppings

3.13.3.1. Bonded toppings are constructed by applying the topping mixture over a hardened concrete base to which a bonding agent has been applied. By definition, bonded toppings are designed to bond to the concrete base or an existing concrete surface.

3.13.3.2. Bond strength between topping and base course shall not be less than 0.9 MPa, per CSA A23.1.

3.13.3.3. Base Course Finishing and Preparation

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- 3.13.3.3.1. Base courses which are to receive bonded toppings are to be finished by one of two of the following methods:
 - 3.13.3.3.1.1. Rough broom finish (very rough finish – amplitude ± 5 mm).
 - 3.13.3.3.2. Steel trowel finish.
 - 3.13.3.3.2.1. When a rough broom finish is provided, the slab surface shall be cleaned by high-pressure water blasting to ensure all laitance, dirt, dust, construction debris and the like are removed prior to application of the bonding agent. The bonding agent shall be applied in strict accordance with manufacturer's recommendations.
 - 3.13.3.3.2.2. When a steel trowel finish is provided, the slab is to be roughened by means of shot blasting prior to the application of the bonding agent. Ensure all laitance, dirt, dust, construction debris and the like are removed immediately prior to the application of the bonding agent. Employ all necessary means to control dust and debris during shot blasting.
 - 3.13.3.4. Placing and Finishing Toppings
 - 3.13.3.4.1. Place and finish the toppings in accordance with CSA A23.1.
 - 3.13.3.5. Curing
 - 3.13.3.5.1. Continuously wet cure bonded toppings for a minimum of seven days.
 - 3.13.3.6. Jointing
 - 3.13.3.6.1. Bonded toppings do not require special provisions with respect to jointing provided all the provisions noted above are adhered to.
 - 3.13.3.6.2. The location of joints in the topping shall match those in the base course.
 - 3.13.4. Unbonded (Loose Laid) Toppings
 - 3.13.4.1. Unbonded or loose laid toppings are constructed by applying the topping mixture over a bond breaker and hardened concrete base, to which no bonding agent has been applied. By definition, unbonded toppings are specifically designed so as not to bond to the concrete base.
 - 3.13.4.2. Base Course Finishing and Preparation
 - 3.13.4.2.1. Base courses which are to receive unbonded or loose laid toppings are to be finished smooth by means of a steel trowel.
 - 3.13.4.3. Placing and Finishing Toppings
 - 3.13.4.3.1. Place toppings on bond breaker and finish the toppings in accordance with CSA A23.1.
 - 3.13.4.4. Curing
 - 3.13.4.4.1. Continuously wet cure unbonded toppings for a minimum of seven days.
 - 3.13.4.5. Jointing
 - 3.13.4.5.1. Unbonded toppings are to be saw cut, as per the typical detail for slabs-on-grade, at a maximum spacing of 3.0 m in both directions, unless noted otherwise in the Contract Documents. For toppings that are to receive hard architectural floor finishes, the jointing shall be laid out in accordance with the Consultant's requirements and is subject to final approval by the Consultant.
 - 3.13.5. Cracks in Toppings
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- 3.13.5.1. All cracks in concrete toppings shall be repaired by the Contractor. Extent of repair and method of crack repair shall meet the requirements of the flooring installation Contractor and the Owner.

3.14. OPENINGS THROUGH COMPLETED MEMBERS

- 3.14.1. Do not cut openings through completed members without the Consultant's approval.
- 3.14.2. Where the location of openings is approved, locate the reinforcement by x-ray, cover meter, or other positive means as required by the Consultant and adjust the location of the opening so that no reinforcement is cut unless specifically approved otherwise in writing by the Consultant.
- 3.14.3. In the case of precast concrete slabs, holes shall be cut or drilled only by the precast concrete Contractor.

3.15. MAKING GOOD

- 3.15.1. Make good temporary openings left in concrete construction around pipes, ducts and the like using a mortar of the same proportions as the surrounding Work. Reinforce mortar with welded wire fabric where openings exceed 75 mm. Roughen existing surfaces to receive mortar or apply suitable bonding agent such that mortar will be securely bonded to existing concrete.

3.16. GROUTING BENEATH BASE PLATES

- 3.16.1. Grout beneath plates bearing on concrete with an approved non-shrink flowable grout. Comply with the manufacturer's directions for mixing and placing grout. Completely fill voids below plates. Fill voids left by shims after shims are removed.
- 3.16.2. During cold weather, preheat base plates and footings and maintain temperature at minimum 12°C for 6 days after grouting.
- 3.16.3. Refer to Section 05 12 00 - Structural Steel for lifting of base plates to determine adequacy of grouting. If defects are found, more base plates will be raised.

3.17. TREATMENT OF FORMED SURFACES NOT DESIGNATED AS ARCHITECTURALLY EXPOSED CONCRETE

- 3.17.1. Do Work in accordance with CSA A23.1 and as follows:
- 3.17.1.1. Provide smooth form finish to concrete surfaces exposed to public view and surfaces to receive plaster, damp-proofing, moisture resistant membrane, and the like.
- 3.17.1.2. Remove traces of form lining compound from concrete surfaces which may affect the bonding of following surface application.

3.18. WATER STORAGE TANKS (WATER TIGHT CONSTRUCTION)

- 3.18.1. Conform with the requirements of this Section including the following for the construction of the walls and base slabs of the water storage tanks members designated to be watertight.
- 3.18.2. Temperature Control
- 3.18.2.1. Concrete temperature at time of delivery 27°C maximum, 18°C minimum.
- 3.18.2.2. Maximum cooling rate not to exceed 7°C per day.
- 3.18.2.3. In the case of the base slab, employ a temperature monitoring system during each pour to determine the internal concrete temperature at regular intervals. Submit details of the proposed monitoring system to the Consultant for review.

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- 3.18.3. Joints
 - 3.18.3.1. For each pour, arrange to begin saw-cutting of joints no later than 30 minutes after the maximum temperature in each pour is reached, and to complete the saw-cutting within a maximum of 2 hours.
 - 3.18.3.2. Note that this timing of saw-cutting could occur at any time of the day or night. Plan accordingly.
 - 3.18.4. Curing
 - 3.18.4.1. Maintain 7 days continuous moist curing after placing concrete. Provide an approved membrane waterproofing immediately thereafter.
 - 3.18.5. Crack Repair
 - 3.18.5.1. Just prior to the installation of the tank liner and insulation, carefully examine all exposed interior and exterior surfaces and repair any cracks in them.
 - 3.18.6. Water Test
 - 3.18.6.1. At least 28 days after concreting the last section of each pool or tank, and after the sealing of joints, fill each pool or tank with water and leave standing for 10 days.
 - 3.18.6.2. Fill each pool or tank gradually such that the differential temperature between the water the pool or tank concrete does not exceed 7°C.
 - 3.18.6.3. Locate and repair all areas where leakage occurs and retest until each pool or tank is watertight.

3.19. QUALITY CONTROL

- 3.19.1. Implement a system of quality control to ensure that the minimum standards specified in this Section are attained.
- 3.19.2. Adhere to the requirements of the project "Concrete Quality Plan" prepared and submitted as required by this Specification.
- 3.19.3. Bring to the attention of the Consultant any defects in the Work or departures from the Contract Documents which may occur during Construction. The Consultant will decide upon corrective action and will provide recommendations in writing.
- 3.19.4. The Consultant's general review during construction and inspection and testing by independent inspection and testing agencies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of its contractual responsibility.

3.20. NOTIFICATION

- 3.20.1. Prior to commencing significant segments of the Work, give the Consultant and independent inspection and testing companies appropriate notification so as to afford them reasonable opportunity to review the Work. Failure to meet this requirement may be cause for the Consultant to classify the Work as defective.

3.21. INSPECTION AND TESTING

- 3.21.1. Appointment of Independent Inspection and Testing Companies
 - 3.21.1.1. The Owner or Consultant will appoint the independent inspection and testing companies to make inspections or perform tests as the Consultant directs. The independent inspection and testing companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct.

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- 3.21.1.2. When defects are revealed, the Owner may request, at the Contractor's expense, additional inspection or testing to ascertain the full extent of the defect.
 - 3.21.2. Concrete Quality Tests
 - 3.21.2.1. Concrete quality tests shall be carried out in accordance with CSA A23.1 and shall include the following:
 - 3.21.2.1.1. Slump
 - 3.21.2.1.2. Air content of fresh concrete
 - 3.21.2.1.3. Temperature of fresh concrete
 - 3.21.2.1.4. Compressive strength
 - 3.21.2.1.5. Density (for low-density and semi-low-density concrete only)
 - 3.21.2.1.6. Flexural strength
 - 3.21.2.1.7. Splitting tensile strength
 - 3.21.2.1.8. Chloride permeability
 - 3.21.2.2. Cement and Aggregates: The Consultant may make tests on these materials as deemed necessary during the Work.
 - 3.21.2.3. Compressive Strength Tests: Compressive cylinder testing will be carried out in accordance with CSA A23.1 and as follows: Three companion laboratory cured concrete standard compression test cylinders; one tested at 7 days and two tested at 28 days, constitute a strength test. During the placing of concrete in cold weather one additional field cured test cylinder will be made and tested at 7 days. The results of the 7 day tests related to curing procedure shall be the basis to strip soffit forms from horizontal or inclined members.
 - 3.21.2.4. HVSCM Concrete: Compressive cylinder testing will be carried out in accordance with CSA A23.1 and as follows: Four companion laboratory cured concrete standard compression test cylinders; one tested at 7 days, one tested at 28 days and two tested at 56 or 91 days, whichever is the specified test age. In addition, two accelerated test cylinders shall be made and tested in accordance with CSA A23.1/A23.2 .
 - 3.21.2.5. Core Samples for Chloride Ion Permeability Test
 - 3.21.2.5.1. C-1, A-1 and C-XL concrete exposure classes: Chloride ion permeability test shall be carried out in accordance to CSA A23.1 and ASTM C1202 and as follows: Each test shall consist of 4 companion in-situ core specimens at locations determined by the Consultant. Test one core specimen at 7 days, one at 28 days and two at 56 days.
 - 3.21.2.5.2. Where cores are taken for chloride ion permeability tests, the core areas are to be filled and reinstated with King Self-Leveling Concrete or suitable equivalent approved by the Consultant. The Independent Testing and Inspection agency will perform four concrete cores for each pour consisting of concrete exposure class C-1, A-1 or C-XL.
 - 3.21.2.6. Cylinders for Chloride Ion Permeability Test
 - 3.21.2.6.1. C-1, A-1 and C-XL concrete exposure classes: Rapid chloride permeability test shall be carried out in accordance to CSA A23.1 and ASTM C1202 and as follows: Each test shall consist of 3 cylinder specimens. Concrete specimens are to be field cured in conditions similar to the in-situ concrete. Test one cylinder specimen at 7 days, one at 28 days and two at 56 days.
 - 3.21.3. Tensile Bond Tests: Tensile bond tests will be carried out in accordance with CSA A23.1 for all bonded toppings.
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- 3.21.4. Lightweight Concrete: In addition to the above tests, fresh weight and dry weight tests may be made on a sampling basis.
 - 3.21.5. Grout under Baseplates: At least one strength test may be made each day that grout is placed under baseplates.
 - 3.21.6. Inspection of Substrate (Soil/Rock)
 - 3.21.6.1. Substrate (Soil/Rock) at footing founding elevations will be inspected.

3.22. DEFECTIVE MATERIALS AND WORK

- 3.22.1. Where evidence exists that defective Work has occurred or that Work has been carried out incorporating defective materials, the Consultant may have tests, concrete coring, inspections or surveys performed, analytical calculations of structural strength made and the like in order to help determine whether the Work must be repaired or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the Work may be acceptable.
- 3.22.2. All testing shall be conducted in accordance with the requirements of the local building code identified on the Structural General Notes, except where this would in the Consultant's opinion cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- 3.22.3. Materials or Work which fails to meet the requirements specified in the Contract Documents may be rejected by the Consultant whenever found at any time prior to the Total Performance of the Work regardless of previous inspection. If rejected, defective materials or Work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

3.23. PROTECTION

- 3.23.1. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 03 30 00

PART 1 - GENERAL

1.1. STANDARD

- 1.1.1. Concrete materials and methods of construction: to CAN/CSA-A23.1 (M90), and OPSS standards.

1.2. INSPECTION

- 1.2.1. Concrete testing: to CAN/CSA-A23.2 - (M90) by testing laboratory designated and paid for by Contractor through testing allowance.
- 1.2.2. Give the Contract Administrator minimum 24 hours' notice before each concrete pour.

1.3. QUALITY ASSURANCE

- 1.3.1. All work shall be performed as per plans and specifications and shall include but not be limited to the supply of all materials such as granular, concrete, colour hardeners, imprinting tools and sealers.
- 1.3.2. Samples shall be provided for approval by the City/University Representative along with references of past installations, which are comparable, in terms of size and complexity. A color sample (minimum 200mm x 200mm) shall be provided for all requests for approved equivalents. For construction, an on-site mockup shall be provided, at a minimum of 2.0 meters square and shall be poured, finished, washed and sealed for City/University approval prior to commencement.
- Samples shall remain in place until project completion and acceptance of all Impressed Cast-in-place concrete.
- 1.3.3. The concrete contractor must satisfy the City/University authorities requirements in respect to job site supervisor, equipment and qualified labor force that has worked with the above-mentioned materials and able to meet necessary deadlines. The contractor must have a minimum of 5 years' experience applying and finishing color hardeners on exterior concrete finishes.
- 1.3.4. All materials used shall be outlined on a formal Tech-Data sheet for future information.

1.4. GRADE WORK

- 1.4.1. The general contractor shall be responsible for all fine grades up to 125 mm depth.
- 1.4.2. All granular bases shall be fine graded to ensure contract concrete thickness. Uneven fine grade will not be accepted.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Concrete: shall be 32 Mpa compressive strength with 5-7% air entrainment. The City/University
- 2.1.2. does not accept slag in the concrete mix design.
- 2.1.3. Concrete coarse aggregate shall consist of a blend of 10mm and 20mm crushed limestone aggregate.
- 2.1.4. All mixing water shall be fresh, clean, and potable.
- 2.1.5. Concrete slump shall not exceed 100mm without the use of a high range water reducers.
- 2.1.6. Portland cement: to CAN/CSA-A5 - (93), Type (10).
- 2.1.7. Shrinkage compensating grout: pre-mixed, non-metallic aggregate, 50 MPa compressive strength at 28 days.
- 2.1.8. Premoulded joint filler: bituminous impregnated fiberboard to ASTM D1751-83 (1991). Use Seal-tite System by R.W. Meadows or approved equivalent.

- 2.1.9. Joint sealer: bituminous joint sealer (tube form), bituminous tack coat.
- 2.1.10. Concrete sealer: confirmed by contractor prior to construction and approved by the Owner
- 2.1.11. Powder Release: confirmed by contractor prior to construction and approved by the Owner.
- 2.1.12. All other materials: to CAN/CSA-A23.1-M90.

2.2. MIX PROPORTIONS

- 2.2.1. Method: Alternative (1) of CAN-CSA-A23.1 - (M90).
- 2.2.2. Cement type: as specified under 2.1. Class C-2.
- 2.2.3. Minimum 28 day compressive strengths and exposure classifications:
- 2.2.4. Pavements, walks, curbs and exposed site concrete: 32 MPa; C-2.
- 2.2.5. Nominal size of coarse aggregate: Clause 14 of CAN/CSA-A23.1 - (M90)
- 2.2.6. Slump: to Table 6 of CAN/CSA-A23.1 - M90.
- 2.2.7. Air content: all concrete to contain purposely entrained air in accordance with Table 10 of CAN/CSA-A23.1 (M90). Minimum 5%-7% air entrainment.
- 2.2.8. Admixtures: to Clause 6 of CAN/CSA-A23.1 (M90).

2.3. COLORS

- 2.3.1. Contractor to confirm color of existing concrete and approval by City/University prior to construction.
- 2.3.2. Repairs within existing areas:
 - 1. Repairs to older, existing colored concrete must match the existing appearance. Use a color and release agent that closely align with the current concrete finish.
- 2.3.3. .3 New areas:
 - 1. Integral colored concrete shall utilize pigments by a recognized manufacturer or an approved equivalent. The pigment loading rate must be 5% per cubic meter. The integrally colored concrete shall be antiqued with a powder release agent in a complementary color before imprinting with textured mats.
 - 2. Surface hardener for colored concrete must be a product from a recognized manufacturer or an approved equivalent. Apply at a minimum coverage rate of 55 pounds per 100 square feet.
- 2.3.4. Special Projects: to be selected by City/University.

2.4. PATTERNS

- 2.4.1. Repairs to older, existing colored and patterned concrete to match existing.
- 2.4.2. New, proposed colored and patterned concrete:
 - 1. **Inside** of Road Right of Way (road allowance): as per contract documents. Pattern to be confirmed by contractor prior to construction and approved by Owner.
 - 2. **Outside** of Road Right of Way (road allowance): as per contract documents. *Pattern to be confirmed by contractor prior to construction and approved by Owner.*
 - 3. **Special Projects**: as per contract documents.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Installation shall conform to OPSD 310.010 (Concrete Sidewalk), 310.020 (Concrete Sidewalk Adjacent to Curb and Gutter), and 310.030 (Concrete Sidewalk Ramps at Intersections).

3.1.2. When placing curb OPSD 600.080, a 50 mm lip shall be included along the back edge to support the concrete pad.

3.2. COLOUR HARDENER APPLICATION

3.2.1. Application of color hardener shall consist of two applications to equal 55lbs per 100 square feet. The first application of color hardener shall consist of 2/3 the specified rate and must be floated into the moist concrete. The second application of color hardener shall be applied, floated then lightly trowelled prior to the imprinting procedure.

3.2.2. A surface retarder may be applied if required as approved by the City/University Representative. Water is not permitted.

3.2.3. Concrete contractor must have a minimum 5 years experience in applying and finishing color hardeners on exterior concrete finishes.

3.3. RELEASE AGENT APPLICATION

3.3.1. Integral colored concrete confirmed by contractor prior to construction and approved by the Owner.

3.3.2. Surface Hardener colored concrete confirmed by contractor prior to construction and approved by the Owner.

3.3.3. Apply powder release agent evenly over freshly trowelled concrete surface. At no time shall the release agent be floated or trowel led into the wet concrete surface. Release agent shall be applied to concrete in such a way as to not mar or affect the smooth trowelled concrete surface.

3.4. EXPANSION JOINTS AND SAWCUT CONTROL JOINTS

3.4.1. The use of expansion joint fiber board shall only be used when new concrete is to be poured against two adjacent concrete surfaces at which point only the side other than the existing curb shall receive the fiber board. Plastic sheeting is to be used against all existing concrete curbs to ensure there is not bond. The following day, cut between the existing curb and new concrete with a diamond blade saw to remove plastic and to insure a clean joint.

3.4.2. Cut all imprinted concrete along existing curbs at each existing curb cut, and once between half the distance of the existing curb cuts. Saw cut shall follow an imprinted pattern line closest to each existing curb cut and shall be a minimum of 1/3 the depth of concrete.

3.4.3. Asphalt impregnated expansion joint shall be installed perpendicular to existing curb cuts within 30-meter intervals.

3.4.4. Place fiber expansion joints as per OPSD 310.020 (Concrete Sidewalk Adjacent to Curb and Gutter).

3.4.5. Where concrete is installed adjacent to asphalt surfacing, a bituminous tack coat will be applied to the sides of the concrete as per manufacturer's specifications, if installed *prior* to asphalt. If concrete is installed *after* asphalt, a bituminous joint sealer (tube form) will be used and installed as per manufacturer's specifications.

3.4.6. Do not trowel dummy or contraction joints. Saw cut control joints **along pattern lines** and match saw cuts in concrete curbing. Saw cuts shall be 1/3 the depth of the concrete.

3.5. CURING

3.5.1. Cure and protect concrete in accordance with CAN/CSA-A23.1 - M90, except that curing compounds shall not be used where bond is required by subsequent topping or coating.

3.6. SEALING

- 3.6.1. All imprinted concrete surfaces shall be treated with a deep penetrating approved sealer - MATTE FINISH.
- 3.6.2. All colored concrete shall be sealed with QC-18 Acrylic Concrete Sealer after the excess powder release has been washed off and the surface allowed to dry. Sealer shall not be applied prior to a minimum of 10 days curing. Concrete must be completely dry prior to sealing. Product distributed by Form & Build Supply (1-800-563-2285) or approved equivalent.
- 3.6.3. All concrete to be sealed must be pressure washed and buffed to ensure a clean surface to allow proper penetration of sealer. A City/University representative shall be present at the commencement of washing to confirm the finished color against the approved sample.

3.7. WARRANTY

- 3.7.1. 24-month standard warranty to apply from substantial completion.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide concrete floor finishing including but not limited to following:
 - 1.2.1.1. curing and sealing.
 - 1.2.1.2. premoulded joint filler.
 - 1.2.1.3. sawcutting construction and control joints in concrete.
 - 1.2.1.4. caulking construction and control joints and over premoulded joint filler with sealant.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of concrete formwork: Section 03 10 00, Concrete Forming.
 - 1.2.2.2. Provision of concrete reinforcing: Section 03 20 00, Concrete Reinforcement.
 - 1.2.2.3. Provision of cast-in-place concrete: Section 03 30 00, Cast-In-Place Concrete.

1.3. REFERENCES

- 1.3.1. Reference Standards:
 - 1.3.1.1. ACI 302.1R-15 - Guide for Concrete Floor and Slab Construction
 - 1.3.1.2. ASTM C156-20 - Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete
 - 1.3.1.3. ASTM C309-19 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - 1.3.1.4. CSA A23.1-19 - Concrete materials and methods of concrete construction
 - 1.3.1.5. CSA A23.2-19 - Test methods and standard practices for concrete

1.4. ADMINSTRATIVE REQUIREMENTS

- 1.4.1. Pre-Installation Meetings: At least 35 Days prior to commencement of work, arrange for Project site meeting of all parties associated with work of this Section. Presided over by Contractor, include Consultant who may attend, manufacturer, Subcontractor performing work of this Section, Owner's Representative and testing company's representative. Review Specification for work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of placement and other matters affecting construction, to permit compliance with intent of this Section.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit manufacturer's Product data, performance criteria and other documentation for each material specified in this Section proposed for use, including:
 - 1.5.1.1. liquid curing/sealing and curing/hardener.
 - 1.5.1.2. joint sealant and primer.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Maintenance Data: Submit maintenance manuals in accordance with Section 01 70 00 to Consultant. Contribute to this manual with complete detailed and specific instructions for maintaining, preserving and keeping clean surfaces of this work and which give adequate warning of maintenance practices or materials detrimental to sealed surfaces.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
- 1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Storage and Handling Requirements: Store materials on site in manner to prevent damage thereto. Protect materials from inclement weather. Comply with CSA A23.1, Clause 7.1.

1.9. SITE CONDITIONS

- 1.9.1. Ambient Conditions:
- 1.9.1.1. Temporary Lighting: Minimum 1-200 W light source, placed 2.5 m (8') above floor surface, for each 40 m² (430 sq ft) floor being finished.
- 1.9.1.2. During hot weather, conform to CSA A23.1, Clause 7.4.
- 1.9.1.3. During cold weather, provide temporary heating and enclosures required. Mix, place and protect concrete in accordance with CSA A23.1, Clause 7.4.

1.10. WARRANTY

- 1.10.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; failure of floor finish remaining in place and bonding to structural slab and finish becoming defective and spalling and/or cracking.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. BASF; www.master-builders-solutions.basf.com
- 2.1.1.2. CPD Construction Products; www.cpd.ca
- 2.1.1.3. Euclid Chemical Canada Ltd.; www.euclidchemical.com
- 2.1.1.4. Master® Builders Solutions; www.master-builders-solutions.basf.com
- 2.1.1.5. Sika Canada Inc.; www.sika.ca
- 2.1.1.6. W.R. Meadows of Canada; www.wrmeadows.com

2.2. MATERIALS

- 2.2.1. Supply liquid admixtures for concrete from single manufacturer. Supply liquid curing/sealing compound by same manufacturer which is supplying shake hardener.
- 2.2.2. Liquid Curing/Sealing Compound: ASTM C309 Type 1, Class B and CSA A23.1, water based acrylic, "EVERCLEAR VOX" or "DIAMOND CLEAR VOX" by Euclid Chemical Canada Ltd., or

- "MasterKure® CC 200 WB" by Master® Builders Solutions, "Sika® Florseal WB 18 & 25" by Sika Canada Inc., "CIPADECK® Cure & Seal WB" by CPD Construction Products or "Sealtight Vocomp-20" by W.R. Meadows of Canada.
- 2.2.3. Pigmented Curing Compound: ASTM C309 Type 2, Class B white pigmented resin based, "Sika® Florseal WB 18 & 25" by Sika Canada Inc., "KUREZ VOX White Pigmented" by Euclid Chemical Canada Ltd. or "1220 White Pigmented Curing Compound" by W.R. Meadows of Canada.
- 2.2.4. Clear Liquid Dustproofing Compound: ASTM C309 Type 1, Class B and CSA A23.1, water based acrylic, "EVERCLEAR VOX" by Euclid Chemical Canada Ltd., "MasterKure® CC 200 WB" by Master® Builders Solutions, "Sika® Florseal WB 18 & 25" by Sika Canada Inc., "CIPADECK® Cure & Seal WB" by CPD Construction Products or "Sealtight Vocomp-20" by W.R. Meadows of Canada.
- 2.2.5. Water for Curing: Water conforming to CSA A23.1, Clause 4.2.2, clear and entirely free from any elements which might cause staining of concrete.
- 2.2.6. Polyethylene Film (for Water Curing): Minimum 0.1 mm (4 mils) thick, complying with maximum allowable moisture loss requirements of ASTM C156.
- 2.2.7. Backer Rod: Extruded, closed cell, circular polyethylene foam, sized 25% larger than joint width into which it will be installed, "Cera-Rod™ Non-Gassing, Heat-Resistant Backer Rod" by W.R. Meadows of Canada.
- 2.2.8. Joint Sealant: 2 component, chemically reactive polyurethane or polysulfide modified sealant over premoulded joint filler; self-levelling, grey colour. "Vulkem 245" by Tremco, "Eucolastic II (pourable grade)" by Euclid Chemical Canada Ltd., "Sikaflex® 2c SL" by Sika Canada Inc., "Deck-O-Seal® – Pour Grade Two-Part, Elastomeric, Polysulfide-Based Sealant" by W.R. Meadows of Canada or "MasterSeal® SL2™" by Master® Builders Solutions.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions: Protect materials and work of this Section from damage in accordance with CSA A23.1, Clause 8.5.7. Protect other work from damage resulting from this Work. Replace damaged work which cannot be satisfactorily repaired.
- 3.2.2. Surface Preparation:
- 3.2.2.1. After concrete has been placed, strike off concrete level and flush to screeds with true straight edge.
- 3.2.2.2. Immediately after striking off concrete, level and consolidate with wooden darby or bull float. Complete levelling and consolidation before free moisture (bleeding) rises to surfaces.
- 3.2.2.3. Wait until concrete stiffens sufficiently to sustain foot pressure with only about 6 mm (1/4") indentation.
- 3.2.2.4. Float concrete with hand float or with power float. If free bleed water remains on surface at this time, remove it before floating.

3.3. INSTALLATION

3.3.1. Floor Finishing:

3.3.1.1. Power screed interior floor slabs with mechanical vibratory screeding equipment. Machine float and machine trowel floor surfaces to smooth, level and dense surfaces free from trowel marks, ridges and depressions, except where specified otherwise.

3.3.1.2. Power screed exterior floor slabs with mechanical vibratory screeding equipment. Float using magnesium floats and trowel to level and dense surfaces and finish to sidewalk "swirl" texture.

3.3.1.3. Use hand held vibrators and hand screed, float and trowel areas where power equipment is inaccessible, to same density and surface quality specified for floors finished with power operated equipment.

3.3.1.4. For concrete mixes containing steel fibre reinforcement, ensure finishing process leaves surface free of protruding fibres. If fibres protrude from surface after concrete has set, remove protruding fibres by grinding.

3.3.1.5. Miscellaneous Finishes:

3.3.1.5.1. In areas specified to receive subsequent epoxy or urethane floor overlay or coating, finish concrete floor surface with 1 pass steel trowel.

3.3.1.5.2. Swirled Finish: In final trowelling of Steel Trowel Finish, where swirled finish is scheduled, impart slightly textured surface to concrete by spin trowelling.

3.3.2. Sawcutting of Control Joints and Construction Joints:

3.3.2.1. Sawcut control joints and construction joints in slabs where indicated on Drawings, 5 mm wide x 50 mm deep (3/16" x 2") for slabs on grade, in straight lines. For slabs on permanent metal floor deck sawcut control joints and construction as follows:

3.3.2.1.1. 5 mm wide x 19 mm deep (3/16" x 3/4").

3.3.2.2. Unless soft cut method is used, perform sawcutting 12 to 24 hrs after concrete has been placed, depending on when saw can run over concrete surface without leaving tread marks, when concrete can be sawn without dislodging aggregate and before uncontrolled shrinkage has occurred. Do not postpone sawing operations beyond these time limitations. Do not sawcut concrete, not utilizing retarding admixtures placed with temperature exceeding 26 deg C (79 deg F) later than 12 hrs after placing.

3.3.2.3. Continuously spray water on saw blade at all times during sawing. Grind edges of sawcuts to eliminate burrs; do not grind to bevel or chamfer joint edges. In sawcutting floor slabs on metal deck, run wet vacuum cleaner immediately behind sawcutting equipment.

3.3.2.4. After sawing and grinding, clean joints with jet of water and blow-out with compressed air. Immediately broom clean, residue caused by sawing operation as work progresses.

3.3.2.5. When cleaned joints are dry and prior to traffic being allowed over area, install temporary filler using polyethylene rope in such joints to prevent contamination of same.

3.3.3. Curing/sealing of Floors:

3.3.3.1. Liquid Curing/Sealing Compound: Prior to sawcutting operations cure and seal floor with liquid curing/sealing compound by method and at rate recommended by manufacturer. Apply an additional coat of liquid dustproofing compound 28 Days following concrete cure.

3.3.3.2. Water Curing:

3.3.3.2.1. Water cure floors designated to be surfaced with ceramic or quarry tile, epoxy or urethane. Do not use curing/sealing compound.

3.3.3.2.2. Water down entire floor area and cover with polyethylene sheets for minimum 7 Days. Sheet coverage includes exposed edges. Provide suitable weights to prevent blow-off or displacement of sheets.

- 3.3.3.2.3. Remove cover after minimum 7 consecutive Days. Allow to air dry until concrete has developed design strength.
- 3.3.4. Joint Sealant:
 - 3.3.4.1. Following joint sealant installation specifications do not apply in areas of concrete slab to receive subsequent floor finishes such as tile, carpet, resilient tile and epoxy topping system.
 - 3.3.4.2. Do not fill isolation joints, construction joints and control joints sooner than 120 Days after concrete placement. Execute joint sealing during cool, dry ambient conditions when slab is in contracted state to minimize future joint separation at sealant filled joints.
 - 3.3.4.3. Remove temporary filler from sawcut joints. Remove 6 mm (1/4") scored strip from top of premoulded joint filler. Clean joints and blow clean with compressed air.
 - 3.3.4.4. Reinstall backer rod into construction/expansion joints, set to proper sealant depth per sealant manufacturer's printed directions. Fill remainder of joint with standard joint sealant.
 - 3.3.4.5. Caulk over premoulded isolation joint fillers with specified standard joint filler sealant.
 - 3.3.4.6. Prime wall of joint as recommended by sealant manufacturer. Mix sealant as directed by manufacturer. Coat surfaces of metal in contact with sealant with primer as recommended by sealant manufacturer.
 - 3.3.4.7. Fill exterior sawn construction and control joints and over premoulded isolation joint filler with specified standard joint sealant.
 - 3.3.4.8. Comply with manufacturer's application and substrate temperature requirements. Mask floor to edge of joints and fill joint with sealant. After initial set, prime sealant surface with sealant and refill joints with sealant as required to produce slightly convex joint surface.
- 3.3.5. Tolerances:
 - 3.3.5.1. Slab-on-grade flatness tolerances in accordance with ACI 302.1R, will be:
 - 3.3.5.1.1. $F_F = 20$ and $F_L = 15$ overall for noncritical: mechanical rooms, non-public areas, surfaces to have raised computer flooring, surface to have thick-set tile and parking structure slabs.
 - 3.3.5.1.2. $F_F = 25$ and $F_L = 20$ overall for carpeted areas of commercial office buildings or lightly-trafficked office/industrial buildings.
 - 3.3.5.1.3. $F_F = 35$ and $F_L = 25$ overall for thin-set flooring or warehouse floor with moderate or heavy traffic.
 - 3.3.5.2. Suspended floor slab flatness tolerances in accordance with ACI 302.1R, will be:
 - 3.3.5.2.1. $F_F = 20$ and $F_L = 15$ or N/A overall for noncritical: mechanical rooms, non-public areas, surfaces to have raised computer flooring, surface to have thick-set tile and parking structure slabs.
 - 3.3.5.2.2. $F_F = 25$ and $F_L = 20$ or N/A overall for carpeted areas of commercial office buildings or lightly-trafficked office/industrial buildings.
 - 3.3.5.2.3. $F_F = 35$ and $F_L = 20$ or N/A overall for thin-set flooring.
- 3.4. REPAIR**
 - 3.4.1. Crack Repair:
 - 3.4.1.1. After concrete has cured, examine concrete floor surfaces and repair cracks. Route cracks out with mechanical router to minimum depth of 13 mm (1/2"). Then clean and fill cracks in same manner as control joints.
 - 3.4.1.2. Correct defects in defined traffic floor only by grinding or removal and replacement of defective slabs. Areas requiring corrective work will be identified by Consultant. Verify corrected areas with Consultant.
 - 3.4.1.3. Perform corrective work at times convenient to Consultant and at no cost to Owner.

3.5. SITE QUALITY CONTROL

3.5.1. Site Tests and Inspections:

3.5.1.1. Independent inspection and testing company may be appointed and paid for by Owner to carry out inspection and testing as directed by Consultant.

3.5.1.2. Perform tests in accordance with CSA A23.2.

3.5.1.3. Clear Liquid Dustproofing Compound Testing: Perform water tests using "RILEM" tubes on concrete surfaces where liquid dustproofing compound was applied. If water penetrates concrete surface, test is considered a fail and area tested will require an additional coat of liquid dustproofing compound at no cost to Owner.

3.5.1.4. Forward Inspection Company's reports of tests to Consultant and Contractor with opinion or reason for any abnormalities noted thereon.

3.5.1.5. Cooperate with and assist Inspection Company's personnel during inspection and tests.

3.5.2. Non-Conforming Work: Remove defective materials and completed work which fail tests and replace as directed by Consultant.

3.6. ATTACHMENTS

3.6.1. Floor Finishes Schedule:

3.6.1.1. Carpet:

3.6.1.1.1. Finish: Steel trowel.

3.6.1.1.2. Hardener: None required.

3.6.1.1.3. Curing: Liquid curing/sealing compound, or water or poly curing.

3.6.1.2. Resilient Flooring:

3.6.1.2.1. Finish: Steel trowel followed by blastrack.

3.6.1.2.2. Hardener: None required.

3.6.1.2.3. Curing: Liquid curing/sealing compound, or water or poly curing.

3.6.1.3. Trowel Applied Composition Flooring (Epoxy, Urethane Acrylic, Neoprene, Polyester):

3.6.1.3.1. Finish: Steel trowel followed by blastrack.

3.6.1.3.2. Hardener: If recommended by composition flooring material manufacturer.

3.6.1.3.3. Curing: Water or poly curing.

3.6.1.4. Liquid Applied Rubber or Plastic Membrane (Mechanical Waterproofing):

3.6.1.4.1. Finish: Steel trowel.

3.6.1.4.2. Hardener: None required.

3.6.1.4.3. Curing: Water or poly curing.

3.6.1.5. Tile:

3.6.1.5.1. Adhesive or Thinset Mortar:

3.6.1.5.1.1. Finish: Steel trowel.

3.6.1.5.1.2. Hardener: None required.

3.6.1.5.1.3. Curing: Water or poly curing.

3.6.1.6. Finished Concrete, Standard Exposed:

3.6.1.6.1.1. Finish: Steel trowel.

3.6.1.6.1.2. Curing: Liquid curing/sealing compound followed by clear liquid dustproofing compound.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide cast cement underlayment including but not limited to following:
 - 1.2.1.1. gypsum cement underlayment.
 - 1.2.1.2. hydraulic cement underlayment.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Filling and sealing of sawcut joints in concrete slab: Section 03 35 13, Concrete Floor Finishing.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. SDS: Safety Data Sheets.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM C472-20 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit manufacturer's Product data, performance criteria and other documentation for each material specified in this Section proposed for use.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
 - 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.6.2. Mock-Ups: Construct minimum 10 m² (100 sq ft) mock-up sample at Project location designated by Consultant for review. Once reviewed and no objections recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Storage and Handling Requirements:

1.7.1.1. Store materials on site in manner to prevent damage thereto. Protect materials from inclement weather.

1.7.1.2. Refer to Product SDS for precautionary measures during storage and handling.

1.8. SITE CONDITIONS

1.8.1. Ambient Conditions:

1.8.1.1. Temporary Lighting: Minimum 1-200 W light source, placed 2.5 m (8') above floor surface, for each 40 m² (430 sq ft) floor being finished.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

2.1.1.1. ARDEX Group; www.ardex.ca

2.1.1.2. CGC Inc.; www.cgcinc.com

2.1.1.3. ChemRex; www.chemrex.com

2.1.1.4. CPD Construction Products; www.cpd.ca

2.1.1.5. Custom Building Products; www.customtechflooring.com

2.1.1.6. Euclid Chemical Canada Inc.; www.euclidchemical.com

2.1.1.7. MAPEI Inc.; www.mapei.ca

2.1.1.8. Maxxon Canada; www.maxxon.ca

2.1.1.9. Sika Canada Inc.; www.sika.ca

2.1.2. Substitution Limitations: Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

2.2.1. Self-Leveling Topping: Provide 1 of following:

2.2.1.1. ARDEX Cementitious Self-Leveling Floor Underlayment: "ARDEX V 1200™, ARDEX K 15®, ARDEX K 16™, ARDEX SD-T®" or commercial topping in accordance with manufacturer's recommendations for following:

2.2.1.1.1. Typical leveling without short downtime limitation requirements: "ARDEX V 1200™" by ARDEX Group normal setting polymer-modified self-leveling 0 mm - 25 mm (0" - 1") underlayment with a compressive strength greater than 31 MPa (4,500 psi).

2.2.1.1.2. Where fast track or thicker applications are required: "ARDEX K 15®" by ARDEX Group high-performance fast-setting self-leveling 0 mm - 38 mm (0" - 1-1/2") underlayment with a compressive strength greater than 38 MPa (5,500 psi).

2.2.1.1.3. Where extended flow and skim coat self-leveling properties are required: "ARDEX K 16™" by ARDEX Group fast setting, skim coat 0 mm - 25 mm (0" - 1") cement based concrete topping and underlayment with a compressive strength greater than 36 MPa (5,300 psi).

2.2.1.1.4. Self-leveling high strength concrete wear topping: "ARDEX SD-T®" by ARDEX Group premium fast setting self-leveling grey or white 0 mm - 50 mm (0" - 2") cement based concrete topping and underlayment with a compressive strength greater than 42 MPa (6,100 psi).

- 2.2.1.1.5. Use "ARDEX P 51™" porous substrate primer, "ARDEX P 82™" non-porous substrate primer: by ARDEX Group in accordance with manufacturer's recommendations for various substrates such as concrete, wood, cut back adhesives, epoxy, terrazzo, quarry and ceramic.
- 2.2.1.1.6. Use "ARDEX Feather Finish®", "ARDEX SD-P®" by ARDEX Group for isolated re-slope areas, isolated bug holes, isolated defect areas, non-moving cracks and seams, various repair or resurfacing areas.
- 2.2.1.2. Custom Building Products cementitious self-leveling floor underlayment: "CustomTech™ TechLevel™ 100", "CustomTech™ TechLevel™ 150", "CustomTech™ TechLevel™ XP-1™", "TechLevel-HPT" or commercial topping in accordance with manufacturer's recommendations for following:
 - 2.2.1.2.1. Without short downtime limitations requirements: "CustomTech™ TechLevel™ 100" by Custom Building Products normal setting polymer-modified self-leveling 0 mm - 38 mm (0" - 1-1/2") underlayment with a compressive strength greater than 27.5 MPa (4000 psi).
 - 2.2.1.2.2. Without short downtime limitations requirements: "CustomTech™ TechLevel™ 150" by Custom Building Products normal setting calcium aluminate-based self-leveling 0 mm - 38 mm (0" - 1-1/2") underlayment with a compressive strength greater than 29.6 MPa (4300 psi).
 - 2.2.1.2.3. Without short downtime limitations requirements: "CustomTech™ TechLevel™ XP-1™" by Custom Building Products normal setting calcium aluminate-based self-leveling 0 mm - 50 mm (0" - 2") underlayment with a compressive strength greater than 37.9 MPa (5500 psi).
 - 2.2.1.2.4. Without short downtime limitations requirements: "TechLevel-HPT" by Custom Building Products fast-setting self-leveling 6 mm - 25 mm (1/4" - 1") self-leveling high strength concrete wear topping with a compressive strength greater than 14.4 MPa (6000 psi).
 - 2.2.1.2.5. Use "TechPrime A Acrylic Primer" porous and non-porous substrate primer: by Custom Building Products in accordance with manufacturer's recommendations for various substrates such as concrete, wood, cut back adhesives, epoxy, terrazzo, quarry and ceramic.
 - 2.2.1.2.6. Use "Silk™ Patching & Finishing Compound" by Custom Building Products for isolated re-slope areas, isolated bug holes, isolated defect areas, non-moving cracks and seams, various repair or resurfacing areas.
- 2.2.1.3. MAPEI Inc. cementitious self-leveling floor underlayment: "Novoplan® 2 Plus, Ultraplan® 1 Plus, Ultraplan® M20 Plus" or commercial topping in accordance with manufacturer's recommendations for following:
 - 2.2.1.3.1. Without short downtime limitations requirements: "Novoplan® 2 Plus" by MAPEI Inc. normal setting polymer-modified self-leveling 0 mm - 25 mm (0" - 1") underlayment with a compressive strength greater than 29 MPa (4200 psi).
 - 2.2.1.3.2. Where short downtime limitations are required: "Ultraplan® 1 Plus" by MAPEI Inc. high-performance fast-setting self-leveling 0 mm - 38 mm (0" - 1-1/2") underlayment with a compressive strength greater than 31 MPa (4500 psi).
 - 2.2.1.3.3. Where extended flow characteristics are required: "Ultraplan® M20 Plus" by MAPEI Inc. fast setting self-leveling 0 mm - 50 mm (0" - 2") cement based concrete topping and underlayment with a compressive strength greater than 34.4 MPa (5000 psi).
 - 2.2.1.3.4. Self-Leveling Concrete Wear Topping: "Ultraplan® M20 Plus" by MAPEI Inc. fast setting self-leveling 13 mm - 50 mm (1/2" - 2") cement based concrete topping and underlayment with a compressive strength greater than 34.4 MPa (5000 psi).

- 2.2.1.4. Maxxon Canada Level Right-FS 10, Cementitious Self-Leveling Poured Floor Underlayment: Floor, Level Right-Plus, Level-Right or Commercial Topping in accordance with manufacturer's recommendations for following:
 - 2.2.1.4.1. Level-Right FS 10: 0 mm - 9 mm (0" - 3/8") thickness; up to 7000 psi, thin topping self levelling floor underlayment for topping concrete or precast. Proper surface preparation shall be provided such shot blasting or epoxy primers; remove tile glue and adhesive or other exterior foreign materials.
 - 2.2.1.4.2. Level-Right Plus: 0 mm - 38 mm (0" - 1-1/2"), up to 7000 psi, thick self levelling floor underlayment for unlevelled concrete or precast, pre-filling deep holes with aggregate and other similar materials.
 - 2.2.1.4.3. Level-Right (non-polymer): 0 mm - 75 mm (0" - 3"), up to 5500 psi; surface preparation shall be subject to site conditions. Use over polystyrene foam, lightweight concrete, precast, terrazzo flooring, ceramic, quarry and marble tile, adhesive, tile and concrete. Over wood frames use metal lath for reinforcement.
 - 2.2.1.4.4. Level-Right WearTop: Self-leveling cement-based topping for resurfacing interior concrete to provide level and smooth floors areas requiring a hard, smooth, flat concrete surface. Apply permitted sealer just 2 hours after installation except when an epoxy or other floor covering will be installed.
- 2.2.1.5. Sika cementitious self-leveling floor underlayment: "Sika Level 125, Sika Level 125 Rapid, Sikafloor Level 25" in accordance with manufacturer's recommendations for following:
 - 2.2.1.5.1. Without short downtime limitations requirements: "Sika Level 125" by Sika Canada Inc. polymer-modified self-leveling 0 mm - 25 mm (0" - 1") underlayment with a compressive strength greater than 29 MPa (4200 psi).
 - 2.2.1.5.2. Where short downtime limitations are required: "Sika Level 125 Rapid" by Sika Canada Inc. rapid strength gain, fast-setting self-leveler 0 mm - 25 mm (0" - 1") underlayment with a compressive strength greater than 38 MPa (5500 psi).
 - 2.2.1.5.3. Self-leveling concrete wear topping "Sikafloor Level 25" by Sika Canada Inc. rapid setting, polymer modified, self-leveling cementitious topping 5 mm - 25 mm (1/4" - 1") with a compressive strength greater than 38 MPa (5500 psi).
 - 2.2.1.5.4. Use "Sika Level 01 Primer, Sika Level 02 Primer, Sika Level 03 Primer" by Sika Canada Inc. in accordance with manufacturer's recommendations for various substrates such as concrete, wood, cut back adhesives, epoxy terrazzo, quarry tile and ceramic tile.
 - 2.2.1.5.5. Use "Sika Level Patch, Sika Level Skim Coat, Sika Level Screed" by Sika Canada Inc. for isolated re-slope areas, isolated bug holes, isolated defect areas, non-moving cracks and seams, various repair or resurfacing areas. Consult manufacturer's written instructions for specific uses.
- 2.2.2. Leakproof sealants, patching compound and primer as recommended by topping manufacturer's recommendations.
- 2.2.3. Other Permitted Products and Manufacturers: "Super Flo-Top" by Euclid Chemical Canada Inc., "Levelrock 4500" by CGC Inc., Industrial Product Group, "Floor Leveller C26 UL" by Target Products Ltd., "Sonoflow" by ChemRex or "CPD® Topcrete SL" by CPD Construction Products.
- 2.2.4. Protective Coating: Water based, breathable, water retardent, slip resistant, long wearing under foot traffic, polymerized, portland cementitious protective coating, "Maxxon® Acrylic Sealer" by Maxxon Canada.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Self-levelling Topping:
 - 3.2.1.1. Ensure sub-floor is structurally sound. Clean sub-floor and remove mud, oil, grease other contaminating materials.
 - 3.2.1.2. Grind and patch existing concrete slabs as required; level slabs, clean surfaces, remove adhesives and residues. Surfaces shall be smooth, clean, free of gouges, matter detrimental to bond of leveling coat and/or flooring and shall be ready to receive flooring.
 - 3.2.1.3. Make Good existing floor substrates suitable to receive thin, direct applied floor finishes including but not limited to scraping, grinding, patching and latex modified cementitious overlays as required.
 - 3.2.1.4. Patch damaged sub-floor with patching compound compatible with leak proof sealants and leveling topping and its primer. Seal cracks and voids with approved leak proof sealants compatible with self-leveling topping and its primer.
 - 3.2.1.5. Level all slabs to accommodate flooring with self-leveling underlayment. All floor areas shall be flush with adjacent areas. Prepare mix in accordance with manufacturer's instructions. Prepare for flush application of new flooring material. Provide aluminum retaining angles or other suitable means of containing leveling coat in areas required.
 - 3.2.1.6. Apply primer at recommended rate. Ensure area is enclosed from exterior elements and proper ventilation and required temperature is maintained. Place topping at recommended thickness and spread and screed to smooth surface. Dry self-leveling topping to finished floor applicator's requirements. Apply sealers to seal cementitious underlayment prior to installation of glue down flooring application. Ensure sealers are compatible with finish floor adhesive and installation systems.
 - 3.2.1.7. Provide slump test verifying conformance to manufacturer's requirements. Perform slump test at beginning of each installation to verify required slump. Test cubes in accordance with modified ASTM C472.
 - 3.2.1.8. Provide protection from heavy loads during construction when floor is subject to wheeled or concentrated loads.
- 3.2.2. Protective Coatings: Apply protective coatings in accordance with manufacturer's instructions.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

END OF SECTION

PART 1 - GENERAL**1.1. RELATED REQUIREMENTS**

- 1.1.1.1. Section 04 03 01.13 Heritage Masonry Cleaning
- 1.1.1.2. Section 04 03 05.13 Heritage Mortaring
- 1.1.1.3. Section 04 03 05.21 Heritage Repointing

1.2. REFERENCES

- 1.2.1. Canadian Standards Association (CSA International).
 - 1.2.1.1. CSA A179, Mortar and Grout for Unit Masonry.
 - 1.2.1.2. CSA-A371, Masonry Construction for Buildings.
- 1.2.2. Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - 1.2.2.1. Material Safety Data Sheets (MSDS).
- 1.2.3. Parks Canada.
 - 1.2.3.1. Standards and Guidelines for the Conservation of Historic Places in Canada-Second Edition.

1.3. SUBMITTALS

- 1.3.1. Submit documents and samples in accordance with Section 01 33 00 – Submittal Procedures and as specified in related Sections.
- 1.3.2. Product Data: submit manufacturer's printed product literature, specifications and data sheet for each product:
 - 1.3.2.1. Indicate date of manufacture of product and shelf life.
 - 1.3.2.2. Submit WHMIS and MSDS data sheets.
- 1.3.3. A list of tools and equipment to be used for all masonry work including for raking and repointing joints and for mortar repairs.
- 1.3.4. Provide a list of workers, masons and foreman, including a description of their experience with similar masonry heritage restoration works. The list should be organized into teams of workers to be used for each of the following tasks:
 - 1.3.4.1. Masonry Cleaning:
 - 1.3.4.1.1. General cleaning of work area.
 - 1.3.4.1.2. Removal of specific stains such as paint.
 - 1.3.4.1.3. Removal of atmospheric soiling.
 - 1.3.4.1.4. Removal of biological growth.
 - 1.3.4.1.5. Removal of efflorescence.
 - 1.3.4.2. Wall restoration:
 - 1.3.4.2.1. Masonry raking and repointing
 - 1.3.4.2.2. Masonry dismantling and rebuilding
 - 1.3.4.2.3. Anchor installation
 - 1.3.4.3. Stone repairs
 - 1.3.4.3.1. Stone dutchman repairs
 - 1.3.4.3.2. Mortar repairs

- 1.3.4.3.3. Shard repairs
- 1.3.4.3.4. Stone fracture repairs
- 1.3.4.3.5. In situ crack repairs
- 1.3.4.4. Mortar mixing: no more than two people should be assigned the task of mixing all mortars for the project. Both need to have been approved by the Consultant through the mock-up process.
- 1.3.4.5. Shop drawings:
 - 1.3.4.5.1. As required by other specified sections.
- 1.3.4.6. Samples:
 - 1.3.4.6.1. One of each type of masonry unit, accessory, anchor and reinforcing.
- 1.3.4.7. Scheduling:
 - 1.3.4.7.1. Submit dates indicating critical stages in masonry work. Include completion of shop fabrication and delivery to site where applicable.
 - 1.3.4.7.2. Include in schedule time for the required mock-ups, Consultant reviews and repair identification.
 - 1.3.4.7.3. Include detailing the duration of work on each of the areas with the duration and sequencing of each task, and the sequencing of each area.
- 1.3.4.8. Manufacturer's Instructions.
 - 1.3.4.8.1. Submit manufacturer's installation instructions.
- 1.3.4.9. Test Reports.
 - 1.3.4.9.1. Submit certified test reports showing compliance of materials with specified performance characteristics and physical properties.

1.4. QUALITY ASSURANCE - EXECUTION

- 1.4.1. Perform work in accordance with established procedures for heritage masonry conservation and The Standards and Guidelines for the Conservation of Historic Places in Canada.
- 1.4.2. Masonry Subcontractor:
 - 1.4.2.1. Masonry Subcontractor is to have extensive experience in heritage masonry work of similar size and complexity.
 - 1.4.2.2. Masonry Subcontractor is to have a good level of understanding of structural behavior of masonry walls.
- 1.4.3. Masons:
 - 1.4.3.1. Mason is to have extensive experience in heritage masonry work.
 - 1.4.3.2. Masons are to have proof of training for all proprietary restoration mortars and grouting.
- 1.4.4. Perform work under the direction of the Consultant.
 - 1.4.4.1. Provide demonstrated, specialized, skilled and competent trades persons who shall have extensive experience in all types of specified work. The skills of individuals will be subject to review and acceptance by the Consultant. Review will include production of basic mock-ups for all types of work specified.
 - 1.4.4.2. Provide a list of the proposed workers a minimum one week prior to commencement of their masonry work in this project.
 - 1.4.4.3. No workers shall be changed during the progress of the work without written acceptance by the Consultant.
 - 1.4.4.4. All workers shall be required to demonstrate competence levels of each masonry procedure to the satisfaction of the Consultant, before being permitted to work on the building.

1.5. QUALITY ASSURANCE – MOCK-UPS

- 1.5.1. Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
- 1.5.2. Construct mock-ups under supervision of Consultant to demonstrate a full understanding of specified procedures, techniques and formulations are achieved before work commences.
- 1.5.3. Construct mock-ups for each type of work procedure specified in part 3 of the Div 04 specifications.
- 1.5.4. Work cannot proceed for each type of work procedure without a reviewed and accepted mock-up. There will be no exceptions.
- 1.5.5. For all work procedures, only workers who performed a given mock-up will be allowed to perform the specified work procedure in question. There will be no exceptions.
- 1.5.6. Construct mock-ups to illustrate:
 - 1.5.6.1. General cleaning and cleaning for each type staining.
 - 1.5.6.2. Each type of repair procedure.
 - 1.5.6.3. Dismantling of wall.
 - 1.5.6.4. Deep-raking raking out of mortar: 6 m including horizontal and vertical joints at each of the following locations: areas of walls to be dismantled and reconstructed; areas of removal of the outer stone wall and areas of wall to be repointed.
 - 1.5.6.5. Repointing: Each type of stonework and mortar type, including methodology to meet environmental requirements for mortar curing. Include front-pointing color mock-up on wall, minimum size 6 linear meters.
 - 1.5.6.6. Backpointing (all depths): each type of stonework and mortar type, including methodology to meet environmental requirements for mortar curing, minimum size 6 linear meters.
- 1.5.7. Mock-up will be used:
 - 1.5.7.1. To judge workmanship, substrate preparation, operation of equipment and material application.
 - 1.5.7.2. For testing to determine compliance with performance requirements.
 - 1.5.7.3. Quality and degree of finish required.
- 1.5.8. Construct mock-up where indicated by Consultant.
 - 1.5.8.1. All mock-ups indicated above will be in same location.
 - 1.5.8.2. Coordinate and sequence activities accordingly.
- 1.5.9. Notify Consultant five business days prior to the start of the mock-up and allow three business days for inspection of mock-up by Consultant before proceeding with work.
- 1.5.10. Repeat mock-up until satisfactory results are obtained to satisfaction of Consultant.
- 1.5.11. When accepted by Consultant in writing, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.6. QUALITY ASSURANCE – SITE REVIEWS

- 1.6.1. Make mason's workshop accessible to Consultant for site review of current work-in-progress.

1.7. DELIVERY, STORAGE, AND HANDLING

- 1.7.1. Deliver, store, handle and protect materials in accordance with Section 01 61 00 – Common Product Requirements.
- 1.7.2. Deliver materials to job site in dry condition.
- 1.7.3. Storage and Protection.

- 1.7.3.1. Keep materials dry until use except where wetting of bricks or stone is specified. Protect from freezing and contamination.
- 1.7.3.2. Store under on pallets or plank platforms held off ground by means of plank or timber skids.
- 1.7.3.3. Store in covered enclosed weather protected enclosure.
- 1.7.4. Do not use materials which have exceeded manufacturer's recommended shelf life.

1.8. ENVIRONMENTAL REQUIREMENTS

- 1.8.1. Execute all mortar work when ambient temperature and humidity meet requirements specified for 04 03 05.13 – Heritage Motoring.
- 1.8.2. Provide continuous heating, ventilation and humidity control within the fabric enclosure during the period of October 1st and ending March 31st.
- 1.8.3. When ambient temperature drops below 10 degrees Celsius, provide heating and ventilation at own cost around curing area to ensure that stated environmental conditions are maintained for curing period. Take precautions to avoid overheating masonry.
- 1.8.4. Submit enclosure system for review by Consultant in accordance with Section 01 33 00 – Submittal Procedures. Refer to 01 50 00 – Temporary Facilities and Controls.

1.9. PRE-CONSTRUCTION CONFERENCE

- 1.9.1. One (1) week prior to scheduled start of work of this Section, the representatives of the following entities shall meet at the project site: Consultant, contractor, and representatives of other entities directly concerned with Work of this Section. This meeting will be coordinated through the Project Contractor.
- 1.9.2. Attendees shall review all pertinent details and specifications, noting any potential problems and making any changes, deletions or additions as deemed necessary. The Conference will include but not be limited to the following:
 - 1.9.2.1. Verify Project requirements.
 - 1.9.2.2. Review installation and substrate conditions.
 - 1.9.2.3. Coordination with other trades.
 - 1.9.2.4. Availability of materials and stone delivery rate
 - 1.9.2.5. Warranty and submittal requirements.
 - 1.9.2.6. Scheduling and sequencing of work.
 - 1.9.2.7. Scaffold and site installations
 - 1.9.2.8. Additional items relating to the Work.
- 1.9.3. Attendees shall also inspect the worksite and review condition of site and substrates, protection requirements, determine where mock-ups will be prepared and where or how other requirements such as lighting and ventilation will be implemented.
- 1.9.4. Minutes will be taken of the meeting, including agreement or disagreement on matters of significance. A copy of the minutes will be furnished to all attendees.

1.10. DOCUMENTATION

- 1.10.1. Refer to Section 01 35 91 – Heritage Protective Measures.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1.1. Refer to related sections for stone, brick, related materials, accessories and material preparation procedures.
- 2.1.1.2. Refer to section 04 03 01.13 – Heritage Masonry Cleaning for masonry cleaning procedures.
- 2.1.1.3. Isolation joint: 13mm thick 150mm high asphalt impregnated fibreboard.

2.2. SOURCE QUALITY CONTROL

- 2.2.1. Retain purchase orders, invoices, suppliers test certificates and documents to prove that materials used in contract meet requirements of specification.
- 2.2.2. Produce above upon request by Consultant and allow free access to sources where materials were procured.

PART 3 - EXECUTION

3.1. SEQUENCE OF WORK

- 3.1.1. Refer to specifications for each item of work listed below.
- 3.1.2. Submit the detailed raking and repointing plan, and associated schedule.
- 3.1.3. Install protection at each opening.
- 3.1.4. Submit dismantling, joint cutting and repointing plan indicating the schedule (sequence and duration) of each work phase and related tasks.
- 3.1.5. Complete stone documentation and numbering.
- 3.1.6. Allow for time for mock-ups to be completed for each type of cleaning, pointing and repair.
- 3.1.7. Allow access and time for survey by Consultant to identify repairs requiring consolidation prior to cutting out the joints, and other general repairs.
- 3.1.8. Cut out of joints as per submitted plan and as per specifications.
- 3.1.9. Back point and cure area (note that some repairs may need to be completed prior to back pointing)
- 3.1.10. Clean and wash down masonry.
- 3.1.11. Complete masonry repairs as per drawings. Provide required shoring.
- 3.1.12. Dismantle masonry (stone and bricks).
- 3.1.13. Review of removed stones by Consultant.
- 3.1.14. Repair stones on bench and prepare new stone.
- 3.1.15. Rebuild.
- 3.1.16. Back point and cure.
- 3.1.17. Clean and wash down masonry.
- 3.1.18. Front point and cure.
- 3.1.19. Complete final wash down.

3.2. VERIFICATION OF CONDITIONS

- 3.2.1. Report in writing, to Consultant, areas of deteriorated masonry revealed and not conforming to specified requirements of the Work.
- 3.2.2. Obtain Consultant's approval and instructions of repair and replacement of masonry units before proceeding with repair work.

3.3. MANUFACTURER'S INSTRUCTIONS

- 3.3.1. Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.4. PROTECTION

- 3.4.1. Take necessary safety measures to protect workers, building occupants and environment from silica and lead contamination during removal of mortar. Refer to 01 35 13 – Special Project Requirements.
- 3.4.2. Ensure workers are informed of hazards and trained in procedures prior to commencing work.

3.5. PREPARATION

- 3.5.1. Inspect site with Consultant and verify extent and location of mortar types prior to commencing installation.
- 3.5.2. Support:
- 3.5.2.1. Construct shoring, cradling, and temporary framing work to support structure parts during removal and resetting operations, in accordance with approved drawings. Drawings to be stamped and signed by engineer experienced with historic masonry structures and registered in Province of Ontario.
- 3.5.2.2. Leave work in safe condition when work is not in progress.
- 3.5.3. Take utmost care not to damage historic fabric. Make good any damage.
- 3.5.4. Seal and protect openings, doors, windows, and adjacent areas to prevent damage and spread of construction dust, water or other materials into the building.
- 3.5.5. Cover sills and projecting courses with rigid protection, secured into joints, for duration of work.
- 3.5.6. Prevent scaffolding, hoists or construction equipment from bearing directly against masonry or roof. Provide lumber or plywood with padding of sufficient thickness to prevent damage.
- 3.5.7. Obtain Consultant's approval prior to proceeding, for:
- 3.5.7.1. Extent and type of stone to be replaced, repaired or removed.
- 3.5.7.2. Methodology and tools to be employed before commencing work.

3.6. INSTALLATION

- 3.6.1. Do masonry work in accordance with CSA-A371 except where specified otherwise.
- 3.6.2. Build masonry plumb, level, and true to line, with vertical joints in alignment.
- 3.6.3. Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- 3.6.4. Install isolation joints as indicated on drawings and as per manufacturer's instructions.

3.7. CONSTRUCTION

- 3.7.1. Remove, repair and replace masonry as indicated.
- 3.7.2. Jointing:
- 3.7.2.1. Allow joints to set just enough to remove excess water, then finish joint as specified.
- 3.7.2.2. Finish joints as specified in Section 04 03 05.21 – Heritage Repointing.

3.8. SITE TOLERANCES

- 3.8.1. All joints must line up with existing stone coursing.

3.9. FIELD QUALITY ASSURANCE

- 3.9.1. Coordinate, include and complete all the inspection and testing required. The testing is to be completed by a laboratory that has the required experience for testing heritage mortars.

3.10. PROTECTION – WORK AND MATERIALS

- 3.10.1. At end of each working day, cover unprotected work with waterproof membranes. Membranes should extend to 0.5 m over surface area of work and be tightly installed to prevent finished work from drying out too rapidly.
- 3.10.2. Protect masonry and other work from marking and impact damage. Protect completed work from mortar droppings. Use non-staining coverings.
- 3.10.3. Maintain protection for minimum three weeks upon completion of the work.

END OF SECTION

PART 1 - GENERAL

1.1. SUMMARY OF WORK

- 1.1.1. General cleaning of exterior masonry within the scope of work.
- 1.1.2. Cleaning types includes:
 - 1.1.2.1. General cleaning of atmospheric soiling on stone.
 - 1.1.2.2. Cleaning of thick sulphate and heavy atmospheric soiling on stone.
 - 1.1.2.3. Removal of caulked sealants.
 - 1.1.2.4. Surfactant cleaning on stone.
 - 1.1.2.5. Removal of salts from stone and wall surfaces using clay poultices.
 - 1.1.2.6. Removal of biological growth on stone.

1.2. REFERENCES

- 1.2.1. Federal Legislation.
 - 1.2.1.1. Canadian Environmental Assessment Act, (CEPA).
 - 1.2.1.2. Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- 1.2.2. Material Safety Data Sheets (MSDS).
 - 1.2.2.1. Mine Safety and Health Administration/National Institute for Occupational Safety and Health (MSHA/NIOSH) Standards.

1.3. QUALITY ASSURANCE

- 1.3.1. Refer to the requirements of Section 04 03 01 – Common Work Results for Heritage Masonry.

1.4. SEQUENCING AND SCHEDULING

- 1.4.1. Perform cleaning prior to start of masonry work, and following completion of replacement of stone and backpointing, and prior to carrying out stone repairs, and following front pointing. Sequence subsequent applications to approval of Consultant.
- 1.4.2. Allow period of curing as specified in applicable sections prior to all cleaning operations.

1.5. PROJECT CONDITIONS

- 1.5.1. General Project conditions are defined in Section 04 03 01 – Common Work Results for Heritage Masonry.

1.6. ENVIRONMENTAL REQUIREMENTS FOR EXTERIOR MASONRY

- 1.6.1. Do not use wet cleaning methods when there is threat of frost.
- 1.6.2. Do not use chemical cleaners when ambient temperature is below 10 degrees Celsius.
- 1.6.3. Do not use chemical cleaners when surface temperature of materials to be cleaned is below 10 degrees Celsius.
- 1.6.4. Provide shading to wall to avoid cleaning in full, hot sunlight.
- 1.6.5. Do not clean if there is risk of cleaning materials being blown onto publicly accessible areas, or if other materials will be damaged by cleaning process.
- 1.6.6. Collect and dispose of used cleaning materials and products immediately below and local to area of cleaning. Prevent run off and absorption of water, chemicals or abrasives into masonry below cleaning area.
- 1.6.7. Collection and disposal system to approval of Consultant.

1.7. MOCK-UPS

- 1.7.1. Submit samples and construct mock-ups in accordance with Section 01 33 00 – Submittal Procedures, and Section 04 03 01 - Common Work Results for Masonry.
- 1.7.2. General:
 - 1.7.2.1. Do mock-up tests in accordance with Section 04 03 01 - Common Work Results for Masonry.
 - 1.7.2.2. The location of the test patches will be identified by Consultant.
 - 1.7.2.3. Allow for maximum of 3 cleaning test patches for each type of deposit being removed.
 - 1.7.2.4. Allow for maximum of 4 test patches for each other type of cleaning specified herein and for each type of stones.
 - 1.7.2.5. Allow for 200 cm² test patch for each type of cleaning specified herein.
 - 1.7.2.6. Notify Consultant two weeks before commencing cleaning of each test patch. Obtain approval from Consultant before commencing test.
 - 1.7.2.7. Prior to cleaning mock-ups, submit all relevant product data for review by Consultant.
 - 1.7.2.8. Conduct tests on building to determine effectiveness of low-pressure wash cleaning methods.
 - 1.7.2.9. Determine effect of cleaning operations on surrounding historic material and plants.
 - 1.7.2.10. Stop work when cleaning has detrimental effect on surrounding material and plants.
 - 1.7.2.11. Proceed with cleaning after written instructions are received from the Consultant.
 - 1.7.2.12. Protect masonry openings from water/chemical infiltration during cleaning.
 - 1.7.2.13. Collect, neutralize and dispose of water and chemicals in accordance with contract requirements, applicable regulations and Canadian Environmental Protection Act, (CEPA).
- 1.7.3. Test brushing and spraying as an alternative to pressure washing. Consult Consultant to review test results. Use method approved by Consultant.
- 1.7.4. Test rust removal methods to establish effective poultice formulations and dwell times.
- 1.7.5. Test a variety of guano (avian droppings) removal methods as specified in PART 3 - EXECUTION, to establish the most effective method.
- 1.7.6. For other cleaning methods, prepare mock-ups as prescribed under PART 3 - EXECUTION.
- 1.7.7. Submit mock-ups for each of the cleaning procedures described in this section.

1.8. SUBMITTALS

- 1.8.1. Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- 1.8.2. Submit WHMIS documentation.
- 1.8.3. Comply with the requirements of Workplace Hazardous Materials Information Sheet (WHMIS) and submit documentation to Consultant.
- 1.8.4. Submit details of protection measures.
- 1.8.5. Submit schedule of cleaning work. Include interfacing of schedule with cleaning of masonry required in other sections.
- 1.8.6. Submit data sheets of all cleaning products specified in this section.
- 1.8.7. Test Results:
 - 1.8.7.1. Submit two copies of test results describing cleaning methods used for cleaning of each test patch.
- 1.8.8. Samples:

- 1.8.8.1. Demonstrate machinery, tools, and nozzles.
- 1.8.8.2. Submit samples of each cleaning material.

PART 2 - PRODUCTS

2.1. GENERAL

- 2.1.1. Any materials or equipment not listed below will not be allowed for use without prior consent by the Consultant.
- 2.1.2. Provide for all materials proof of meeting the requirements of the Canadian Environmental Protection Act (CEPA).
- 2.1.3. Heritage protection materials and accessories are described Section 01 35 91 – Heritage Protective Measures.

2.2. MATERIALS

- 2.2.1. Water: potable water, clean and free from contaminants.
- 2.2.2. Compressed air: free from oil or other contaminants.
- 2.2.3. Aluminum tape.
- 2.2.4. Ethylene Diamine Tetra-acetic Acid (EDTA)
- 2.2.5. Surfactant for gentle cleaning:
 - 2.2.5.1. Acceptable products:
 - 2.2.5.1.1. Orvus Paste
- 2.2.6. General atmospheric soiling:
 - 2.2.6.1. Acceptable products:
 - 2.2.6.1.1. Prosoco Revive
 - 2.2.6.1.2. Enviro Klean Klean N Release
- 2.2.7. Heavy atmospheric soiling
 - 2.2.7.1. Acceptable products:
 - 2.2.7.1.1. Prosoco Sure Klean 766 Limestone & Masonry Prewash with Prosoco Sure Klean Limestone & Masonry Afterwash
 - 2.2.7.1.2. Prosoco Sure Klean Limestone Restorer
 - 2.2.7.1.3. Dumond Safe n' Easy Limestone Cleaner or equivalent
- 2.2.8. Biocide for organic soiling:
 - 2.2.8.1. Acceptable products:
 - 2.2.8.1.1. D/2 Biological Solution
 - 2.2.8.1.2. Keim Algicide Plus algicide and fungicidal wash
- 2.2.9. Ferric stain removal system:
 - 2.2.9.1. EDTA
 - 2.2.9.2. Diatomaceous clay
- 2.2.10. Paint stripping system:
 - 2.2.10.1. Dumond Smart Strip PRO
 - 2.2.10.2. Dumond Laminated paper

- 2.2.11. Poultice for copper and salt staining system:
- 2.2.11.1. Absorbent clay, attapulgite clay (Fuller's Earth).
- 2.2.11.2. Poultice reinforcement and accessories:
- 2.2.11.3. Fibre reinforcing; fibrillated fibre concrete reinforcement.
- 2.2.11.4. Plastic mesh reinforcing; alkali resistant.
- 2.2.11.5. Curing sheet: clear film, household plastic shrink wrap.

2.3. TOOLS

- 2.3.1. List described is not definitive:
- 2.3.1.1. Scrapers: wood, plastic or stainless steel depending on work performed. All steel scrapers will require rounded edges to prevent gouging.
- 2.3.1.2. Buckets of various sizes with fitted lids.
- 2.3.1.3. Colourfast sponges for aqueous based cleaning chemicals.
- 2.3.1.4. Stiff nylon brushes.
- 2.3.1.5. Soft nylon brushes.
- 2.3.1.6. 4 ml and 6 ml polyethylene sheeting.
- 2.3.1.7. Small wooden wedges.
- 2.3.2. Protection equipment:
- 2.3.2.1. Masks, glasses, gloves, suits as required by specific product.

2.4. EQUIPMENT

- 2.4.1. Water cleaning and rinsing equipment:
- 2.4.1.1. Use water pumps fitted with accurate pressure regulators and gauges capable of being preset and locked at maximum required levels.
- 2.4.1.2. Low pressure water rinsing equipment (under 400 PSI / 3 MPa). Maximum flow of 15 litres per minute. Pressure gauge at pump. Fan type nozzles. Equip with heaters to provide a range of water temperature.
- 2.4.2. Air compressors equipped with on-line oil filters to avoid spraying oil onto masonry.
- 2.4.3. Chemical fume extractor filtering system with 100% capability of drawing and filtering chemical fumes produced in all relevant working areas.
- 2.4.4. Heavy duty electric heat gun. Heat generated from electric coils. No open flame.
- 2.4.5. Vacuum Cleaner designed for industrial use, HEPA type

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. For stones that are completely dismantled and reused:
- 3.1.1.1. Stones must be cleaned of all stains and old mortar (included mortar feathered on surface) prior to reuse.
- 3.1.2. For walls that are rehabilitated in situ:
- 3.1.2.1. Biocide wash must be completed prior to the start of the masonry work, and prior to front pointing. Localized biocide treatment will be required in areas of stone dismantling.

- 3.1.2.2. Chemical cleaning must be carried out after joint cut out and deep back pointing are completed, but before final finished repointing work begins. All cleaning must be completed prior to any wall openings or only after wall openings are made and stones are reset and backpointed. All cleaning must be completed prior to all mortar repair work.

3.2. PROTECTION

- 3.2.1. All protection must be in place to protect property from chemicals, water and abrasives used for carrying out work. This includes:
- 3.2.1.1. Maintain clean air controls to all work areas, ensuring that no fumes are carried to other areas of the building or to the exterior where workers or pedestrians may be present.
- 3.2.1.2. Provide complete floor, wall, glass, metal, and property protection to areas not included in work.
- 3.2.1.3. Provide effective troughs to collect run-off fluids used in the cleaning processes.
- 3.2.1.4. Provide full protection to workers.
- 3.2.1.4.1. Workers must be informed of the hazards related to the chemicals that they are using.

3.3. PREPARATION

- 3.3.1. Provide all protection as stated above and elsewhere in this Contract Specification.
- 3.3.2. Proceed with cleaning only under well-lit conditions.
- 3.3.3. Provide a functioning means of extracting air and control of its directional flow, including filtering where necessary.

3.4. GENERAL CLEANING FOR INITIAL AND BIOCIDES WASH DOWN OF WALLS

- 3.4.1. Initial wash cleaning of the walls should take place prior to start of any masonry work, and second biocide wash down should take place prior to front pointing.
- 3.4.2. Ensure that temperature is above 10C during the day and night.
- 3.4.3. Cleaning method and materials will only proceed once mock-ups are performed and discussed with Consultant.
- 3.4.4. Rinse wall with pressure washers using 400 PSI (3 MPa) or less.
- 3.4.5. Apply biocide undiluted or mixed with water as directed. Reapply if rain occurs within 12 hours of application.
- 3.4.6. Allow for 24-hour dwell time.
- 3.4.7. Brush surface vigorously by hand with stiff bristle brush.
- 3.4.8. Rinse with pressure wash.

3.5. GENERAL CLEANING OF ATMOSPHERIC SOILING ON STONE

- 3.5.1. Pressure wash with water at maximum 400 PSI (3 MPa).
- 3.5.2. Apply proprietary cleaners as directed by Consultant.
- 3.5.3. Adjust water temperature as directed by Consultant.

3.6. CLEANING OF THICK SULFATE AND HEAVY ATMOSPHERIC SOILING ON STONE

- 3.6.1. Protect all adjacent architectural stone details sufficiently to ensure the cleaning medium does not flow or drip on the surface. Trap, retain and safely discard all such dripping or overflowing cleaning medium.
- 3.6.2. Apply cleaner liberally to affected soiled surface using a medium firm painter's brush. Agitate on surface with swirling motion for several minutes.

- 3.6.3. Only apply to surface areas that can be controlled within 30-minute period. Approximately 4 sq. ft. per worker.
- 3.6.4. Apply cleaning products as per manufacturer's instructions and as directed by the Consultant.
- 3.6.5. Rinse all of surface thoroughly using low pressure rinse of 400 PSI (3 MPa) being certain that the wand is fitted with a fan-tipped nozzle which is held not closer than 12 inches from surface.
- 3.6.6. Continue to rinse thoroughly such that all blackened surfaces have been thoroughly gone over several times and the surface pH has neutralized.
- 3.6.7. Spot clean following same procedure as above to remove surfaces still retaining black deposits.

3.7. REMOVAL OF CAULKED SEALANTS

- 3.7.1. All caulking and sealants are to be removed including:
 - 3.7.1.1. Between metal flashing and masonry.
 - 3.7.1.2. Between door or transom casing and masonry.
 - 3.7.1.3. Between any signage, devices, and fixtures removed from masonry.
- 3.7.2. Full skin and breathing protection are required.
- 3.7.3. Methods and procedures
 - 3.7.3.1. Begin by cutting away as much of the caulking as is possible using small sharp knives, combined with pulling away by hand.
 - 3.7.3.2. Liberally apply thickened paint stripper to the stone where the caulking adheres to the grains of the surface and cover immediately with light plastic to prevent drying.
 - 3.7.3.2.1. Do not apply in direct sunlight. Keep working surface while shaded.
 - 3.7.3.2.2. Do not let the stripper dry on the surface. Keep covered to prevent drying, adding liberal amounts of the chemical to maintain a wet, active contact with the surface.
 - 3.7.3.3. Allow the stripper to dwell on the surface for approx. 20 minutes.
 - 3.7.3.4. Agitate the surface with a small stiff bristle brush.
 - 3.7.3.5. As it begins to peel and lift, swab the caulking up, being certain that the cotton rag used for swabbing is wetted with additional stripper.
 - 3.7.3.6. Repeat procedure as necessary. A final pass over the surface using a sharp chisel pneumatically driven at low speed may be used if approval is given by the Consultant.

3.8. PIGEON DROPPINGS (GUANO)

- 3.8.1. For removal of heavy pigeon dropping (guano) soiling: Comply with provincial and local requirements and these specifications, provided that in any case of conflict, the more stringent requirements shall apply. Work shall be performed under regulations in effect at the time work is performed. Regulations include, but are not limited to:
 - 3.8.1.1. Ministry of Labour Occupational Health and Safety Act and regulations, including Regulations for Construction Projects, as amended.
 - 3.8.1.2. Ministry of Environment regulations for the transportation and disposal of waste, including R.R.O. Reg. 347.
- 3.8.2. Cleaning of bird soiling and staining from stone masonry.
- 3.8.3. Remove bird soiling from building surfaces.
- 3.8.4. Use scrapers. Remove as much soiling as possible.
- 3.8.5. Use low pressure, maximum 140 kPa surfactant cleaning. Supplement with bristle brushing on sound substrates.

3.8.6. Use additional techniques and poultices as necessary or as directed.

3.8.7. Allow poultices to dry.

3.8.8. Re-perform poultice procedure as necessary.

3.8.9. Water-abrasive clean pigeon repellent.

3.9. FERRIC STAIN REMOVAL

3.9.1. Prepare poultices using EDTA mixed in diatomaceous clay.

3.9.2. Chemical preparations will be directed and supervised by the Consultant.

3.9.3. Dwell times and the effectiveness of the various poultices will be determined through mock-ups directed and supervised by the Consultant.

3.9.4. Repeat application for up to 5 cycles.

3.9.5. Provide low pressure micro-abrasive cleaning to provide final touch up to the cleaned areas where it is felt to be necessary by the Consultant.

3.9.6. Applies to all wall areas of ferric oxide cleaning.

3.10. REMOVAL OF BITUMEN AND TARS

3.10.1. Scrape and remove thick deposits.

3.10.1.1. Assist this dry removal using CO2 freezing of surface if necessary and according to instructions given by Consultant.

3.10.2. Apply poultice based on organic solvent.

3.10.3. Take appropriate care to strictly maintain the tar to the affected area. Do not let the stain transfer or bleed to other areas of the masonry.

3.11. PAINT REMOVAL

3.11.1. Mechanical removal of paint will precede that of chemical removal.

3.11.2. Scrape surfaces with non-ferric scrappers to remove loose paint.

3.11.3. Beyond scraping of loose paint, a number of mock-ups using any of the following procedures and materials under the direction and supervision of the Consultant will be carried out, with the aim of determining the best method and procedure to remove the paint without causing damage to the stones.

3.11.3.1. Carry out a mock-up using a heat gun and scraper to determine the effectiveness of this method.

3.11.3.2. Carry out a mock-up using paint stripper in gel form.

3.11.3.2.1. Work surface must be between 20 and 25 degrees Celsius.

3.11.3.2.2. Apply paint stripper liberally to surface of paint.

3.11.3.2.3. Cover with plastic sheeting to avoid evaporation.

3.11.3.2.4. Leave in contact, making sure that surface is agitated frequently with a stiff brush, and the paint stripper is generously spread over the surface throughout the dwell time.

3.11.3.2.5. Dwell time will be determined by calculating the maximum effect of the chemical within a given time. This will be determined by the Consultant.

3.11.3.2.6. Scrape all loosened paint and discard immediately.

3.11.3.2.7. Repeat procedure until natural surface of the stone is exposed.

3.11.3.2.8. Rinse and scrub by hand with hot water.

3.11.3.3. Carry out mock-ups using Paint Removal systems. Two applications will be required.

- 3.11.4. Install air extraction and filter system for all chemical procedures described above where chemical fumes are emitted and maintain throughout work once the prescribed method to remove paint is determined by Consultant.
- 3.11.4.1. Fumes originating from any of the paint removing procedures will not be tolerated and must be extracted and filtered at the contained location of work.
- 3.11.4.2. Contractor must prove the effectiveness of the extraction system by carrying out air quality tests daily.
- 3.11.4.3. Failure to provide adequate extraction and filtering equipment will lead to an immediate demand from the Consultant to stop work until the problem is corrected and at no extra cost to the Consultant for delays or equipment improvement.

3.12. SURFACTANT CLEANING

- 3.12.1. The following method will be used for cleaning of all light or loosely bonded forms of soiling including areas soiled by site work during project or for any other lightly soiled areas of masonry.
- 3.12.2. Dry brush with stiff bristle brush all surfaces to remove accumulated loose dirt, suctioning the dirt with a vacuum as it loosens.
- 3.12.3. Provide protection, troughs and all installations necessary to ensure cleaning solution does not spill, drip or in any other way make contact with sensitive areas of wall.
- 3.12.4. Liberally wet the surface of the soiled stones with the surfactant and hot water solution.
- 3.12.4.1. Concentrations of the surfactant and water solution will be determined by the Consultant.
- 3.12.5. Brush aggressively by hand using a stiff bristle brush. Do not allow to dry. Work on maximum surface areas which are manageable any one time.
- 3.12.5.1. Brushes must be of various shapes and sizes to allow easy and certain contact with all shaped surfaces of the stones being cleaned.
- 3.12.6. Discard surfactant solution as soon as it becomes dirty and replace with fresh solution.
- 3.12.7. Once surface is clean and to the satisfaction of the Consultant, rinse the surface of the cleaned stones by applying liberally with hot water keeping certain to collect all spillage of the rinse water.
- 3.12.8. Any damage of adjacent wall surfaces such as mortars, glass, plaster, metal, and wood, will be replaced or repaired to the Consultant's satisfaction at the expense of the Subcontractor.

3.13. REMOVAL OF SALTS FROM STONE AND WALL SURFACES USING CLAY POULTICES

- 3.13.1. Brush and vacuum all loose salt efflorescence from the affected surface of stones.
- 3.13.2. Mix diatomaceous earth in a bucket with sufficient amounts of potable water to create a wet but cohesive consistency. The Consultant will determine the correct consistency for the clay poultice mixture.
- 3.13.3. Apply clay poultice to the affected surface of wall to a thickness of 6 mm.
- 3.13.4. Cover with polyethylene for 24 hours, remove and allow poultice to dry at a control atmospheric temperature between 18 and 24 degrees Celsius and a relative humidity of 65%.
- 3.13.5. When the poultice has thoroughly dried after approximately 7 days, remove the poultice by scraping with wooden scrapers directly into disposable bags and remove from site.
- 3.13.6. Brush and vacuum the surface thoroughly.
- 3.13.7. Rinse with a low-pressure water rinse.
- 3.13.8. Allow wall area to wait 3 days before repeating the procedures, maintaining temperatures between 18 and 24 degrees Celsius and humidity at 65% during this waiting period.

3.13.9. Repeat procedure above for a minimum of 3 times, or as requested by the Consultant.

3.14. GENERAL CLEANING FOR FINAL WASH DOWN OF WALLS.

3.14.1. Final wash cleaning of the walls will not take place until 28 days have passed after front-pointing is completed.

3.14.2. Cleaning method and materials will only proceed once mock-ups are performed and discussed with Consultant.

3.14.3. Rinse with medium pressure water at maximum 400 PSI (3 MPa)

3.14.4. Apply surfactant mixed with clean water as directed and brush surface vigorously by hand with stiff bristle brush.

3.14.5. Rinse with pressure wash.

3.15. CLEAN-UP

3.15.1. Rinse off masonry to the satisfaction of the Consultant.

3.15.2. Rinse from bottom to top and from top to bottom.

3.15.3. Upon completion, check the pH levels of stone where chemicals have been used during the cleaning process. If pH levels are not neutral, flush with water. Continue flushing as necessary until pH level of wall surface achieves a neutral pH value of 7 to 8.5.

3.15.4. Collect and dispose of cleaning materials and clean up work area as work progresses.

3.15.5. Collect and dispose of chemicals and hazardous waste in accordance with applicable hazardous waste legislation.

3.15.6. Carefully scrape residue into plastic bags and remove. Remove and dispose of droppings.

3.15.7. Upon completion, clean and restore areas used for work to condition at least equal to that previously existing.

END OF SECTION

PART 1 - GENERAL

1.1. SUMMARY

- 1.1.1. Mortar work for historic stone and brick.

1.2. ALTERNATES

- 1.2.1. Obtain Consultant's approval before changing manufacturer's brands or sources of supply of mortar materials during entire contract or other methods of mixing mortar specified elsewhere in this specification.

1.3. REFERENCES

- 1.3.1. ASTM International
- 1.3.1.1. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.
- 1.3.1.2. ASTM C 207, Standard Specification for Hydrated Lime for Masonry Purposes.
- 1.3.1.3. ASTM C 270, Standard Specification for Mortar for Unit Masonry.
- 1.3.1.4. ASTM C 780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- 1.3.1.5. ASTM C 926, Standard Specification for Application of Portland Cement-Based Plaster.
- 1.3.1.6. ASTM C 1072, Standard Test Method for Measurement of Masonry Flexural Bond Strength.
- 1.3.2. CSA International
- 1.3.2.1. CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- 1.3.2.2. CAN/CSA-A179, Mortar and Grout for Unit Masonry.
- 1.3.2.3. CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- 1.3.3. European standards.
- 1.3.3.1. EN 459-1, Building lime. Definitions, specifications and conformity criteria.
- 1.3.3.2. EN 459-2, Building Lime. Test Methods

1.4. ALLOWABLE TOLERANCES

- 1.4.1. If mortar fails to meet the 7-day compressive strength requirements, but meets the 28 day compressive strength requirement, it is acceptable. If mortar fails to meet the 7 day compressive strength requirement, but its strength at 7 days exceeds two thirds of the minimum value required for the 7 day strength, Contractor may elect to continue work at his own risk while awaiting the results of the 28 day tests, or to take down the work affected.

1.5. SUBMITTALS

- 1.5.1. Submit in accordance with Section 01 33 00 – Submittal Procedures and Section 04 03 01 – Common Work Results for Heritage Masonry.
- 1.5.2. Product Data:
- 1.5.2.1. Submit manufacturer's instructions, printed product literature and data sheets for mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.5.2.2. Prior to mixing or preparation of mortars submit for review to Consultant confirmation of source or product data sheet of all mortar and grout products
- 1.5.3. Samples:

- 1.5.3.1. Provide samples in quantity and size in accordance with CAN/CSA-A179.
- 1.5.3.2. Provide colour matched samples for all mortar types. Provide up to 5 samples for each mortar type of 100mm diameter and 40 mm thick. Cure as specified in related sections.
- 1.5.3.3. Prepare samples to represent same exposure conditions of building. Fully cure minimum 3 days.
- 1.5.3.4. Additional cubes for testing. Provide additional series of cubes for long term testing by the Owner as follows:
- 1.5.3.5. For all mortar types: up to 5 sets of cubes from selected mortar batches as directed by Consultant.

1.6. TEST REPORTS

- 1.6.1. Submit test reports.
- 1.6.2. Test results to show that properties match allowable tolerances.
- 1.6.3. All tests to indicate quantity and ratio of mortar materials, including water added.
- 1.6.4. Test reports required for each mortar type minimum 14 days prior to commencement of work. Submit test results during site work as directed by Consultant as follows:
 - 1.6.4.1. Air content: mortar mix in plastic state.
 - 1.6.4.2. Vicat cone penetration: mortar mix.
 - 1.6.4.3. Mortar compressive strength: at 7 and 28 days or as otherwise required.
 - 1.6.4.4. Flow test: mortar mix.
- 1.6.5. Test reports required following commencement of work. For all mortar types carry out all following tests for first 5 batches and every 10th subsequent batch:
 - 1.6.5.1. Vicat cone penetration measurements.
- 1.6.6. Mock-up: provide colour matched samples on building for final acceptance of materials.
- 1.6.7. Refer to Section 04 03 01 – Common Work Results for Heritage Masonry for other quality assurance requirements.

1.7. QUALITY ASSURANCE

- 1.7.1. Refer to the requirements of Section 04 03 01 – Common Work Results for Heritage Masonry.
- 1.7.2. Contractor to appoint 2 individuals to mix mortar for duration of project. If these individuals must be changed, mortar mixing must cease until new individual is trained, and mortar mix is tested.
- 1.7.3. Consultant to be in attendance for mortar mixing mock-up, which is to include Vicat testing. If two (2) individuals are appointed to mix mortar for the project, they are both required to attend the mortar mixing mock-up.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Deliver, store, handle and protect materials in accordance with Section 04 03 01 – Common Work Results for Heritage Masonry.

1.9. ENVIRONMENTAL REQUIREMENTS

- 1.9.1. Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- 1.9.2. Execute work when ambient temperature is between 10 and 27 degrees Celsius. When ambient temperature is below 10 degrees Celsius, cure and heat work as directed by Consultant.
- 1.9.3. Prepare and maintain temperature of mortar between 10 and 27 degrees Celsius until used.
- 1.9.4. When temperature is 10 degrees Celsius or less:

- 1.9.4.1. Store materials for immediate use within heated enclosure. Allow these materials to reach minimum temperature of 10 degrees Celsius (that is equilibrium with air temperature in enclosure).
- 1.9.4.2. Heat water to minimum of 20 degrees Celsius and maximum of 25 degrees Celsius:
- 1.9.4.3. At time of use temperature of mortar to be minimum of 10 degrees Celsius and maximum of 27 degrees Celsius.
- 1.9.5. Do not mix cement with water or with sand or with water-sand mixtures having higher temperature than 25 degrees Celsius.
- 1.9.6. Ambient Conditions:
 - 1.9.6.1. Provide weather-tight enclosure (mortar shed) to store materials and mix mortars, maintain air temperature above 10 degrees C at all times. Ensure that the enclosure is adequately ventilated and lit.
 - 1.9.6.2. Maintain maximum/minimum thermometers and relative humidity gauges on site and in enclosures.
 - 1.9.6.3. Maintain a daily record of temperature and humidity.
- 1.9.7. Install relative humidity and temperature equipment, record temperature and relative humidity and submit report to Consultant.
- 1.9.8. Allow the following delay intervals between the completion of bedding mortar work and the installation of face pointing mortars:
 - 1.9.8.1. 7 days for Portland Cement/Lime Mortars
- 1.9.9. For Portland Cement / Lime Mortars, maintain the following conditions.
 - 1.9.10. Maintain conditions for 7 days;
 - 1.9.10.1. Temperatures greater than 10 degrees Celsius.
 - 1.9.10.2. Relative Humidity: minimum 80% for 3 days.
 - 1.9.10.3. Relative Humidity: minimum 50% for 4 days.
 - 1.9.11. Where reconstruction/rebuilding of the masonry occurs and /or where complete masonry wall re-assembly occurs, extend curing period to a minimum of 28 days. Maintain temperatures greater than 10 degrees Celsius and RH greater than 25%.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Pre-bagged, pre mixed mortars are to be used.
- 2.1.2. Use the same manufacturer and supplier for mortar material for entire project:
 - 2.1.2.1. Mortar product(s) are to be designed for use in context of heritage conservation work
 - 2.1.2.2. Mortar product(s) are to meet allowable tolerances, described in Part 1.5 of this specification. Mortar mix for bedding mortar and pointing mortar can be different mixes, as required to meet the allowable tolerances
 - 2.1.2.3. Mortar product(s) to contain hydraulic lime (not hydrated lime), confirming to ASTM C141/C141M-14.
 - 2.1.2.4. Mortar products to contain sand conforming to CSA-A179-14 sharp, screened and washed siliceous pit sand, free of any organic material.
 - 2.1.2.5. Mortar products to contain an air entraining agent.
 - 2.1.2.6. Cement cannot be present in the mortar product(s).

- 2.1.2.7. Colour: Bagged mortar to be coloured in factory, by the supplier. Mortar is not to have pigments added on site. A custom colour mortar matching the existing condition, to be prepared by the manufacturer. To achieve custom colour, assume representative specimens of existing mortar are to be shipped to the mortar supplier, or the mortar supplier is to visit the building to prepare samples.
- 2.1.3. Water: potable, clean and free from contaminants. Pre-treat water having high iron or other metal content to prevent staining.
- 2.1.4. All products be stored and used in accordance with manufacturer's recommendations, including maximum shelf life. Store materials in dry conditions away from wet or moisture.

2.2. MORTAR SCHEDULE

- 2.2.1. Mortar Type to be confirmed based on testing results. Mortar(s) are to be consistent with the requirements in this section and to the satisfaction of the Consultant.
- 2.2.2. Mortar Type 1: Bedding Mortar:
 - 2.2.2.1. Location: All above ground and below ground masonry and stone setting. Below grade repointing.
 - 2.2.2.2. Vicat Cone penetration of mortar mix in plastic state, to ASTM C780:
 - 2.2.2.2.1. 25 mm minimum, 40 mm maximum
 - 2.2.2.3. Air content of plastic mix, using meter designed to record air content of mortars to EN 459-2:
 - 2.2.2.3.1. 6 % minimum, 14 % maximum.
 - 2.2.2.4. Mortar compression strength, tested in conformance with CSA A3004-C2:
 - 2.2.2.4.1. 7 days, 0.5 – 2.0 MPa,
 - 2.2.2.4.2. 28 days, 1.5 – 4.0 MPa,
 - 2.2.2.4.3. 90 days, 2.5 – 6.0 MPa.
- 2.2.3. Mortar Type 2: Pointing Mortar:
 - 2.2.3.1. Location: Above grade repointing
 - 2.2.3.2. Colour: Match grey original mortar.
 - 2.2.3.3. Vicat Cone penetration of mortar mix in plastic state, to ASTM C780:
 - 2.2.3.3.1. 10 mm minimum, 25 mm maximum
 - 2.2.3.4. Air content of plastic mix, using meter designed to record air content of mortars to EN 459-2:
 - 2.2.3.4.1. 6 % minimum, 14 % maximum.
 - 2.2.3.5. Mortar compression strength, tested in conformance with CSA A3004-C2:
 - 2.2.3.5.1. 7 days, 0.5 – 2.0 MPa,
 - 2.2.3.5.2. 28 days, 1.5 – 4.0 MPa,
 - 2.2.3.5.3. 90 days, 2.5 – 6.0 MPa.
- 2.2.4. Mortar Type 3: Repair Mortar:
 - 2.2.4.1. Location: Minor limestone repairs.
 - 2.2.4.2. Colour: Custom colour match to be performed by supplier, mortar is not to be pigmented on site.
 - 2.2.4.3. Acceptable products: Reconstec 350 Limestone, Jahn M70-Limestone, or similar.

2.3. EQUIPMENT

- 2.3.1. A high speed 2500rpm drill manufactured for the dedicated work of mixing mortars must be used. It should have an open rectangular, double paddle mixer attachment.
- 2.3.2. Vicat Cone penetrometer for measuring consistency.
- 2.3.3. Hard bristle nylon brush.
- 2.3.4. Spiral paddle mill comprising a mechanically driven rotating barrel with integral internal
- 2.3.5. Trowels, various sizes
- 2.3.6. Graduated cylinders purchased from a lab supply store, 2L, 1L, 500mL volumes to measure water volume.
- 2.3.7. Appropriately sized buckets for mortar mixing: 7.5L (2 gallon); 13L (3.5 gallon); and 19L (5gallon).
- 2.3.8. A level table for mixing mortars.
- 2.3.9. Clean rags.
- 2.3.10. Stopwatches for measuring mortar mixing times.
- 2.3.11. Plumber's hemp: asbestos-free, oil-free jute rope.

PART 3 - EXECUTION

3.1. GENERAL PREPARATIONS

- 3.1.1. All mortars are to be mixed on site as per this section.
- 3.1.2. Mix mortar ingredients in quantities for use within periods specified. Do not re-temper.
- 3.1.3. Use power driven paddle mixers that are pre-approved by the Consultant. Use one mixer exclusively for cement-lime mixes. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes.
- 3.1.4. Mixing by hand for repointing mortars must be carried out using a high speed, 2500rpm, drill with paddle mixer attachment. Mixing to be completed in sufficiently sized container to allow full contact of the paddle with the mortar during the mixing process, thus insuring thorough incorporation of ingredients and air-entrainment. Mixing to be pre-approved by Consultant.
- 3.1.5. Mix to a consistency to meet specified performance requirements and to align with Vicat test requirements outlined in this specification. Adjust water content as required.
- 3.1.6. Maintain uniformity of each mix throughout project.
- 3.1.7. Mix Characteristics:
 - 3.1.7.1. Pointing mortar: slightly stiffer than bedding mortar with a consistency such that the mortar can be hand-formed into a stiff ball.
 - 3.1.7.2. Record amount of water required to reach this consistency and use for subsequent mixes.

3.2. MIXING – GENERAL

- 3.2.1. Submit mixing tools and container for approval prior to starting pointing work.
- 3.2.2. Use mortar within 2 hours. Re-temper only by remixing, but do not add water.
- 3.2.3. When using pre bagged mortar, always mix the entire contents of the bag. Do not mix partial batches. This avoids segregation issues of components within the dry mortar mix.
- 3.2.4. Using graduated cylinders, measure water quantities required to mix mortar. Begin with 80% of maximum water volume recommended in manufacturer product data.
- 3.2.5. Begin with water in a clean mixing bucket and add dry mortar mix to the water.

- 3.2.6. Mix as per manufacturer's instructions using power drill with double paddle mixer attachment. Periodically use a trowel by hand, to ensure that no dry mortar mix is left unincorporated at the base of the mixing bucket.
- 3.2.7. When mixing, avoid splatter on adjacent surfaces. Clean up all mortar droppings and splashings using clean sponge and water immediately, before mortar cure.
- 3.2.8. If required, add additional water to ensure mortar has reached consistency determined by Vicat Cone penetration testing.
- 3.2.9. Avoid too wet a mix which stains the face of the work. Record water quantities and use for subsequent mixes to help ensure uniformity of all subsequent mixes.
- 3.2.10. Clean all mixing boards, mixing buckets and mechanical mixing machine between batches.
- 3.2.11. Mortar must be weaker than the units it is binding.
- 3.2.12. Mortar must not contain elements detrimental to the original masonry or surrounding materials.

3.3. FIELD QUALITY CONTROL

- 3.3.1. Ensure testing equipment is ready and in working order.
- 3.3.2. Record water quantities and repeat for subsequent mixes.
- 3.3.3. Monitor mixing times for each stage and repeat for subsequent mixes.
- 3.3.4. Apply Vicat cone test to ensure desirable performance of the mortar and record results.
- 3.3.5. Consultant to apply Vicat cone test to ensure desirable performance of mortar and record results.

3.4. CONSTRUCTION

- 3.4.1. Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise.
- 3.4.2. Allow lime mortar to set for approved period before subjecting to load.
- 3.4.3. Damp cure bedding and pointing mortars in accordance with Section 04 03 05.21 – Heritage Repointing.

3.5. CLEANING

- 3.5.1. Progress Cleaning: clean in accordance with Section 01 35 13 – Special Project Requirements and 01 74 00 – Cleaning and Waste Management.
- 3.5.2. Leave Work area clean at end of each day.
- 3.5.3. Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 35 13 – Special Project Requirements and 01 74 00 – Cleaning and Waste Management.
- 3.5.4. Remove mortar droppings and splashings using clean sponge and water immediately, before mortar and grout cure.
- 3.5.5. Clean masonry with low pressure 15 to 45 psi clean water and soft natural bristle brush.
- 3.5.6. Obtain approval Consultant prior to using other cleaning methods for persistent stains.

3.6. PROTECTION OF COMPLETED WORK

- 3.6.1. Cover completed and partially completed work not enclosed or sheltered at end of each workday.
- 3.6.2. Enclose and protect work using wetted burlap.
- 3.6.3. Cover with waterproof tarps to prevent weather from eroding recently laid material.
- 3.6.3.1. Maintain tarps in place for minimum of 4 weeks after laying.

- 3.6.3.2. Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- 3.6.4. Anchor coverings securely in position.

END OF SECTION

PART 1 - GENERAL

1.1. SUMMARY OF WORK

- 1.1.1. Repointing at areas previously repointed with insufficient mortar.
- 1.1.2. Repointing at areas with deterioration.
- 1.1.3. Repointing at areas of new infill and at joints around new stone and brick masonry openings.

1.2. REFERENCES

- 1.2.1. CSA Group
- 1.2.1.1. CAN/CSA-A179, Mortar and Grout for Unit Masonry.
- 1.2.1.2. CSA-A371-04, Masonry Construction for Buildings.

1.3. DEFINITIONS

- 1.3.1. Raking: the removal of loose/deteriorated mortar until sound mortar is reached to a minimum depth of 40 mm, and up to 50 mm
- 1.3.2. Deep raking: removal of mortar to a depth of 50 to 300 mm.
- 1.3.3. Very-deep-raking: removal of loose/deteriorated mortar beyond a depth of 300 mm and up to full depth of stone.
- 1.3.4. Repointing: filling and finishing of masonry joints from which mortar is missing, has been raked out or has been omitted.
- 1.3.5. Back pointing: repointing to depths specified, to bring mortar face to specified depth for raked joints.
- 1.3.6. Deep back pointing: back-pointing joints that are deeper than 50 mm to a depth of 300 mm.
- 1.3.7. Very deep back pointing: back-pointing joints that are deeper than 300 mm to the full depth of stone.
- 1.3.8. Front Pointing: repointing face of joint, to depth specified for raked joints.
- 1.3.9. Tooling: finishing of masonry joints using tool to provide final contour.
- 1.3.10. Low-pressure water cleaning: water soaking of masonry using less than 350 kPa (50 psi) water pressure, measured at nozzle tip of hose.

1.4. SYSTEM DESCRIPTION

- 1.4.1. Work of this Section includes but is not limited to:
 - 1.4.1.1. Visually inspecting for obvious signs of deteriorated masonry and testing/verification of masonry joints.
 - 1.4.1.2. Raking identified unsound joints.
 - 1.4.1.3. Preparation of masonry surface including joints surface cleaning, flushing of voids and open joints, and masonry wetting.
 - 1.4.1.4. Repointing of identified masonry joints.
 - 1.4.1.5. Ensuring cure of mortar.

1.5. ACTION AND INFORMATIONAL SUBMITTALS

- 1.5.1. Submit in accordance with Section 01 33 00 – Submittal Procedures.
- 1.5.2. Submit samples and construction mock-ups in accordance with Section 04 03 01 – Common Work Results for Heritage Masonry.

1.6. QUALITY ASSURANCE

- 1.6.1. Refer to the requirements of Section 04 03 01 – Common Work Results for Heritage Masonry.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Deliver, store, handle and protect materials in accordance with Section 04 03 01 – Common Work Results for Heritage Masonry.

1.8. SITE CONDITIONS

- 1.8.1. Maintain site conditions in accordance with Section 04 03 01 – Common Work Results for Heritage Masonry.
- 1.8.2. Existing pointing mortars and parging may contain substantial quantities of silica, classifying it as a hazardous material under specific conditions. Perform work specified in the present sections according to the precautions specified by Owner. Designated Substances Survey to be completed prior to commencing work.

PART 2 - PRODUCTS

2.1. MATERIALS:

- 2.1.1. Mortar products, materials, proportions, and preparation: in accordance with Section 04 03 05.13 – Heritage Mortaring.
- 2.1.2. Curing accessories:
- 2.1.2.1. Burlap: clean, non-staining, free of printed matter, to Consultant's approval.
- 2.1.2.2. Polythene plastic sheeting.
- 2.1.2.3. Perforated hose or approved alternate misting system.
- 2.1.2.4. Wood support frame

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: verify masonry, staging and storage areas and notify Consultant in writing of conditions detrimental to acceptable and timely completion of Work.
- 3.1.1.1. Visually inspect substrate in presence of Consultant.
- 3.1.1.2. Inform in writing Consultant areas of deteriorated masonry not previously identified.
- 3.1.2. Notify Consultant immediately if evidence of hazardous materials is discovered in work area.
- 3.1.3. Stop work in that area and report to Consultant immediately evidence of hazardous materials.

3.2. PROTECTION OF IN-PLACE CONDITIONS

- 3.2.1. Protection requirements are specified in Section 04 03 01 – Common Work Results for Heritage Masonry.

3.3. GENERAL

- 3.3.1. Perform work in accordance with CSA-A371 and approved mock-ups.
- 3.3.2. Tool and compact using jointing tool to force mortar into joint.
- 3.3.3. Finish joints to quarried stone square and slightly recessed.
- 3.3.4. Use suitable approved jointing tool to finish joints.
- 3.3.5. Obtain Consultant approval prior to proceeding, for:

- 3.3.5.1. Condition of raked-out joints prior to commencing, backpointing or repointing operations.
- 3.3.5.2. Condition of voids and damming procedures prior to commencing grouting operations.
- 3.3.5.3. Methods to prevent materials entering or penetrating wall cavities of building.

3.4. RAKING JOINTS

- 3.4.1. Remove mortar without chipping, altering or damaging masonry units.
- 3.4.2. Rake joints free of deteriorated and loose mortar, dirt, and other undesirable material.
- 3.4.3. Tools and techniques:
 - 3.4.3.1. Tools for cutting out shall be narrower than the joint. Overcutting will not be allowed. Original joint width must be retained.
 - 3.4.3.2. Cutting out of mortar shall be carried out by one of the following techniques:
 - 3.4.3.2.1. Cutting out with hammer and chisels with dust channels, cutting away from the arrises to prevent spalling of the masonry.
 - 3.4.3.2.2. Flat-bladed quirks and light hammers, hacksaw blades or similar tools are to be used where fine joints are encountered.
 - 3.4.3.2.3. Small hand-held low-impact pneumatic carving tools, fitted with appropriate points and chisels to the approval of the Consultant for cutting out work only.
 - 3.4.3.2.4. Handheld rotary saws or any type of grinder or wheel are not permitted on this project.
 - 3.4.3.2.5. Clean joints back for the full specified depth, removing all mortar on the masonry surfaces to a square surface of existing mortar at back of joint.
 - 3.4.3.3. Clear out all loose particles and leave ready for inspection.
 - 3.4.3.4. Remove deteriorated and adhered mortar from masonry surfaces to full depth of deteriorated mortar but in no case less than 40 mm leaving square corners and flat surface at back of cut. Clean out voids and cavities encountered. Refer to drawings for locations of deep and very deep raking out.
- 3.4.4. Cleaning joints:
 - 3.4.4.1. Clean surfaces of joints by compressed air without damaging texture of exposed joints or masonry units.
 - 3.4.4.2. Flush open joints and voids; clean open joints and voids with low pressure water and if not free draining blow clean with compressed air.
 - 3.4.4.3. Leave no standing water.
- 3.4.5. Replace stone damaged because of careless raking of saw cutting at no cost to the Owner.

3.5. BACKPOINTING

- 3.5.1. Fill open joints and voids where depths exceed 25 mm.
- 3.5.2. Immediately prior to backpointing, thoroughly wet joints to control absorption.
- 3.5.3. Allow water to soak into masonry and mortar. Leave surface damp and free of standing water. Ensure that dust and debris are removed from joints and wall surfaces prior to repointing.
- 3.5.4. Build-up mortar in layers maximum 25 mm and minimum 12 mm in depth. Use *Mortar Type 1*, refer to Section 04 03 05.13 – Heritage Mortaring. Depending on depth of joints and voids, building up in layers of 25mm may not be possible. In all cases, pack mortar firmly into voids and joints, ensuring full contact with back and sides of joint and leaving no voids.
- 3.5.5. Keep masonry damp and free of standing water while pointing is being performed.
- 3.5.6. Allow bottom layers to set before applying subsequent layers. Maintain joint width.

- 3.5.7. Remove excess mortar from masonry face before it sets.
- 3.5.8. Finish the face of back pointing mortar to depth of 25 mm from stone face and score the surface in preparation of front pointing.
- 3.5.9. Damp cure mortar, in accordance with Part 3.9 PROTECTION AND CURING

3.6. FRONT POINTING: MORTAR

- 3.6.1. Immediately prior to pointing, thoroughly wet joints to control absorption.
- 3.6.2. Allow water to soak into masonry and mortar. Leave surface wet and free of standing water.
- 3.6.3. Completely fill with mortar. Use *Mortar Type 2*, refer to Section 04 03 05.13 – Heritage Mortaring.
- 3.6.4. Keep masonry damp while pointing is being performed.
- 3.6.5. Pointing in freezing weather is not permitted. Refer to Section 04 03 01 – Common Work Results for Heritage Masonry for environmental requirements.
- 3.6.6. Refer to drawings for location of joint finish styles:
 - 3.6.6.1. For concave finish joint:
 - 3.6.6.1.1. If surface of masonry units or stone has worn rounded edges keep pointing back from surface to keep same width of joint. Avoid feather edges. Pack mortar solidly into voids and joints with positive adhesion to contact surfaces.
 - 3.6.6.1.2. At initial set, finish joints with stippling action using a short stout bristle brush to compact joint. Produce textured finish, exposing aggregate. Do not project mortar beyond arrises or feather mortar.
 - 3.6.6.1.3. Keep recessed joints approximately 1 mm back from arrises.
 - 3.6.6.1.4. Damp cure mortar, in accordance with Part 3.9 PROTECTION AND CURING

3.7. RESETTING LOOSE STONE

- 3.7.1. Fix dislodged masonry units in correct location with water soaked softwood wedges.
- 3.7.2. Insert and compress firm mortar to within 40 mm of pointing surface. Allow mortar to set minimum 24 hours.
- 3.7.3. Pull out wood wedges when dried and shrunken.
- 3.7.4. Point to surface in one layer.

3.8. CLEANING

- 3.8.1. Progress Cleaning: clean in accordance with Section 01 35 13 – Special Project Requirements and Section 01 74 00 – Cleaning and Waste Management.
 - 3.8.1.1. Leave Work area clean at end of each day.
- 3.8.2. Clean surfaces thoroughly of mortar droppings, stains and other blemishes resulting from work of this contract daily, as work progresses. Mortar droppings must be removed prior to their curing.
- 3.8.3. Remove droppings and splashings using clean water and thick cotton rags.
- 3.8.4. Clean masonry with stiff natural bristle brushes and plain water only if mortar joints have fully cured.

3.9. PROTECTION AND CURING

- 3.9.1. Cover completed and partially completed work not enclosed or sheltered at end of each workday.
 - 3.9.1.1. Membranes should extend to 0.5 m over surface area of work and be tightly installed to prevent finished work from drying out too rapidly.

- 3.9.2. Cover with waterproof tarps to protect newly laid mortar from frost, rainfall and rapid drying conditions such as wind.
- 3.9.2.1. Maintain tarps in place for minimum of 4 weeks after repointing.
- 3.9.2.2. Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- 3.9.3. Anchor coverings securely in position.
- 3.9.4. Damp cure:
 - 3.9.4.1. Provide damp cure for back pointing and for front pointing mortars, at a minimum temperature of 10 degrees C.
 - 3.9.4.2. Install and maintain wetted burlap protection during the curing process, using heavy and tight-woven burlap. Cover burlap in clear heavy plastic sheeting:
 - 3.9.4.2.1. Minimum 7 days.
 - 3.9.4.2.2. Wet mist burlap only - ensure no direct spray reaches surface of curing mortar.
 - 3.9.4.2.3. Ensure burlap is not in contact with masonry. Leave air space of minimum 50 mm between burlap and masonry.
 - 3.9.4.2.4. Shade areas of work from direct sunlight and maintain constant dampness of burlap.
 - 3.9.4.3. Provide for off-hours and week-end work as required to maintain specified curing conditions.
- 3.9.5. Protect from drying winds. Pay particular attention at corners of structure.
- 3.9.6. Maintain ambient temperature of minimum 10 degrees C after repointing masonry for:
 - 3.9.6.1. Minimum 7 days in summer.
 - 3.9.6.2. Minimum 30 days in cold weather conditions using dry heated enclosures.

3.10. PROTECTION OF COMPLETED WORK

- 3.10.1. Protect adjacent finished work against damage which may be caused by on-going work.

END OF SECTION

PART 1 - GENERAL

1.1. SUMMARY OF WORK

1.1.1. Repair of existing stone masonry including:

1.1.1.1. Repair of anchor holes.

1.1.1.2. Repairing cracks in stones.

1.2. REFERENCES

1.2.1. Definitions:

1.2.1.1. Repair of Stone: mechanical or plastic repair, done to restore original appearance and function of partly deteriorated stones.

1.2.1.2. Filling: material used to rebuild broken or deteriorated part of stone.

1.2.1.3. Adhesive: material used to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.

1.2.1.4. Mortar: material used to re-bed the stone element being repaired and to repoint adjacent mortar joints.

1.2.2. References:

1.2.2.1. ASTM International

1.2.2.1.1. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.

1.2.2.1.2. ASTM A 276, Standard Specification for Stainless Steel Bars and Shapes.

1.2.2.2. Canadian General Standards Board (CGSB)

1.2.2.2.1. CAN/CGSB-75.1, Tile, Ceramic.

1.2.2.3. CSA Group

1.2.2.3.1. CAN/CSA-A179, Mortar and Grout for Unit Masonry.

1.2.2.3.2. CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3. ACTION AND INFORMATIONAL SUBMITTALS

1.3.1. Submit in accordance with Section 01 33 00 – Submittal Procedures, and Section 04 03 01 – Common Work Results for Heritage Masonry.

1.3.2. Product Data:

1.3.2.1. Submit manufacturer's instructions, printed product literature and data sheets including product characteristics, performance criteria, physical size, finish, and limitations.

1.3.2.1.1. Application/installation instructions.

1.3.2.1.2. Laboratory test reports certifying compliance of products with specification requirements.

1.3.2.1.3. Manufacturer's material safety data sheets (MSDS) for safe handling of specified materials and products, in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

1.3.3. Samples: Submit colour samples of repair mortars.

1.3.4. Certificates:

1.3.4.1. Submit upon request by Consultant purchase orders, invoices, suppliers test certificates and documents to prove materials used in contract meet requirements of specification. Allow free access to sources where materials were procured.

1.4. CLOSEOUT SUBMITTALS

- 1.4.1. Submit in accordance with Section 01 78 39 – Project Record Documents.
- 1.4.2. Record Documentation:
 - 1.4.2.1. Provide marked up set of drawings to provide referencing system identifying locations of stone repairs.
 - 1.4.2.2. Provide photographically record of dismantle and rebuilt stonework.

1.5. QUALITY ASSURANCE

- 1.5.1. Mock-ups:
 - 1.5.1.1. Execute mock-up for each type of conservation procedure, in accordance with Section 04 03 01 – Common Work Results for Heritage Masonry.
 - 1.5.1.2. Construct minimum one mock-up of a representative sample of each type of repair specified, with specified materials and methods.
 - 1.5.1.3. Use existing stonework when constructing job mock-up.
 - 1.5.1.4. Construct mock-up where directed by Consultant.
 - 1.5.1.5. Select locations of mock-ups in consultation with Consultant.
 - 1.5.1.6. Provide a mock-up schedule at the start of the project, and group mock-ups to allow for efficient Consultant review.
 - 1.5.1.7. Notify Consultant 10 days before commencing each mock-up.
 - 1.5.1.7.1. Obtain approval from Consultant before commencing mock-up.
 - 1.5.1.8. Allow 72 hours for inspection of mock-up Consultant before proceeding with stone repair work.
 - 1.5.1.9. When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
 - 1.5.1.10. Where applicable, repeat repair mortar mock-ups as necessary to match variations in stone colour.
 - 1.5.1.11. Clean mock-up in accordance with Section 04 03 01.13 – Heritage Masonry Cleaning to demonstrate cleaning operations to Consultant before starting cleaning work.
 - 1.5.1.12. Conservation Mortar Repairs:
 - 1.5.1.12.1. In addition to sample disks of all conservation repair mortars, each sample must also be placed into a cut slot of 100mm long x 20mm deep x 20mm wide. This slot will be cut into a stone taken from the building in order to display the qualities of colour and texture matching the exposed surface. As it is normal that many repair mortar samples are prepared before an acceptable match is found, this sample-display block should be prepared to accommodate up to 20 samples.
 - 1.5.1.12.2. Where applicable, repeat repair mortar mock-ups as necessary to match variations in stone colour.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Deliver, store, handle and protect materials in accordance with Section 04 03 01 – Common Work Results for Heritage Masonry.

1.7. SITE CONDITIONS

- 1.7.1. Ambient conditions:
 - 1.7.1.1. Refer to Section 04 03 01 – Common Work Results for Heritage Masonry, Section 1.8 Environmental Requirements.

- 1.7.1.2. Allow materials to reach minimum temperature of 10 degrees C prior to use.
- 1.7.1.3. Refer to manufacturer's instructions for environmental requirements of products.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Use materials and equipment approved by Consultant.
- 2.1.2. Use materials from same manufacturer throughout the Work.
- 2.1.3. Syringes: plastic, 10 to 50 cc.
- 2.1.4. Injection needles; #12 and #16 gauge, length and other gauges to suit application.
- 2.1.5. Dowels: stainless steel threaded rods to ASTM A580, type 316, 2 to 12 mm diameter to suit applications.
- 2.1.6. Ethyl alcohol. 10% dilution to repair cracks.
- 2.1.7. Water: potable, clean and free from contaminants. Pre-treat water having high iron or other metal content, to prevent staining.
- 2.1.8. Sponges, 100% cotton rags, absorbent towels.
- 2.1.9. Tape for epoxy curing protection: aluminum type, pressure-sensitive, fluid-resistant, 38 mm minimum width.
- 2.1.10. Acetone.
- 2.1.11. Hammers, mallets, chisels broad to fine, points, pitchforks, stone rasps, sharpening equipment.
- 2.1.12. Pottery clay, for damming at crack injections.
- 2.1.13. St-Astier natural hydraulic lime NHL 2, for dutchman cavity slurry.

2.2. EQUIPMENT

- 2.2.1. Equipment for specific interventions are listed in related sections.
- 2.2.2. Provide all standard masonry tools, accessories, and equipment used in masonry restoration.
- 2.2.3. In addition, supply the following smaller specialized tools and equipment:
 - 2.2.3.1. Small 14.5 volt cordless drills of good quality.
 - 2.2.3.2. Small 100 mm grinders.
 - 2.2.3.3. HEPA vacuum cleaners equipped with thin brush heads.
 - 2.2.3.4. Tungsten Carbide tipped drill bits of 2 – 6 mm for drilling small holes.
 - 2.2.3.5. Light weight, quick-release clamps of various sizes.
 - 2.2.3.6. Strap clamps.
 - 2.2.3.7. Plunge-type core drill, capable of coring hole of 6mm.
 - 2.2.3.8. Metal artist spatulas of various sizes.
 - 2.2.3.9. Carbide-tipped scribe for marking cut lines on stone.
 - 2.2.3.10. Neoprene carvers mallet, small size (127 mm diameter).
 - 2.2.3.11. Small carbide-tipped chisels of sizes 6 to 13 mm.
 - 2.2.3.12. Multi-use "Dremel" tool with diamond discs.
 - 2.2.3.13. Carborundum rubbing of fine, medium, and coarse grain.

2.3. REPAIR MORTAR

- 2.3.1. Use Mortar Type 3 for walls and surface repairs, refer to Section 04 03 05.13 Heritage Mortaring.
- 2.3.2. Products are to be evaluated as suitable for the noted applications. All listed products are to be submitted for review, and evaluated in mock-ups, to be reviewed by the Consultant.

2.4. EPOXY

- 2.4.1. Epoxy Type A: for dutchman repair dowels and pins: low viscosity, UV stable, capable of setting and curing in wet conditions, suitable for overhead applications.
- 2.4.2. Epoxy Type B: for dutchman repair dowels and pins: high viscosity and injectable using a fine syringe, UV stable, capable of setting and curing in wet conditions.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: verify masonry, staging and storage areas and Consultant in writing of conditions detrimental to acceptable and timely completion of Work.
 - 3.1.1.1. Visually inspect substrate in presence of Consultant.
 - 3.1.1.2. Inform in writing Consultant areas of deteriorated masonry not previously identified.
- 3.1.2. Obtain Consultant's approval and instructions for repair and replacement of masonry units before proceeding with repair work.
- 3.1.3. Obtain Consultant's approval for tools to be employed prior to commencing work.
- 3.1.4. Stop work in that area and report to Consultant immediately any evidence of hazardous materials.
- 3.1.5. The Consultant will mark, on the face of masonry or otherwise give direction at all locations of work to be conducted before work begins.
- 3.1.6. Provide the Consultant with 5 days' notice prior to commencing each intervention on a new area of the masonry.
- 3.1.7. All repairs must be damp cured.

3.2. RUBBING BACK OF STONE

- 3.2.1. Where indicated, rub back friable stone to remove loose detail only.
- 3.2.2. Determine required locations for rubbing of stone with Consultant before commencing work.
- 3.2.3. Rub back with wooden tools or sandstone blocks to prevent marking of stone.
- 3.2.4. Bevel the edge of any edges of retained and firm surface plates to ensure water shedding.

3.3. SCALING BACK OF STONE

- 3.3.1. Prepare stone where the surface layer of stone is friable and dislodging.
- 3.3.2. Determine required locations for dressing of stone with Consultant before commencing work.
- 3.3.3. At scaling stone, work using hand tools stone-carving chisels (with no mallet) to remove the loose material and then working alternately with chisel and piece of limestone stone rub back stone to remove sugary surface and chisel marks.
- 3.3.4. Use hand tools stone-carving chisels only. Work using hand tools stone-carving chisels (with no mallet) to remove the loose material. Using a piece of limestone, gently rub and bevel the edge of any edges of retained and firm surface plates to ensure water shedding. If required by Consultant, stitch the bevelled edge and inject/shelter coat/fill any fissure along the bevelled line.
- 3.3.5. Use hand tools stone-carving chisels only.

3.4. DRESSING BACK

- 3.4.1. Prepare stone where:
 - 3.4.1.1. Vertical flashings are required over stone surfaces.
 - 3.4.1.2. Spall stone surface that is too small to pin back.
- 3.4.2. Determine required locations for dressing of stone with Consultant before commencing work.
- 3.4.3. Dress irregular stone surfaces to smooth face to permit acceptable installation of flashing.
- 3.4.4. Dress back incipient spalls that are too small to pin back.
- 3.4.5. Use hand tools stone-carving chisels only.

3.5. FILLING OF STONE CRACKS IN PLACE

- 3.5.1. Flush crack with clean water until all dirt and loose material are removed, and crack is thoroughly wet.
- 3.5.2. Carry out final flushing with 10% ethyl alcohol solution.
- 3.5.3. Prepare *NHL 2 slurry*. Dilution to be determined by injection lime type through mortars and for ease of flow through syringes.
- 3.5.4. Inject *NHL 2 slurry* full into cracks. Dam deep cracks with non-marking pottery clay to ensure complete filling. Starting at the base of the crack, move needle slowly upward along crack opening, allowing capillary suction to draw the grout inward as the syringe moves. Repeat applications as necessary.
- 3.5.5. Clean surface of stone free of grout as work progresses. Do not allow grout to be absorbed into surface. Only use 100% cotton cloths rinsed in clean water.
- 3.5.6. Where appropriate, use *Repair Mortar Type 1* undiluted to fill outer parts of crack or where width of crack warrants. Consultant to verify minimum dimensions for use of *Repair Mortar Type 1* in these instances.
- 3.5.7. Allow grout to harden.
- 3.5.8. Immediately clean up spills or runs.

3.6. REPAIR MORTAR FILLS AND SURFACE REPAIRS

- 3.6.1. Use *Mortar Type 3*, as directed by Consultant. Prepare repair mortar according to manufacturer's instructions.
- 3.6.2. Prepare surfaces to receive repair mortar: remove previous repair materials and clean out loose debris from host stone. Clean cavity thoroughly with HEPA vacuum equipped with brush heads.
- 3.6.3. Wet substrate using spray bottles according to porosity of stone to prevent substrate from draining moisture from mortar.
- 3.6.4. Immediately prior to commencing patching re-wet surface. Remove standing water.
- 3.6.5. Place *Mortar Type 3*, in maximum 15 mm layers. Allow repair mortar to set before applying successive layers (lifts). Press repair mortar into cavity to provide homogeneous patch free of voids. Build up profile to surrounding surfaces.
- 3.6.6. Slightly overfill at surface and cover with damp absorbent towel.
- 3.6.7. Protect the repair mortar with a moistened cloth for several hours. When it just yields to thumb pressure, the mortar is ready for cutting and/or shaping and texturing. The time it takes before the cutting can take place will vary and depend on ambient temperature and humidity
- 3.6.8. At appropriate time, finish mortar flush with adjacent stone.
- 3.6.9. Texture surface of mortar to match adjacent surface.

- 3.6.10. Apply and fix in place moistened burlap over which is placed a sheet of plastic which is fixed and sealed at the edges securely to control evaporation. Maintain in place for 7 days.
- 3.6.11. Mist periodically over a 5 day period if required, but not necessary if humidity is observed by beading on the inside surface of the plastic protection sheet. Do not let burlap dry out during 7 day damp curing period.
- 3.6.12. Where scaffolding attachments are removed, control mortar shrinkage and cure mortar by applying aluminum tape over repair.

3.7. DUTCHMAN REPAIRS

- 3.7.1. If required, new stone will be supplied as per Section 04 03 43.16 – Heritage Stone Replacing.
- 3.7.2. Location and dimension of cutting required to remove deteriorated stone will be marked and agreed upon by the Consultant prior to cutting.
- 3.7.3. Only stones marked on drawings or otherwise marked out by the Consultant shall be cut into for purposes of inserting a dutchman.
- 3.7.4. Adjacent masonry units should not be cut into, displaced, or in any way damaged while cutting or removing of masonry units.
- 3.7.5. Consultant shall approve methods and tools used for cutting out purposes. Obtain Consultant's review before commencing cutting.
- 3.7.6. Select new stone for dutchman to match colour and characteristics of host stone, free from defects and with same direction of bedding as adjacent work. Dutchman inserts are to have the same bedding orientation as the host stone.
- 3.7.7. Cut piece of sufficient surface area to cover area of damage. Cut to rectangular or square frame, minimum 250 mm deep behind wall or arris line. For moulded (profiled and sculptural) dutchman, cut out 250mm from the lowest seated edge.
- 3.7.8. In cases where the dutchman repair includes the full depth of stone make cavity good behind dutchman.
- 3.7.9. Finely rub and finish bed faces true with uniform arris, with maximum 1 mm joint between host stone and dutchman.
- 3.7.10. Hand chisel cut-out accurately to lines free of rough edges and spalled surfaces. Slightly undercut bed joints for tight fit of dutchman insert. Cutting out will follow precise incised lines (scribed) which are squared and following right angles, clean sided, and to an even specified depth.
- 3.7.11. When adjacent to indent location, rake all bedding mortar to the depth of the dutchman.
- 3.7.12. Smooth, tool or carve surface to match exposed surface of stone adjacent to the prepared cavity. Do not rub, tool or in any way affect the original surface of stone adjacent to the dutchman insert. Dutchman insert must be shaped and prepared to fit in all aspects of dimension prior to being fixed in place.
- 3.7.13. Dry set dutchman insert stone to insure required tight fit and flush with adjacent surface.
- 3.7.14. Provide attachment of insert stone to cavity by inserting stainless steel rods into back side of new stone set in epoxy. Use epoxy Type A or B to suit application. Size and quantity of rods to be determined with consultant. The drilled holes should reach 50-75 mm into the connecting surface.
- 3.7.15. The holes must be thoroughly cleaned before epoxy is injected. Blow holes clean with compressed dry air through nozzle that reaches to bottom of drilled hole. Adapt nozzle with extension if necessary. Apply epoxy into holes just prior to setting stone in place. Before inserting the pin into the hole, coat the pin in epoxy, by rotating the pin in a bath of epoxy. Ensure epoxy is coating between the threads of the pin. Carefully place pin into hole, rotate the pin while inserting.
- 3.7.16. Epoxy must be insensitive to moisture and wet during curing. Dutchman will be blind-pinned only.

- 3.7.17. Prepare NHL 2 slurry and butter cavity to receive stone. Use soup-like consistency slurry, colour matched to stone colour, and set and fill cavity joint around dutchman. This will require thorough soaking of stone surfaces prior to applying the slurry. It is critical that all preparations are made such that the insertion can be made and secure quickly before slurry thickens. Slurries are to be mixed fresh everyday as required. During use, store in a lid-sealed container to prevent drying.
- 3.7.18. Carefully insert stone into cavity with dowels properly located in holes. Clean off slurry from face. Wedge in place where possible to do so using adjacent mortar joints.
- 3.7.19. Leave face of stone piece with slight projection. Finish to match host stone by rubbing back or tooling. Rubbing back or tooling marks on existing stone are not permitted.
- 3.7.20. Allow epoxy to cure, keeping dutchman insert damp with wetted rags and plastic. Cut joint slurry flush with surface, sponge clean all stone surfaces to remove slurry stains. Reapply damp protection and leave for 14 days to insure curing. Upon removal of damp protection, ensure all joints are filled flush by injecting with NHL 2 slurry shelter coat which is coloured to match the stone when dry.

3.8. PROTECTION

- 3.8.1. Prevent damage to stone surfaces which are to remain. Make good damage incurred.
- 3.8.2. Protect surrounding components from damage during work.
- 3.8.3. Ensure historic fabric is undamaged. Make good damage incurred.
- 3.8.4. Obtain Consultant's approval for repair methodology.

3.9. CLEANING

- 3.9.1. Obtain Consultant's approval of cleaning operations before starting cleaning work.
- 3.9.2. Protect plants, grass vegetation and adjacent grounds from excessive water accumulation.
- 3.9.3. Clean stonework surfaces after repairs have been completed and mortar has set.
- 3.9.4. Clean stone surfaces of adhesive, epoxy, or mortar residue resulting from work performed without damage to stone or joints.
- 3.9.5. Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning and Waste Management.
 - 3.9.5.1. Leave Work area clean at end of each day.
- 3.9.6. Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 – Cleaning and Waste Management.

3.10. PROTECTION OF COMPLETED WORK

- 3.10.1. Protect finished work from impact damage for period of 2 weeks.

END OF SECTION

PART 1 - GENERAL

1.1. DEFINITIONS

- 1.1.1. Sound stone – stone that has no visible fissures, cracks or stylolites. Stylolites are thin, dark clay deposits that appear as irregular fissures through the full depth of the stone or nearly the full depth. A sound stone will have no holes or missing pieces.

1.2. SHOP DRAWINGS

- 1.2.1. Submit shop drawings, setting diagrams and photographs in accordance with Section 01 33 00 – Submittal Procedures.
- 1.2.2. Indicate all sizes and sections of moulded (profiled) and carved (sculptural) stone, arrangements of joints and bonding, anchoring, direction of beds, dowelling and cramping, and finishes.
- 1.2.3. Prepare full size drawings of moulded and carved elements. Include details missing from Consultant's drawings. Provide fully detailed 3D drawings in .dwg format of all pieces for production.
- 1.2.4. Each shop drawing shall bear stamp of professional engineer registered in Province of Ontario with expertise in analysis of stonework, for areas where dressing back of existing stone is within bearing plane.
- 1.2.5. Stone anchor shop drawings must also be stamped by a professional engineer registered in Province of Ontario.

1.3. DELIVERY, STORAGE AND HANDLING

- 1.3.1. Coordinate with the City for the delivery of the City-supplied stone.
- 1.3.2. Transport, store, handle and protect materials, including City-supplied stone, in accordance with Section 04 03 01 – Common Work Results for Heritage Masonry.
- 1.3.3. Transport materials, including City-supplied stone, to job site in dry condition and in purpose made containers, packed to avoid chipping, damage or soiling, and protected from frost.
- 1.3.4. Label each container to clearly indicate contents and location on building.
- 1.3.5. Each stone indicated on shop drawings must bear corresponding number marked on its back or bed. Mark quarry bed or direction of bedding and location of stone on building. Use concealed permanent markings.
- 1.3.6. Take ownership of stone and be responsible for quality, cutting errors and damage.
- 1.3.7. Handling:
- 1.3.7.1. Avoid excessive handling; protect against chipping damage, soiling, or staining.
- 1.3.7.2. Repairing stone damaged during handling is not permitted.
- 1.3.7.3. Replace stone damaged by handling. Pay cost of replaced stone including installation

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Refer to related sections for stone, anchors, cramps, dowels, mortar, related materials, accessories, and material preparation procedures.
- 2.1.2. Limestone:
- 2.1.2.1. Colour and texture to maintain continuity of existing units to be replaced or to match adjacent units, as applicable.
- 2.1.2.2. Stone to be selected by the Consultant.

2.2. STONE SELECTION CRITERIA

- 2.2.1. A sample stone block will be made available to the Consultant at the stone fabricator shop for review. The Consultant will mark areas of the block face that are considered acceptable, and areas that are not. The block is to be kept at the stone fabrication shop for the duration of the project and serve as a standard of quality for all project stone replacements.
- 2.2.2. A sample of cut stone will be provided for review by the Consultant before any stone units are fabricated.
- 2.2.3. Acceptable stone is to be sound stone as defined in Part 1 of this Section.
- 2.2.4. Stylolites will be deemed to disqualify a stone as a potential replacement if when the surface is wetted with a spray of water, the stylolite remains wet after the rest of the stone surface has dried. If the stylolite dries as fast as the stone surface, the stone will be accepted as sound.

PART 3 - EXECUTION

3.1. FABRICATION

- 3.1.1. Cut stone to shape and dimensions using measurements and profiles of existing stone. Oversize finished face for hand tooling.
- 3.1.2. Use measurements of profiles adjacent to location where new stone is to be set.
- 3.1.3. Cut stone oversized for site trimming where directed by Consultant.
- 3.1.4. Cut stone to lay on its natural quarry bed. Lay arch stones at right angles to thrust. Edge bed projecting undercut members.
- 3.1.5. Dress exposed faces true. Make beds and joints same thickness as existing and at right angles to face.
- 3.1.6. Execute moulded work from full size details. Make exposed arises in true alignment and ease slightly to prevent snipping.
- 3.1.7. Cut stones for anchors, cramps, dowels, and support systems. Provide lewis pin and clamp holes in pieces which cannot be manually handled. Do not cut holes in exposed surfaces.
- 3.1.8. Hand tool finish stone to final size and profile. Applied faux finishing and chisel marks to sawn faces of material are not acceptable.
- 3.1.9. Match finish variations to existing stone and to approval of Consultant.
- 3.1.10. Cut, dress, rub stones to accommodate existing materials and work of other Sections, using methods approved by Consultant.

3.2. STONE CARVING

- 3.2.1. Remove and replace carved stone elements as specified.
- 3.2.2. Examine other carved elements on building to determine correct detailing, missing elements, and weathered details.
- 3.2.3. Produce clay maquettes, take molds, and produce full-size plaster models of proposed carved work for copying. Produce fully detailed 3D drawings in .dwg format.
- 3.2.4. Carve new stone as much as practical at shop, from approved shop drawings and models. Replicate exactly, original work.
- 3.2.5. Carve stone dutchman Inserts in accordance with Section 04 03 43.13 – Heritage Stone Repairing.

3.3. FABRICATION TOLERANCES

- 3.3.1. Fabricate stone pieces to the following tolerances:

- 3.3.2. Unit length, height or bed depth: plus or minus 1.0 mm.
- 3.3.3. Deviation from Square: plus or minus 1.0 mm, with measurement taken using the longest edge as the base.
- 3.3.4. Deviation from flat surface or any exposed surface: plus or minus 0.5 mm.

3.4. INSTALLATION

- 3.4.1. Install stones in accordance with Section 04 03 43.20 – Heritage Stone Rebuilding.
- 3.4.2. Install Stone Dutchman Inserts in accordance with Section 04 03 42.13 – Heritage Stone Repairing.

3.5. PICK UP AND DELIVERY OF STONE

- 3.5.1. Deliver stones to site from the storage facility and unload from vehicle.
- 3.5.2. Co-ordinate procurement schedule with Consultant and City. Blocks, slabs and finished pieces will be provided according to this schedule.
- 3.5.3. Supply equipment for loading and perform loading of stone onto transport at initial pickup.
- 3.5.4. Supply all other transportation, loading, unloading, and associated equipment after delivery to the site.
- 3.5.5. Supply stone to site and to each wall location ready for installation.

END OF SECTION

PART 1 - GENERAL

1.1. ADMINISTRATIVE REQUIREMENTS

- 1.1.1. Conduct a pre-dismantling meeting with The Consultant to verify project requirements, equipment, procedures and assigned storage areas. Comply with Section 04 03 01 – Common Work Results for Heritage Masonry.

1.2. ACTION AND INFORMATIONAL SUBMITTALS

- 1.2.1. Submit in accordance with Section 01 33 00 – Submittal Procedures.
- 1.2.2. Provide submittals indicate in Section 02 42 20 – Removal and Salvage of Heritage Materials.
- 1.2.3. Shop Drawings:
 - 1.2.3.1. Submit drawings for shoring and bracing and temporary framing work.

1.3. CLOSEOUT SUBMITTALS

- 1.3.1. Submit in accordance with Section 01 78 00 - Closeout Submittals.
- 1.3.2. Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Include:
 - 1.3.2.1. Photographically record stonework to be dismantled and rebuilt.
 - 1.3.2.2. Record drawings of layout of stored stones.

1.4. QUALITY ASSURANCE

- 1.4.1. Qualifications:
 - 1.4.1.1. Masonry Contractor:
 - 1.4.1.1.1. Work of this Section: executed by contractor specializing in historic stone conservation work, using similar stone dismantling techniques.
 - 1.4.1.2. Foreperson:
 - 1.4.1.2.1. Provide competent trade foreperson specializing in type of work required.
 - 1.4.1.2.2. Experience: experience in deconstruction of historic stone masonry. Must be present on site throughout Work.
 - 1.4.1.3. Dismantlers:
 - 1.4.1.3.1. Experience: record of successful masonry dismantling.
 - 1.4.2. Mock-ups:
 - 1.4.2.1. Construct mock-up in accordance with Section 01 45 00 - Quality Control.
 - 1.4.2.2. Perform mock-up 1 m x 1 m to demonstrate dismantling procedures for each type of below grade and above grade masonry condition specified in locations designated by the Consultant.
 - 1.4.2.3. Notify the Consultant minimum of 5 working days prior to construction of mock-up.
 - 1.4.2.4. Perform mock-up under supervision of the Consultant to demonstrate a full understanding of specified procedures and techniques is achieved before work commences.
 - 1.4.2.5. Perform mock-up where directed by the Consultant.
 - 1.4.2.6. Work not to proceed prior to approval of mock-up. Allow 5 working days for inspection of mock-up by the Design Consultant before proceeding with masonry dismantling work.
 - 1.4.2.7. When accepted, mock-up will demonstrate minimum standard for this work.

1.5. DELIVERY, STORAGE AND HANDLING

- 1.5.1. Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements, Section 02 42 20 – Removal and Salvage of Heritage Materials, and with manufacturer's written instructions.
- 1.5.2. Protect and store stones to facilitate their resetting.
- 1.5.3. Store dismantled masonry units on wood platforms or pallets, protected from exposure to water, elements, and potential mechanical damage.
- 1.5.4. Submit storage and identification system to The Consultant for review and approval.

1.6. AMBIENT CONDITIONS

- 1.6.1. Loosen wet masonry only when temperature is above 5 degrees C.
- 1.6.2. In temperature 5 degrees C and below:
 - 1.6.2.1. Keep stones dry.
 - 1.6.2.2. Protect wet stones from freezing.

PART 2 - PRODUCTS

2.1. EQUIPMENT

- 2.1.1. Provide all standard masonry tools, accessories, and equipment used in masonry restoration.
- 2.1.2. Flat pry bars, protected with impact absorbing protection (burlap, cardboard).
- 2.1.3. Wooden wedges
- 2.1.4. Inspected nylon hoisting belts
- 2.1.5. Lewis Bolts (do not make holes or indentations in exposed faces of masonry units)
- 2.1.6. Equipment for temporary marking on stones:
 - 2.1.6.1. Ball-point pen on diachylon, attached to stone.
 - 2.1.6.2. Waxless chalk directly on stone.
- 2.1.7. Equipment for final marking on stones: aluminum type, pressure-sensitive, fluid-resistant, 38 mm minimum width tape for final marking
- 2.1.8. Wood platforms or other equipment used to transport and store stones. Section 02 42 20 – Removal and Salvage of Heritage Materials.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Examine masonry, staging and storage areas and notify Consultant in writing of conditions detrimental to acceptable and timely completion of Work.
 - 3.1.1.1. Visually inspect substrate in presence of Consultant.
 - 3.1.1.2. Inform Consultant of unacceptable conditions immediately upon discovery.
 - 3.1.1.3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.
 - 3.1.1.4. Report in writing, to Consultant areas of deteriorated stone not identified in the documents. Obtain Consultant's approval and instructions for repair of stone before proceeding.
 - 3.1.1.5. Stop work in that area and report to Consultant and Owner immediately the evidence of hazardous materials.

3.2. DOCUMENTATION

- 3.2.1. Submit documentation per Section 01 35 91 – Heritage Protective Measures prior to removing any Heritage Materials.

3.3. PREPARATION

- 3.3.1. Provide all submittals as described in Article 1.02 prior to any dismantling work.
- 3.3.2. Remove deteriorated portions of stones using low impact removal methods until sound surface is reached.
- 3.3.3. Remove deteriorated portions of stones by chiselling.
- 3.3.4. Obtain Consultant's approval for alternative methodology and tools to be employed before commencing the work.
- 3.3.5. Clean stone surface of dust and stone chips.

3.4. PROTECTION

- 3.4.1. Prevent damage to portions of building, which are to remain.
- 3.4.2. Notify Consultant immediately if any damage is incurred and make good any such damage.
- 3.4.3. Protect surrounding components from damage during work.
- 3.4.4. Make good damage to historic fabric.
- 3.4.5. Obtain Consultant's approval for repair methodology.

3.5. TEMPORARY MARKING AND RECORDING

- 3.5.1. Mark stone, on face, before removal using marking product which can be completely erased when required without damaging masonry unit:
- 3.5.1.1. Ball-point pen on diachylon, attached to stone.
- 3.5.1.2. Waxless chalk directly on stone.
- 3.5.2. Tracking relocated stones and other masonry units:
- 3.5.2.1. Use numbering, marking, and positioning system shown on drawing.
- 3.5.3. Mark/Identify:
- 3.5.3.1. Stones and other elements or components to show identity and position.
- 3.5.3.2. Wood platforms or other equipment used to transport and store stones.
- 3.5.3.3. Work and storage areas.
- 3.5.3.4. Location from which stones are removed on drawings.
- 3.5.4. Stone location recording system.
- 3.5.4.1. Prepare chart to:
- 3.5.4.1.1. Help locate stones or units when necessary.
- 3.5.4.1.2. To manage availability of platforms.
- 3.5.4.1.3. To manage work and storage areas.
- 3.5.4.2. Keep chart up-to-date and, if required, produce copy every day.
- 3.5.4.3. Prepare drawing to contain relevant information as indicated by example on drawing.
- 3.5.5. Ensure that temporary marking will remain in use resistant to weather, handling, and cleaning until final marking of stones.

3.5.6. Remove markings and adhesive without damaging units:

3.5.6.1. Brush with vegetable fibre brush: either dry or with water.

3.5.6.2. Use no solvent, acid or other chemical product.

3.6. TEMPORARY SHORING

3.6.1. Construct shoring and bracing in accordance with Structural drawings and specifications.

3.6.2. Construct shoring and cradling, and other temporary framing work needed to support structure, or parts of it, during removal operations, according to approved shop drawings.

3.7. METHOD FOR LOOSENING STONES

3.7.1. Use approved methods to loosen stones which will cause no damage either to stones or to other architectural elements. Remove stones in original integral condition and size. Use of hardwood is acceptable; metal wedges or levering devices are not permitted.

3.7.2. Do joint cutting in accordance with Section 04 03 05.21 – Masonry Repointing.

3.7.3. Prior to removing a stone approved for replacement or re-installation, rout out existing mortar joints around the stone.

3.7.4. Remove mortar from top, bottom and side joints, with the back surface of the joint square and of an even depth.

3.7.5. Use only handheld tools with mallet or pneumatic driven percussion at low stroke speed.

3.7.6. Obtain The Consultant's approval for use of power tools before commencing work.

3.7.7. Ensure that adjacent stones are not used as lever points in removal of stone.

3.7.8. Loosen wet masonry when temperature is above 5 degrees C.

3.8. DISMANTLING AND MOVING STONES

3.8.1. Avoid damaging arrises of stone when removing mortar and freeing up.

3.8.2. Remove excess mortar using hand tools.

3.8.3. Use wood wedges where required to remove or dislocate stone.

3.8.3.1. Use flat pry bars protected with impact absorbing protection (burlap, cardboard).

3.8.4. Use regularly inspected nylon hoisting belts. Use minimum 2 belts per stone.

3.8.5. Protect stone from damage when hoisting and lifting from position.

3.8.5.1. Use separators or wood shims to isolate units from hoisting belts.

3.8.6. Where damage occurs to stone, report to Consultant.

3.8.7. Make good damage incurred at no additional cost to Contract.

3.8.8. Obtain approval of repaired damage by Consultant.

3.8.9. Clean loose and deteriorated wall cores to sound material. Remove dust, mortar and stone fragments

3.9. FINAL MARKING

3.9.1. Do final marking after cleaning, on surface that supports good adhesion and legibility.

3.9.2. Use aluminum type, pressure-sensitive, fluid-resistant, 38 mm minimum width tape for final marking

3.9.3. Ensure that marking product used will not affect mortar to stone adhesion when resetting.

3.9.4. Ensure marking product used will survive storage until resetting of stone.

3.10. HANDLING

- 3.10.1. Usage of Lewis bolts for handling stone is not permitted on exposed faces of stones.
- 3.10.2. Place detached stones on wood surfaces during handling. Prevent contact with metal.
- 3.10.3. When stones are lowered to ground, place directly on wooden platform used for transport or storage.
- 3.10.4. Transport and keep stones on wooden platforms.
- 3.10.5. Ensure that sharp edges of stones do not come into contact with hard objects.
- 3.10.6. Protect wet stones from freezing.

3.11. TEMPORARY STORAGE STAGING AREA

- 3.11.1. Place stones in designated area of site for cleaning, detailed inspection and for final marking, before storage.
- 3.11.2. Make stones accessible and retrievable when required. Ensure that they are easily accessible for review.
- 3.11.3. Retain and store all salvaged stone material including deteriorated stones that cannot be reused whole or for repair. Do a preliminary triage of stones into 3 categories for Consultant review: stones that can be reused; deteriorated stones that cannot be reused whole or for repairs; and stones that can be reused for repairs. Deteriorated stones should be salvaged for future repairs if each individual unit meets the following criteria:
 - 3.11.3.1. Sound;
 - 3.11.3.2. Free of salts;
 - 3.11.3.3. Cut to new profile;
 - 3.11.3.4. As directed by The Consultant.

3.12. CLEANING

- 3.12.1. Refer to Section 04 03 01.13 – Heritage Masonry Cleaning

3.13. FINAL STORAGE

- 3.13.1. Lay out storage so that each stone will have its numbered face visible and be accessible or removable without having to move adjacent stones.
- 3.13.2. Show layout of stones to be stored on record drawing.
- 3.13.3. Store rubble stone in a wood box.

END OF SECTION

PART 1 - GENERAL

1.1. DEFINITIONS

- 1.1.1. Sound stone – stone that has no visible fissures, cracks or stylolites. Stylolites are thin, dark clay deposits that appear as irregular fissures through the full depth of the stone or nearly the full depth. A sound stone will have no holes or missing pieces.

1.2. MOCK-UPS

- 1.2.1.1. Construct mock-ups in accordance with Section 04 03 01 - Common Work Results for Heritage Masonry.
- 1.2.1.2. Perform procedural mock-ups for the laying and relaying of masonry units in the presence of the Consultant.

PART 2 - PRODUCTS

2.1. REPLACEMENT STONE

- 2.1.1. Reused stone: refer to Section 04 03 43.19 – Heritage Stone Dismantling.

2.2. ANCHORS, TIES, AND MORTAR

- 2.2.1. Anchors, cramps, dowels: refer to structural.
- 2.2.2. Mortar: refer to Section 04 03 05.13 – Heritage Mortaring.
- 2.2.3. Softwood wedges for setting large stones.

PART 3 - EXECUTION

3.1. PREPARATION

- 3.1.1. Dismantled wall is to be left to dry for a minimum of two weeks or until the wall core is deemed to be sufficiently dry by Consultant and the Designer of Record.
- 3.1.2. Prevent absorption of ground water and exposure to rain. Rest stones in their natural bedding.
- 3.1.3. Handling:
- 3.1.3.1. Move and lift stone units using means to prevent damage.
- 3.1.3.2. Submit stone units dropped or impacted to Consultant for inspection and approval.
- 3.1.3.3. Do not make holes or indentations for Lewis pins or dogs on face or top side of stone.
- 3.1.3.4. Fill holes after moving and lifting.
- 3.1.4. Indicate bedding planes of stone units. Duplicate bedding marks on usable pieces of cut stone.
- 3.1.5. Place safety devices and signs near work area, as directed.
- 3.1.6. Install shoring and supports as required and as indicated by Structural Contract Documents.

3.2. CUTTING/SIZING OF STONE

- 3.2.1. Use calipers, squares, and levels to measure hole for new stone.
- 3.2.2. Site trim by cut-sizing new stone with joint widths not more than 6 -10 mm.

3.3. MOVING STONES

- 3.3.1. Use approved methods to move stones horizontally and to lift stones to working level.
- 3.3.2. Move, handle, and set stones without causing damage.

3.4. RESETTING MISALIGNED STONES

- 3.4.1. Where indicated, re-set misaligned stone. Construct and brace temporary supports for arches to resist loads.
- 3.4.2. Remove stone units as necessary.
- 3.4.3. Re-lay stones true to line and install dowels and cramps.
- 3.4.4. Remove supports.

3.5. LAYING AND RE-LAYING OF STONE WITHIN EXISTING WALL

- 3.5.1. Prepare wall to receive stone.
- 3.5.2. Obtain Consultant's approval of cleaning of core before commencing inserting stone.
- 3.5.3. Mortar fill deep voids of backing/wall cores to within 50 mm of back of stone in maximum 50 mm lifts. Use Mortar Type 1, refer to Section 04 03 05.13 – Heritage Mortaring. Build up thicknesses with stone pieces set in mortar to replace original bonding pattern of core to facework.
- 3.5.4. Reconstruct masonry to ensure full embedding of grouted portion of anchors.
- 3.5.5. Drill and set anchors as specified in applicable Sections. Allow period of curing as specified in applicable sections prior to drilling.
- 3.5.6. Cut stones for connectors and support systems. Set connectors to face stone in appropriate sequence.
- 3.5.7. Clean stone by washing with water and natural fibre brush before laying.
- 3.5.8. Thoroughly dampen surfaces of stone, backing/wall core and apply mortar.
- 3.5.9. Set stones plumb, true, and level in full bed of Mortar Type 1 and with vertical joints filled full except where otherwise specified. Set stones in same orientation as removed stones with even joint widths.
- 3.5.10. Erect face stones ahead of backing/wall core. Fill core with Mortar Type 1 and stone pieces. Size and position stone pieces to interlock with face stones as found. Voids in core construction is not acceptable. Insert stone pieces tightly into mortar to minimize mortar quantity in core.
- 3.5.11. Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight.
- 3.5.12. Prop and anchor projecting stones until wall above is set.
- 3.5.13. Set large stones on water-soaked softwood wedges to support stone in proper alignment until mortar has set. Remove wedges when dry, do not break off.
- 3.5.14. Remove mortar dropping from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.
- 3.5.15. Fill all voids around connectors with mortar type as specified.
- 3.5.16. Lay in Guelph limestone shards only if joint between Guelph Limestone masonry is too large. Prior to installation, confirm condition and requirement for shards with Consultant.

3.6. WALL DISMANTLING, REBUILDING, AND REPAIRS

- 3.6.1. All requirements for masonry dismantling detailed in Section 04 03 43.19 – Heritage Stone Dismantling apply.
 - 3.6.1.1. The marking and recording of stones before dismantling; this includes cap stones, face stones, through stones and back-up stones such that they can be rebuilt in the same location and orientation.
- 3.6.2. Begin dismantling at the top. Dismantle coping stones, face stones, through-stones rubble core and back-up stones.

- 3.6.3. Area and extent of dismantling are to be confirmed on site by Consultant.
- 3.6.4. Brace adjacent wall as required.
- 3.6.5. Brace soil and backfill as required.
- 3.6.6. Stones are to be reviewed by Consultant to determine replacements and repairs.
- 3.6.7. Stones are to be replaced in kind, being of the same size and orientation within the wall as the original.
- 3.6.8. Add replacement stones as required where stones are missing.
- 3.6.9. Rebuild wall to original condition:
 - 3.6.9.1. Perform a rebuilding mock-up for review by the Consultant before proceeding. Rebuilding shall not proceed without a reviewed mock-up. Mock-up must include the rebuilding of face stones, wall core, and back-up stones.
 - 3.6.9.2. Face stones, cap stones, back-up stones and through stones must be butting tightly to each other. There should be no gaps between stones. Each stone is to be solidly supported, making even contact with the stones below.
 - 3.6.9.3. Rebuild face stones, cap stones, back-up stones and through stones in their original location and orientation.
 - 3.6.9.4. Coursing is to line up with existing.
 - 3.6.9.5. Stagger vertical joints as per existing.
 - 3.6.9.6. Follow original vertical inclination of the wall (batter) and curvature of the wall.
- 3.6.10. Rebuild wall core using sound original filler stones and Mortar Type 2, refer to Section 04 03 05.13 – Heritage Mortaring. Add replacement core filler stones as required. Minimize gaps and voids.
- 3.6.11. Cap stones are to be placed such that they do not tip or shift when weight is applied on top. Cap stones should be set level and even, creating a smooth top of wall.
- 3.6.12. Back-fill behind wall with aggregate as required. Aggregate in the size range of 19mm- 38mm is suitable. Compact back-fill using hand-operated compaction equipment.
- 3.6.13. Replace deteriorated cap stones as required.
- 3.6.14. Remove biological growth from all masonry joints. Ensure stones are well supported after removal. Confirm with Owner if any areas require rebuilding after removal of biological growth from joints.

3.7. JOINT POINTING AND FINISHING

- 3.7.1. Damp cure bedding and pointing mortars in accordance with Section 04 03 05.21 – Heritage Repointing.
- 3.7.2. Finish all joints in accordance with Section 04 03 05.21 – Heritage Repointing.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide masonry units including but not limited to following:
 - 1.2.1.1. concrete block masonry with sequestered carbon dioxide.
 - 1.2.1.2. brick masonry.
 - 1.2.1.3. block lintels and other special units.
 - 1.2.1.4. masonry mortar.
 - 1.2.1.5. masonry reinforcing.
 - 1.2.1.6. anchor and tie systems.
 - 1.2.1.7. reinforcing steel bars and concrete fill for block lintels.
 - 1.2.1.8. cavity wall insulation.
 - 1.2.1.9. air/vapour barrier system.
 - 1.2.1.10. weepholes, dampproof course, through-wall flashings.
 - 1.2.1.11. expansion joints and joint flashings.
 - 1.2.1.12. control joints and preformed joint filler.
 - 1.2.1.13. compressible filler.
 - 1.2.1.14. anchor bolts for securing wood coping atop masonry.
 - 1.2.1.15. building recesses to receive recessed work of this Contract; i.e. washroom accessories, fire extinguisher cabinets, drinking fountains, electrical panels, boxes and other work as shown or specified.
 - 1.2.1.16. cleaning masonry.
- 1.2.2. Products installed but not supplied under this Section:
 - 1.2.2.1. loose steel lintels.
 - 1.2.2.2. access doors.
- 1.2.3. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.3.1. Vertical reinforcing steel and wire ties: Section 03 20 00, Concrete Reinforcement.
 - 1.2.3.2. Supply and installation of flashing reglets; concrete fill for top 2 courses of load bearing wall, setting, installing wall plates for steel joists and beams: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.3.3. Supply of miscellaneous steel required to be built-in or installed in masonry: Section 05 50 00, Metal Fabrications.
 - 1.2.3.4. Supply and installation of metal flashings in direct connection with roofing: Section 07 52 16, Modified Bituminous Membrane Roofing.
 - 1.2.3.5. Firestopping and smoke seals: Section 07 84 00, Firestopping and Smoke Seals.

- 1.2.3.6. Caulking at exterior expansion and control joints and caulking of interior control joints; caulking between masonry walls and adjacent materials: Section 07 92 00, Joint Sealants.
- 1.2.3.7. Sleeves for mechanical and electrical works penetrating masonry walls or partitions, including packing and sealing same: Division 20, Mechanical General Requirements, Division 21, Fire Suppression, Division 22, Plumbing, Division 23, Heat, Ventilating and Air Conditioning, Division 26, Electrical, Division 27, Communications and Division 28, Electronic Safety and Security.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

- 1.3.1.1. BIA: The Brick Industry Association; www.gobrick.com.
- 1.3.1.2. LTTR: Long Term Thermal Resistance.
- 1.3.1.3. NRCC: National Research Council Canada; www.nrc-cnrc.ca.
- 1.3.1.4. OBC: Ontario Building Code.
- 1.3.1.5. OMCA: Ontario Masonry Contractors' Association; www.canadamasonrycentre.com.
- 1.3.1.6. OHSA: Occupational Health and Safety Act.
- 1.3.1.7. SBS: Styrene Butadiene Styrene.
- 1.3.1.8. STC: Sound Transmission Class.
- 1.3.1.9. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.

1.3.2. Definitions:

- 1.3.2.1. Rain Screen Principle: A theory governing the design of a building enclosure in such a way as to prevent water penetration due to rain; in other words, a scientific approach to eliminating water leakage.

1.3.3. Reference Standards:

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|----------|-----------------------|--|
| 1.3.3.1. | ASTM A123/A123M-17 | - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| 1.3.3.2. | ASTM A153/A153M-16a | - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| 1.3.3.3. | ASTM A580/A580M-18 | - Standard Specification for Stainless Steel Wire |
| 1.3.3.4. | ASTM A653/A653M-23 | - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| 1.3.3.5. | ASTM A666-23 | - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar |
| 1.3.3.6. | ASTM A1011/A1011M-18a | - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength |
| 1.3.3.7. | ASTM A1064/A1064M-22 | - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete |
| 1.3.3.8. | ASTM C67/C67M-20 | - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile |
| 1.3.3.9. | ASTM C207-06(18) | - Standard Specification for Hydrated Lime for Masonry Purposes |

| | | |
|-----------|----------------------|---|
| 1.3.3.10. | ASTM C518-21 | - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |
| 1.3.3.11. | ASTM C1303/C1303M-19 | - Standard Test Method for Predicting Long-Term Thermal Resistance of Closed Cell Foam Insulation |
| 1.3.3.12. | ASTM E96/E96M-22ae1 | - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials |
| 1.3.3.13. | CAN/CGSB-51.34-M86 | - Vapour Barrier, Polyethylene Sheet for Use in Building Construction |
| 1.3.3.14. | CSA A23.1-19 | - Concrete materials and methods of concrete construction |
| 1.3.3.15. | CAN/CSA-A82-14(18) | - Fired Masonry Brick Made from Clay or Shale |
| 1.3.3.16. | CSA A165.1-14(19) | - Concrete Block Masonry Units |
| 1.3.3.17. | CAN/CSA-A179-14(19) | - Mortar and Grout for Unit Masonry |
| 1.3.3.18. | CSA A370-14(18) | - Connectors for Masonry |
| 1.3.3.19. | CSA A371-14(19) | - Masonry Construction for Buildings |
| 1.3.3.20. | CAN/CSA-A3000-18 | - Cementitious Materials Compendium |
| 1.3.3.21. | CSA S304.1-04(20) | - Design of Masonry Structures |
| 1.3.3.22. | CAN/ULC-S102-18 | - Test Method of Surface Burning Characteristics of Building Materials and Assemblies |
| 1.3.3.23. | CAN/ULC-S114-18 | - Standard Method of Test for Determination of Non-Combustibility in Building Materials |
| 1.3.3.24. | CAN/ULC-S701.1-22 | - Standard for Thermal Insulation, Polystyrene Boards |
| 1.3.3.25. | CAN/ULC-S702.1-21 | - Standard for Thermal Insulation, Mineral Fibre for Buildings, Part 1: Material Specification |
| 1.3.3.26. | CAN/ULC-S770-15(20) | - Standard for Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams |

1.4. SUBMITTALS

- 1.4.1. Samples: Submit samples in accordance with Section 01 30 00. Submit 1 each of following samples to Consultant:
- 1.4.1.1. concrete blocks.
 - 1.4.1.2. brick: provide at least 6 bricks showing range of colour and texture, stacked with simulated joints.
 - 1.4.1.3. ties, reinforcement, anchors and connectors, 300 mm (12") long.
 - 1.4.1.4. cavity flashing.
 - 1.4.1.5. air/vapour barrier.
 - 1.4.1.6. cavity insulation.
- 1.4.2. Test and Evaluation Reports:
- 1.4.2.1. If requested, submit laboratory test reports certifying compliance of masonry units and mortar ingredients as specified herein.
 - 1.4.2.2. Submit manufacturer's certificate verifying quantity and source (location company) of sequestered carbon dioxide.

- 1.4.2.3. Submit manufacturer's certificate verifying masonry reinforcement supplied to Project conforms to ASTM A153/A153M, Class B-2 hot dipped galvanized requirements.
- 1.4.2.4. Submit manufacturer's certificate verifying stainless steel masonry reinforcement is type 304/316; wire ties/reinforcing conforms to ASTM A580/A580M and plates/strips/sheets conform to ASTM A666.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
 - 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers. Membership in good standing in OMCA.
- 1.5.2. Mock-Ups: Conform to requirements of Section 01 40 00. Construct 1 site mock-up of following for Consultant's review:
 - 1.5.2.1. Typical brick and block wall assembly as part of Work.
 - 1.5.2.2. Mock-Up Size: 2400 mm x 2400 mm (8' x 8').
 - 1.5.2.3. Provide bond pattern, coloured mortar and jointing as specified.
 - 1.5.2.4. Ensure any irregularity in mortar joints is not noticeable when viewed from a distance of 6 m (20') or more.
 - 1.5.2.5. Do not commence remainder of work of this Section until mock-up panel has been reviewed by Consultant and required changes completed. Once reviewed with no objections recorded, panel becomes standard of comparison for masonry work on site and not destroyed or moved until authorized by Consultant.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Storage and Handling Requirements:
 - 1.6.1.1. Handle, stack and store masonry units on skids and/or under tarps on site to avoid chipping, protect against staining and moisture entry.
 - 1.6.1.2. Do not store or locate materials, plant and equipment in areas which will obstruct access to work by others.

1.7. SITE CONDITIONS

- 1.7.1. Ambient Conditions:
 - 1.7.1.1. Provide uniformly distributed and continuous heating. Prevent stratification and cold spots.
 - 1.7.1.2. Maintain masonry continuously at minimum 4 deg C (39 deg F) during placement and for 48 hours after placement.
 - 1.7.1.3. Employ protection and heating methods which will prevent evaporation of moisture from masonry during curing.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant air/vapour barrier work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; material remaining air and water tight.

PART 2 - PRODUCTS

2.1. MATERIALS

2.1.1. Performance/Design Criteria:

2.1.1.1. Design exterior envelope cavity walls based on Rain Screen Principle advocated by NRCC and provide for drainage of water entering envelope cavity wall system. Provide for compartments in long cavity wall and at corners to achieve appropriate pressure equalization in exterior envelope cavity wall design.

2.1.1.2. Provide only stainless steel reinforcement for exterior envelope walls.

2.1.1.3. Concrete Block Fire and Smoke Separations: Refer to Ontario Concrete Block Association, Metric Technical Manual and provide hollow or solid block assemblies to achieve required fire ratings. Fire and smoke masonry separations shall conform to OBC requirements with respect to materials, classification, equivalent thicknesses, fire resistant ratings, type of concrete and other requirements of authorities having jurisdiction or provide fire rated, ULC listed concrete block assemblies for fire separations.

2.1.1.4. Conform to requirements of CSA S304.1 for determination of loads acting on connectors and design requirements and to CSA A370 and CSA A371 for construction requirements, except where more stringent requirements are noted and/or indicated on Drawings and specified herein.

2.1.1.5. Conform to CAN/CSA-A82, for type and grade specified and ensure bricks pass ASTM C67/C67M, freezing and thawing test.

2.1.2. Obtain each masonry unit from 1 manufacturer. Provide units of uniform texture and colour for each kind required.

2.1.3. Face Brick: Hard burned clay brick masonry units, conforming to CAN/CSA-A82.1, Grade EG, Type X.

2.1.4. Concrete Blocks: Normal and lightweight units, metric modular units with low carbon footprint conforming to CSA A165.1, Normal Type(s) Hollow Units: H/15/A/O, Full Solid Units: SF/15/A/O and Semi-Solid Units: SS/15/A/O, Lightweight Type(s) Hollow Units: Type H/15/C/O, Full Solid Units: Type SF/15/C/O and Semi-Solid Units: Type SS/15/C/O. Permitted Products: "Carbon Cure®" by Brampton Brick Limited; www.bramptonbrick.com, Permacon; www.permacon.ca or "Autoclave Block" by Day & Campbell Limited; www.daycampbell.com.

2.1.5. Ensure exposed surfaces are free of cracks, chips or other blemishes and broken corners. Include required sash blocks for control joints, solid block where noted and concrete block lintels over openings in concrete block walls unless steel lintels are shown.

2.1.6. Unless shown otherwise, external corners on exposed interior block masonry shall be bullnosed units or alternatively, regular units with corners ground smooth with Carborundum grinder.

2.1.7. Through-Wall Flashing:

2.1.7.1. Flexible Flashing: Modified bitumen, self-adhesive sheet membrane reinforced with proprietary glass scrim, minimum thickness 1 mm (40 mils); "Blueskin TWF Self-Adhesive Thru-Wall Flashing System" by Henry Company or "Soprseal WFM" by Soprema Inc.

2.1.7.2. Termination Sealant for Flashings: Single component of trowel consistency, synthetic rubber-based adhesive; "Air-Bloc 21" or "230-21 Rigid Insulation Adhesive" by Henry Company.

2.1.7.3. Galvanized Sheet Flashing (Concealed from View): Commercial quality galvanized sheet to ASTM A653/A653M, 0.38 mm (28 ga) thick minimum, Z275 (G90) zinc coated by hot-dip process.

2.1.7.4. Pre-painted Sheet Steel Exposed to View: Supply 0.38 mm (28 ga) minimum thickness, commercial quality, Type A to ASTM A653/A653M with Z275 (G90) zinc coating designation, pre-painted with "Perspectra Plus Series™" by Baycoat; www.baycoat.com or "WeatherXL™" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com, in colour(s) selected by Consultant.

- 2.1.8. PVC Corner Flashing: Non-reinforced, homogenous, waterproof, impermeable, flexible PVC expandable 1-piece flashing membrane designed to conform to any angle at 2 opposing surfaces suitable for cavity wall construction. "Dry 90 Corner Flashing" by JV Building Products.
- 2.1.9. Lateral Support and Anchorage for Masonry Walls: In accordance with CSA S304.1 and as specified and supplied as part of work of Section 05 50 00.
- 2.1.10. Block Filler:
 - 2.1.10.1. Dry pack grout to consist of 1-part Portland Cement, 1-1/2-parts sand, 2-parts 9 mm (3/8") pea gravel with only sufficient water to dampen mixture.
 - 2.1.10.2. Measure and mix block filler in accordance with CAN/CSA-A179; mix filler to consistency in accordance with manufacturer's recommendations; do not mix different types of grout in same mixer used for mixing of mortar unless mixer is thoroughly cleaned. Use and place grout in its final position within 2-1/2 hours of mixing it. Discard grout not used within 2-1/2 hours. Use coarse grout where required, in spaces 50 mm (2") or more in least horizontal dimension. Use fine grout in spaces less than 50 mm (2") in horizontal dimension.
- 2.1.11. Bituminous Paint: Supply "810-07 Non-Fibered Asphalt Roof and Foundation Coating" by Henry Company; www.henry.com.
- 2.1.12. Anchor Bolts: Minimum 9 mm (3/8") dia steel. In length shown on Drawings, hot dip galvanized.
- 2.1.13. Mortar Dropping Control Device: 25 mm (1") thickness; "The Mortar Net" by Mortar Net USA, Ltd. www.mortarnet.com, "Mortar Trap™" by Hohmann & Barnard, Inc.; www.h-b.com or "Mortar Break" by Advanced Building Products Inc.; www.advancedflashing.com.
- 2.1.14. Compressible Filler: "Backerseal" by Emseal Corporation; www.emseal.com.
- 2.1.15. Premoulded Filler: "Rodofoam PR grade" by GCP Applied Technologies, Inc. or "Rescor Expansion Joint Filler" by W. R. Meadows of Canada Ltd. Premoulded filler shall be twice thickness of opening to be filled.
- 2.1.16. Stone Wool Filler: Stone wool batt insulation by ROCKWOOL™ International A/S; www.rockwool.com.
- 2.1.17. Horizontal Joint Material:
 - 2.1.17.1. "NS – Closed Cell Neoprene Sponge" by Hohmann & Barnard, Inc.; www.h-b.com.
 - 2.1.17.2. Size: 9 mm (3/8") thick x 75 mm (3") wide x roll length.
- 2.1.18. Brick Control Joint Material: "Blok-Lok Exp-Joint" by Blok-Lok Limited; www.blok-lok.com or "NS – Closed Cell Neoprene Sponge" by Hohmann & Barnard, Inc.; www.h-b.com.
- 2.1.19. Rubber Concrete Block Control Joint Material: "RS Series - Regular Rubber Control Joint" by Hohmann & Barnard, Inc.; www.h-b.com or "Titewall BL-A Control Joint" by Blok-Lok Limited; www.blok-lok.com.
- 2.1.20. Control Joint Bond Break: CAN/CGSB-51.34-M, 0.15 mm (6 mil) thick clear polyethylene cut into 1 piece strips with width to suit wall thickness.
- 2.1.21. Sealant: Polyurethane, tested for non-staining of masonry conforming to requirements of Section 07 92 00. Colour selected by Consultant.
- 2.1.22. Masonry Reinforcement:
 - 2.1.22.1. Masonry Connectors and Reinforcement: Performance tolerance requirements and corrosion protection for masonry connectors and horizontal reinforcing in accordance with requirements of CSA A370, CSA A371 and ASTM A1064/A1064M. Provide corrosion and dielectric protection for anchors, connectors, ties, reinforcement and other metal accessories to suit wall design and thickness as follows:
 - 2.1.22.1.1. Level 1 Corrosion Protection - Mill Galvanized: For interior masonry not subject to moisture.

- 2.1.22.1.2. Level 2 Corrosion Protection - Hot Dip Galvanized: For interior masonry in heavy moisture environment; hot dip galvanized after fabrication with min zinc coating in accordance with ASTM A153/A153M Class B for wire ties/reinforcing 458 g/m² (1.5 oz/sq ft) and ASTM A123/A123M for plates/strips/sheets 610 g/m² (2.0 oz/sq ft) (on each face).
- 2.1.22.1.3. Level 3 Corrosion Protection - Stainless Steel Reinforcement at Building Envelope: Type 304/316 stainless steel in accordance with ASTM A580/A580M for wire ties/reinforcing and ASTM A666 for plates/strips/sheets.
- 2.1.22.2. Masonry Reinforcement for Interior Single Wythe Walls: "120 Truss-Mesh" by Hohmann & Barnard, Inc.; www.h-b.com or "BL30" by Blok-Lok Limited; www.blok-lok.com, 3.8 mm (9 ga) deformed wire for single block wythes; sized 50 mm (2") narrower than wall or partition. Provide shop fabricated corners, intersections and curved configuration where required. Finish as specified herein depending upon location of walls.
- 2.1.22.3. Adjustable Masonry Reinforcement for Exterior Composite Walls: "BL36" by Blok-Lok Limited; www.blok-lok.com or "170-ML Truss Adjustable Eye-Wire" by Hohmann & Barnard, Inc.; www.h-b.com, 4.8 mm (3/16") nominal dia deformed wire; sized 50 mm (2") narrower than wall or partition. Stainless steel as specified herein before.
- 2.1.22.4. Adjustable Masonry Reinforcement for Cavity Walls: Provide 1 of following:
- 2.1.22.4.1. "Adjustable Econo-Cavity Blok-Trus II BL37 System 2000" complete with "Wedge-Lok", or "D.A.T. System" complete with "Wedge-Lok" by Blok-Lok Limited; www.blok-lok.com, sized 50 mm (2") narrower than wall or partition. Finish as specified herein before depending upon location of walls. Hot dipped galvanized finish for interior locations as specified herein before. Stainless steel at exterior building envelope as specified herein.
- 2.1.22.4.2. For Tying Brick, Concrete Block and Masonry Unit Veneer:
- 2.1.22.4.2.1. Use "FERO Thermal Tie™ - Block Shear® Masonry Connector" system by Fero Corporation; www.ferocorp.com. "FERO Thermal Tie™ - Block Shear® Masonry Connector" shall transfer shear between brick veneer and backup wall. With use of shear resisting connector, composite load carrying action shall be achieved between brick veneer and backup wall, resulting in a wall system with a changed and improved load resisting capacity. Ensure "FERO Thermal Tie™ - Block Shear® Masonry Connector" assembly consists of "FERO Thermal Tie™ - Block Shear® Masonry Connector" plate, a "FERO V-Tie™ and Insulation Support".
- 2.1.22.4.2.2. "FERO Thermal Tie™ - Block Shear® Masonry Connector" plate component manufactured from 1.519 mm (16 ga) thick sheet metal conforming to CSA A370 and ASTM A1011/A1011M, stainless steel for exterior wall in building envelope.
- 2.1.22.4.2.3. Ensure length of "FERO Thermal Tie™ - Block Shear® Masonry Connector" varies to accommodate block width and insulation thickness, air space width of 25 mm (1") and greater as shown on Drawings. Ensure shear keys and corrugated sections provide for adequate fixity within concrete block wythe. Notch in plate assures proper positioning within concrete block wythe.
- 2.1.22.4.2.4. Incorporate holes within insulation thickness portion of "FERO Thermal Tie™ - Block Shear® Masonry Connector" plate.
- 2.1.22.4.2.5. Manufacture "FERO V-Tie™" from 4.76 mm (0.19") diameter wire conforming to ASTM A1064/A1064M and be stainless steel at exterior wall in building envelope.
- 2.1.22.4.2.6. Mortar legs of "FERO V-Tie™" into place at centerline of brick veneer. Ensure "FERO V-Tie™" sizes suit design requirements and as recommended by system manufacturer.
- 2.1.22.4.2.7. Insulation support shall be polyethylene used to secure sheet insulation in place.
- 2.1.22.4.2.8. Provide "FERO Thermal Tie™ - Block Shear® Masonry Connector" at 800 mm (31") horizontally and 600 mm (24") vertically. Provide 300 mm (12") maximum spacing around wall openings, top, 200 mm (8") from wall base and corners.

- 2.1.22.4.2.9. Provide "120 Truss-Mesh" by Hohmann & Barnard, Inc.; www.b-h.com or "BL30" by Blok-Lok Limited; www.blok-lok.com, 3.8 mm (9 ga) deformed wire for single block wythes, 4.8 mm (3/16") dia for 2 or more wythes; sized 50 mm (2") narrower than wall or partition at every second block course. Provide shop fabricated corners, intersections and curved configuration where required. Finish as specified herein before depending upon location of walls.
- 2.1.22.5. Miscellaneous Metal Ties, Column to Column Ties, Anchors: Adjustable anchors to suit application conforming to CSA A370.
- 2.1.23. Air/Vapour Barrier System: Provide 1 of following:
- 2.1.23.1. SAT System (Foil Faced):
- 2.1.23.1.1. Primer: "ELASTOCOL STICK" by Soprema Inc. or "Blueskin® Adhesive", "Blueskin® LVC Adhesive" or "Aqua-Tac Primer" by Henry Company.
- 2.1.23.1.2. SAT Membrane: SBS modified bitumen membrane, minimum 1.016 mm (40 mils) thick with aluminum foil facer on 1 side and siliconized release paper on the other, cut to suit design and lap requirements; "SOPRASOLIN HD" by Soprema Inc. or "Metal Clad® 705FR" by Henry Company.
- 2.1.23.2. Liquid Membrane System:
- 2.1.23.2.1. One component liquid made from modified rubber. Minimum application temperature 4 deg C (40 deg F).
- 2.1.23.2.2. "SOPRASEAL LM 202 VP", complete with "SOPRASEAL QUICK CORNER" and "SOPRASEAL MESH" by Soprema Inc.
- 2.1.23.2.3. One component, synthetic permeable air barrier membrane, monolithic elastomeric liquid applied coating system; "ExoAir® 230" by Tremco Canada.
- 2.1.23.2.4. One component elastomeric rubber, high solids trowel applied coating system; "Air-Bloc® 31MR" by Henry Company, complete with recommended primers.
- 2.1.23.2.5. One component fluid-applied, water-based vapour-permeable membrane "Wall Guardian FW-100A" by Kemper System Canada, Inc.
- 2.1.23.2.6. One component cold liquid applied, water based, polymer-modified, seamless, elastomeric air/vapour barrier, "Air-Shield LMP" by W. R. Meadows of Canada.
- 2.1.23.2.7. Ensure appropriate manufacturer approved accessories and materials are used in conjunction with liquid applied membrane.
- 2.1.24. Acoustical Insulation: CAN/ULC-S702.1, mineral (glass and stone wool) fibre, flame spread and smoke developed in conformance with OBC requirements and other authorities having jurisdiction in accordance with CAN/ULC-S102. Non-combustible in accordance with requirements of CAN/ULC-S114. Permitted Products: "QUIETZONE® PINK NEXT GEN™ FIBERGLAS® Insulation" by Owens Corning Canada LP; www.owenscorning.ca, "ROCKWOOL™ AFB® - Acoustical Fire Batt Insulation" by ROCKWOOL™ International A/S; www.rockwool.com, "Sound-SHIELD® Formaldehyde-Free Fiber Glass Insulation" by Johns Manville Canada Inc.; www.jm.com or "Thermafiber® SAFB™ Mineral Wool Insulation" by Thermafiber, Inc. (Owens Corning Canada LP); www.thermafiber.com, of sufficient thickness to meet required STC rating for sound-rated partitions and of width to suit metal framing spacing and other miscellaneous spacings.
- 2.1.25. Cavity Insulation: CAN/ULC-S701.1, Type 3, extruded polystyrene with minimum LTTR of RSI (R) value of 0.87 (5.0) per 25 mm (1") when determined in accordance with CAN/ULC-S770 and ASTM C1303/C1303M, minimum compressive strength 110 kPa (16 psi), thickness as indicated on Drawings. Provide "DuPont™ Styrofoam™ Brand Cavitymate™ XPS Foam Insulation" or "STYROFOAM™ Brand CAVITYMATE™ Ultra" by DuPont de Nemours Inc.; www.dupont.com, thickness and thermal value as indicated on Drawings. Conform to OBC Division B, Part 3, paragraph 3.1.11.2 requirements for firestopping in wall assemblies.

- 2.1.26. Wall Insulation: CAN/ULC-S701.1, Type 3, extruded polystyrene insulation with LTTR of RSI (R) value of 0.88 (5) when determined in accordance with CAN/ULC-S770 and ASTM C518, minimum compressive strength 140 kPa (20 psi), thickness as indicated on Drawings. Supply boards with shiplapped edges at horizontal locations and butt joints elsewhere; "STYROFOAM™ Brand Cladmate™ CM20 Extruded Polystyrene Foam Insulation" by DuPont de Nemours Inc.; www.dupont.com or "FOAMULAR® NGX C-200" by Owens Corning Canada LP; www.owenscorning.ca.
- 2.1.27. Cavity Insulation Adhesive and Fasteners: As recommended by manufacturer of cavity insulation selected for Project to suit wall assembly complying with requirements of Section 07 21 00. Provide corrosion resistant screws with 38 mm (1-1/2") diameter plastic washers. Provide number and placement of fasteners per board as recommended by insulation manufacturer.
- 2.1.28. Cavity and Dampproof Flashing:
- 2.1.28.1. Sheet Steel Flashing: 0.759 mm (22 ga) sheet steel to ASTM A653/A653M, Z275 (G90) galvanized coating designation.
- 2.1.29. Beams, Lintels, Shelf Angles and Spacers: Loose steel beams, lintels, shelf angles, spacers and their associated bearing plates, angles and pads, to be set into or to support masonry, are supplied as part of work of Section 05 12 00 or Section 05 50 00, for installation as part of work of this Section.
- 2.1.30. Weep Hole/Brick Vents for Brickwork: Honeycomb type, "QV – Quadro-Vent™" by Hohmann & Barnard, Inc.; www.h-b.com or "Cell Vent" by Blok-Lok Limited; www.blok-lok.com, 9 mm (3/8") thick, height and length to match masonry unit size.
- 2.1.31. Mortar:
- 2.1.31.1. Mortar and Grout for Unit Masonry: Conforming to CAN/CSA-A179.
- 2.1.31.2. Masonry Cement: Conforming to CAN/CSA-A3000.
- 2.1.31.3. Hydrated Lime: Conforming to ASTM C207; Lime Type "N".
- 2.1.31.4. White Portland Cement: Federal White Type GU (Type 10).
- 2.1.31.5. Cement: Cement meeting requirements of CAN/CSA-A3000.
- 2.1.31.6. Sand: Clean, sharp, washed and conforming in all respects to requirements of CAN/CSA-A179.
- 2.1.31.7. Water for Mortar Mixing: Potable, free from any deleterious substances.
- 2.1.32. Fabrication:
- 2.1.32.1. Masonry Lintels: Fabricate masonry block lintels as indicated on Drawings. Section 03 20 00 shall supply and set reinforcing bars into masonry block lintels over openings in block masonry wall in accordance with lintel schedule noted on Structural Drawings. Use concrete, not mortar, to fill block.
- 2.1.32.2. Cutting Units: Cut masonry units with wet saw; pre-soak units using clean water prior to cutting them and clean units using a stiff fibre brush and clean water. Allow units to surface dry prior to placement in wall system.
- 2.1.33. Mixes:
- 2.1.33.1. Mortar Mixing:
- 2.1.33.1.1. Mixing Method 1: Prepare and mix mortar materials under supervision and in small batches for immediate use only. Use and mix proprietary mortar in accordance with manufacturer's instructions to produce following mortar types, CAN/CSA-A179. Do not use re-tempered mortars except for ready mixed mortar which shall be re-tempered in accordance with manufacturer's instructions. Discard mixed mortar after 2 hours.

- 2.1.33.1.2. Mixing Method 2: Mix required amount from site silo (including colour load at pre-set rate) as required. Take representative samples for testing consistency of strength (and colour) according to CAN/CSA-A179. Use mortar within 2 hours after mixing at temperature of 26 deg C (79 deg F), or 2-1/2 hours at temperatures under 10 deg C (50 deg F).
- 2.1.33.1.3. Mix mortar in a mechanical batch mixer. Do not hand mix except for work of a very minor nature.
- 2.1.33.1.4. Mix mortar colour pigment and masonry or Portland cement in accordance with manufacturer's instructions and adjust loading as required to produce mortar matching reviewed sample.
- 2.1.33.1.5. Provide mortar within 2 hours of mixing. Discard mortar after 2 hours. Mortar may be re-tempered within 2 hours of mixing to replace water lost by evaporation (1 hour when temperature is over 26 deg C (79 deg F)).
- 2.1.33.2. Proprietary Mortar Mixes: Lafarge Canada Inc, St. Lawrence Cement Company or Daubois Inc. materials conforming to mix requirements specified.
- 2.1.33.3. Site Silo Mortar Mixes: Daubois Inc., Maxi-Mix Ltd. or Jiffy Concrete Products conforming to mix requirements specified.
- 2.1.33.4. Mortar Colouring Compounds: Pure, synthetic, inorganic pigments by Huntsman Pigments; www.huntsman.com or Bayer Inc. in proportions recommended by manufacturer, but not exceeding 10% of weight of cementitious material. Colours:
 - 2.1.33.4.1. Block Mortar Colour: As later selected by Consultant.
 - 2.1.33.4.2. Brick Mortar Colour: As later selected by Consultant.
- 2.1.33.5. For Bedding Steel Bearing Plates, Lintels, for Laying Bearing Courses Under Concentrated Loads and for Laying Masonry Below Grade: Use Type 'S' cement mortar, having a compressive strength of 12.5 MPa (1813 psi) minimum.
- 2.1.33.6. Except as provided above for laying brick or brick facing only of cavity walls whether backup is load bearing or otherwise, and for all other concrete block masonry: Use Type "N" mortar, having compressive strength of 5 MPa (725 psi) minimum.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions:
 - 3.2.1.1. Provide temporary bracing for masonry work during erection to prevent damage due to winds or other lateral loads until permanent structure provides adequate bracing.
 - 3.2.1.2. Cold Weather Protection:
 - 3.2.1.2.1. During cold weather, provide temporary enclosures and coverings in order to protect masonry work and to allow laying of masonry during inclement weather.
 - 3.2.1.2.2. Provide temporary sheltering of freshly built masonry work, during installation and not less than 96 hours after erection to ensure required ambient temperatures.
 - 3.2.1.2.3. Provide temporary wind bracing for newly laid masonry walls.

- 3.2.1.2.4. Completely cover open tops of freshly built walls each night with waterproof tarpaulins or plastic sheet coverings. Apply coverings to tops and faces of walls during rain or snow or upon stoppage of work.
- 3.2.1.3. Cold Weather Masonry: Provide temporary heated enclosures in accordance with Section 01 50 00 if necessary to maintain:
 - 3.2.1.3.1. Product manufacturer's recommended temperatures for following, before, during and after installation until full cure: Ambient air, substrate, stored Products, installed Products.
 - 3.2.1.3.2. Conform to CSA A371 for Cold Weather Requirements, which applies to mixing, enclosure, placing and curing of masonry materials.
 - 3.2.1.3.3. Cementitious materials storage in accordance with CAN/CSA-A3000.
 - 3.2.1.3.4. Aggregate materials storage in accordance with CSA A23.1.
- 3.2.1.4. Conform to CSA A371 for temporary wind bracing for masonry during construction. Provide temporary bracing for masonry work during erection to prevent damage due to winds or other lateral loads until permanent structure provides adequate bracing.
- 3.2.1.5. Protect masonry units and mortar ingredients before use from rain, snow, ice and freezing in accordance with requirements of CSA A371.
- 3.2.2. Surface Preparation:
 - 3.2.2.1. Apply bituminous paint to steel buried in masonry.
 - 3.2.2.2. When ambient air temperature is at or below 4 deg C (39 deg F), preheat:
 - 3.2.2.2.1. masonry units to 15 deg C (59 deg F).
 - 3.2.2.2.2. cement and aggregate to 15 deg C (59 deg F).
 - 3.2.2.2.3. water to minimum 10 deg C (50 deg F), maximum 15 deg C (59 deg F).
 - 3.2.2.2.4. mixers, reinforcement and ties to 15 deg C (59 deg F).
 - 3.2.2.3. Just prior to installing masonry remove snow, surface frost and ice from surfaces masonry is to be constructed against.
 - 3.2.2.4. Do not mix in water until cement and aggregate have been combined.
 - 3.2.2.5. Do not allow frozen lumps, ice or snow to contaminate mortar mix.
 - 3.2.2.6. Maintain mortar continuously at minimum 10 deg C (50 deg F) during mixture.
 - 3.2.2.7. Do not provide chemicals, additives or other contaminants to mortar mixture without review by Consultant.
 - 3.2.2.8. Wet exposed masonry surfaces minimum once every 24 hours for 14 Days to minimize and retard surface evaporation. Do not allow surface freezing.

3.3. INSTALLATION

- 3.3.1. Provide scaffolding required to complete work of this Section. Provide scaffolding independently supported from floor or ground.
- 3.3.2. Conform to the OHSA; erect scaffolding adequate for proper execution of work, maintain and remove on completion. Lay masonry from scaffolds erected on same side as face work. Do not support scaffolding from finished building surfaces.
- 3.3.3. Conform to CSA S304.1 and CSA A371 for masonry work.
- 3.3.4. Do masonry mortar and grout work in accordance with CAN/CSA-A179 and CSA A371 except where specified otherwise.
- 3.3.5. Execute masonry work under continuous supervision and direction of a competent foreman.

- 3.3.6. Lay and set masonry units using experienced mechanics.
- 3.3.7. Do not erect more than 1500 mm (5') in height of any wall in any 1 Working Day and do not raise any part of wall more than 600 mm (24") above remainder at any time.
- 3.3.8. Do not tooth at wall terminations. Rake back 1/2 unit length where stop-off occurs in horizontal run of masonry.
- 3.3.9. Lay up units true to line with accurately spaced courses. Keep bond plumb throughout. Provide corners and reveals plumb and true. Provide horizontal and vertical joints of uniform thickness in straight lines. Keep exposed faces free from stains, chips and cracks. Keep tolerance in plane 3 mm in 2400 mm (1/8" in 8').
- 3.3.10. Provide running bond unless indicated otherwise.
- 3.3.11. Avoid over plumbing and pounding of masonry corners and jambs after setting position. After mortar has set, if adjustment is required, remove mortar and replace with new mortar.
- 3.3.12. Install masonry wall base anchors in masonry foundation walls to line up with voids in masonry walls above as indicated on Drawings. Solidly fill voids between anchors and masonry with mortar.
- 3.3.13. Dampproof Coursing of Exterior Walls:
 - 3.3.13.1. Install dampproof course where indicated on Drawings. If not fully indicated, install in locations as follows and as specified hereafter:
 - 3.3.13.1.1. Below 2nd exterior block masonry course and 4th exterior brick course above new grade line.
 - 3.3.13.1.2. Over exterior lintels and shelf angles.
 - 3.3.13.1.3. Below first masonry course of inner wythe at floors on grade. Extend dampproof coursing through full thickness of inner wythe.
 - 3.3.13.1.4. Wherever roofs or other exterior, horizontal surfaces intersect masonry walls, immediately above roof flashing or horizontal surface flashing and seal to roof or other flashing or vapour barrier.
 - 3.3.13.2. In cavity walls install thru-wall flashings through full thickness of exterior wythe horizontally across cavity and through insulation to terminate with minimum 150 mm (6") vertical leg against air/vapour barrier. Maintain integrity of air/vapour barrier without damaging flashing, membrane and insulation thermal blanket.
 - 3.3.13.3. Provide corner flashing on inner wythe exterior corner to prevent water or moisture penetration on masonry. Apply as recommended by manufacturer and compatible with adjacent materials.
 - 3.3.13.4. At shelf angles install flashing through exterior wythe up and over shelf angle, horizontally through insulation turning up wall and terminate at and adhere to air/vapour barrier as specified herein.
 - 3.3.13.5. In non-cavity wall install flashing through full thickness of wall to provide dampproofing in accordance with manufacturer's recommendations.
 - 3.3.13.6. Where brick is laid against concrete without air/vapour membrane with less than 25 mm (1") clear space separating them, apply 2 coats dampproofing to concrete.
 - 3.3.13.7. Install flashings to provide continuous waterproofing flashing in wall except where such courses occur over openings in walls extend them past opening minimum of 200 mm (8") and turn up minimum 150 mm (6") at each end to create waterproof dam to prevent water draining into cavity. End dam where flashings terminate at an opening.
- 3.3.14. Laying Concrete Block:
 - 3.3.14.1. Do not wet concrete block before laying. Lay first course of block work in full beds of mortar with joints of uniform thickness. Provide 100% solid blocks at following locations:
 - 3.3.14.1.1. top course of interior block walls and block back-up wythes.
 - 3.3.14.1.2. at sills of openings e.g. windows, louvres, etc.

- 3.3.14.1.3. top course of block below beams, joists and lintels bearing on walls.
- 3.3.14.1.4. at top of parapet walls.
- 3.3.14.2. Provide square end blocks at jambs of openings.
- 3.3.14.3. Provide concrete masonry units with face shells and end joints fully filled with mortar. Do not slush mortar into joints.
- 3.3.14.4. Provide damming and grout fill to vertical concrete block wall cavities at control joints.
- 3.3.14.5. Extend block partitions, both fire-rated and non-fire-rated, up to within 25 mm (1") of underside of structure above unless otherwise indicated, to allow for structural deflection.
- 3.3.15. Brick:
 - 3.3.15.1. Install shelf angles and spacers supplied as part of work of Section 05 50 00. Provide compressible filler below shelf angles.
 - 3.3.15.2. Provide brick veneer tight to cavity compartmentalization.
 - 3.3.15.3. Provide cavity flashing and cavity insulation.
 - 3.3.15.4. Wet brick with absorption rate of over 20 g/minute when tested in accordance with CAN/CSA-A82 before laying.
 - 3.3.15.5. Lay brick in level courses in full beds of mortar with vertical joints flushed up solid. Lay brick by shove joint method, with joints of uniform thickness.
 - 3.3.15.6. Lay face brick in running bond with soldier courses where indicated. Evenly distribute variation in colour preferably working from 3 random pallets simultaneously.
 - 3.3.15.7. In exterior brick cavity walls, provide cavity vents in following locations:
 - 3.3.15.7.1. in vertical masonry joints at 600 mm (24") centres horizontally with vents set 6 mm (1/4") back from face of brick and back of vent flush with back face of brick.
 - 3.3.15.7.2. at bottom and top courses of walls.
 - 3.3.15.7.3. below window sills.
 - 3.3.15.7.4. above window heads.
 - 3.3.15.7.5. above brick flashings and shelf angles.
 - 3.3.15.8. Keep cavities clear of mortar.
- 3.3.16. Concrete Block Lintels:
 - 3.3.16.1. Unless indicated otherwise on Structural Drawings, provide concrete block lintels over openings in masonry walls. Refer to Mechanical and Electrical Drawings for location of ducts and equipment mounted in or projecting through masonry walls. Refer to Structural Drawings for Lintel Schedules.
 - 3.3.16.2. Unless otherwise noted in Door Schedule, set precast U-shaped reinforced block lintels for full thickness of wall plus minimum 200 mm (8") bearing. Provide reinforcement as indicated on Structural Drawings.
 - 3.3.16.3. Fill lintels with concrete and leave shoring in place for minimum 10 Days before removal.
 - 3.3.16.4. Set concrete blocks over lintel unit in a full mortar bedding.
- 3.3.17. Lateral Support Angles:
 - 3.3.17.1. Install lateral support angles to underside of structure, at 2000 mm (6' - 6") oc, for lateral stability of interior masonry walls and back-up wythe masonry walls.
 - 3.3.17.2. Install lateral supports at either horizontal or vertical intervals spaced at not more than:
 - 3.3.17.2.1. 20 x wall thickness for solid wall of solid units.

- 3.3.17.2.2. 18 x wall thickness for solid wall of hollow units.
- 3.3.17.2.3. 36 x wall thickness for partitions.
- 3.3.18. Joint Tooling:
 - 3.3.18.1. Provide joints in masonry, firmly pointed, compacted and tooled.
 - 3.3.18.2. Exterior Masonry Joint Tooling:
 - 3.3.18.2.1. Brick: Concave joints:
 - 3.3.18.2.1.1. Horizontal: Rake back joints 9 mm (3/8").
 - 3.3.18.2.1.2. Vertical: Rake back joints 9 mm (3/8").
 - 3.3.18.2.2. Concrete Block:
 - 3.3.18.2.2.1. Exposed: Concave joints.
 - 3.3.18.2.2.2. Concealed: Flush joints.
 - 3.3.18.2.2.3. Parged: Rake back joints 13 mm (1/2").
 - 3.3.18.3. Interior Masonry Joint Tooling:
 - 3.3.18.3.1. Concrete Block:
 - 3.3.18.3.1.1. Exposed: Concave joints.
 - 3.3.18.3.1.2. Concealed: Flush joints.
- 3.3.19. Built-In Work:
 - 3.3.19.1. Solidly build items of hollow metal work and miscellaneous metal work, including but not limited to grilles, hose cabinets, electrical panels into masonry work, and ensure they are set square and true in walls and partitions.
 - 3.3.19.2. Cut for and build into masonry, anchors, sleeves, inserts, reglets, piping, conduit, outlet boxes, metal flashings and leave chases, slots or openings required for fixing of work of other Sections. Build chases into masonry walls; do not cut.
 - 3.3.19.3. Firestopping and Smoke Seal: Firestopping and smoke seals around penetrations, at control joints and deflection spaces in fire separations shall be part of work of Section 07 84 00. Provide assistance as required to trade performing firestopping.
 - 3.3.19.4. Access Doors: Install access doors and panels in accordance with manufacturer's recommendations.
- 3.3.20. Control Joints: Provide vertical control joints in masonry walls where indicated and as detailed on Drawings. Unless otherwise indicated on Drawings, provide vertical and horizontal control joints as follows:
 - 3.3.20.1. at column grid locations.
 - 3.3.20.2. at abrupt changes in wall height.
 - 3.3.20.3. at changes in wall thickness, such as those at pipe or duct chases and those adjacent to columns or pilasters.
 - 3.3.20.4. above joints in foundations and floors.
 - 3.3.20.5. below joints in roofs and floors that bear on wall.
 - 3.3.20.6. at a distance of not over 1/2 allowable joint spacing from bonded intersections or corners.
 - 3.3.20.7. at 1 or both sides of door and window openings unless other crack control measures are used, such as joint reinforcement or bond beams.
 - 3.3.20.8. Obtain Consultant's review of exact locations of control joints.

- 3.3.21. Movement/Expansion Joints: Provide vertical movement/expansion joints in masonry walls where indicated and as detailed on Drawings. Unless otherwise indicated on Drawings, provide vertical and horizontal control joints as follows:
 - 3.3.21.1. below shelf angle supports.
 - 3.3.21.2. near changes in wall direction (such as building corners).
 - 3.3.21.3. at changes of building height.
 - 3.3.21.4. at changes in wall thickness.
 - 3.3.21.5. periodically along continuous lengths of wall.
 - 3.3.21.6. at wall openings (such as windows and doors).
 - 3.3.21.7. at changes of building materials.
 - 3.3.21.8. in exterior cavity walls with concrete block backup, form vertical control joints in concrete block backup with control joint filler.
 - 3.3.21.9. provide slip plane under steel angles and plates.
- 3.3.22. Air/vapour Barrier Application:
 - 3.3.22.1. Ensure surface to receive membrane is uniform, smooth, flat, dry, clean and free from dust, dirt and other materials detrimental to bonding membrane using torch. Apply primer to exterior wall of type and at rate recommended by membrane manufacturer.
 - 3.3.22.2. In cavity wall construction, apply air/vapour barrier to exterior face of inner masonry exterior wall and foundation wythe; and over all surfaces occurring in that plane such as columns, piers, brackets and similar items in accordance with membrane manufacturer's directions. Cut and seal tightly around penetrations and protrusions so completed installation creates continuous air/vapour barrier in exterior wall and is sealed to all items occurring therein such as windows, door frames and sealed to roof air/vapour barrier membrane.
 - 3.3.22.3. Lap joints minimum of 50 mm (2") and fully seal. Seal around masonry reinforcement and other penetrations.
- 3.3.23. Cavity Insulation:
 - 3.3.23.1. Provide cavity insulation and cavity insulation fasteners in accordance with insulation manufacturer's recommendations and held in place with insulation fasteners.
 - 3.3.23.2. Cut and fit insulation to fully and continuously envelope building and to provide a continuous thermal layer at junction with adjacent wall assemblies.
 - 3.3.23.3. Provide insulation tight to inner wythe starting at base of wall in parallel courses with tight butt joints. Stagger end joints in adjacent course.
 - 3.3.23.4. Provide finished work level, plumb and true.
- 3.3.24. Cavity Compartmentalization:
 - 3.3.24.1. Provide compartmentalization of cavity walls using cavity insulation in 150 mm (6") wide continuous vertical strips adhered to cavity wall insulation and built-up in depth to completely fill cavity for its full height.
 - 3.3.24.2. Provide cavity compartmentalization vertically as follows:
 - 3.3.24.2.1. at 1200 mm (4') from inside and outside corners, both sides.
 - 3.3.24.2.2. along column grid lines.
- 3.3.25. Masonry Reinforcement:
 - 3.3.25.1. Install masonry connectors and masonry reinforcement in accordance with CSA A370 and CSA A371.

- 3.3.25.2. Provide block reinforcement, adjustable veneer ties and veneer anchors in accordance with manufacturer's instructions. Reinforce blockwork.
- 3.3.25.3. Supervise and coordinate installation of veneer anchors.
- 3.3.25.4. Reinforce load bearing interior masonry partitions every alternate horizontal joint with continuous block reinforcing.
- 3.3.26. Cavity Flashing:
 - 3.3.26.1. Install through wall flashings and dampproofing in masonry in accordance with CSA A371 and as specified herein.
 - 3.3.26.2. Set cavity flashings continuously with minimum 100 mm (4") overlap at joints. Seal joints. Extend flashing through exterior wythe of masonry to exterior. Provide exposed edge of flashing to maximum 6 mm (1/4") and present a neat, even appearance. Provide metal drip at all locations where thorough wall flashing occurs at wall face. Remove excess projecting material.
- 3.3.27. Beams, Lintels, Shelf Angles, Shelf Angle Brackets and Spacers: Install bearing plates and pads, angles, beams, lintels, shelf angles and spacers accurately in position.
- 3.3.28. Engineered Masonry: Engineered masonry shall conform to CSA A371 and CSA S304.1 and to details as indicated on Structural Drawings.

3.4. REPAIR

- 3.4.1. Repointing and Tuckpointing: Repoint defective joints as follows:
 - 3.4.1.1. Cut back joints 13 mm (1/2") taking care not to damage units. Remove dust and loose materials by brushing or by water jet. If water jet is used, allow excess water to drain before repointing.
 - 3.4.1.2. Repoint with same mix and colour as original.
 - 3.4.1.3. Pack mortar tightly in thin layers and tool joint to match non-defective joints.

3.5. SITE QUALITY CONTROL

- 3.5.1. Non-Conforming Work:
 - 3.5.1.1. Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
 - 3.5.1.2. Replace masonry units stained or chipped, or materials affected by inadequate protection.
 - 3.5.1.3. Remove and replace work of this Section damaged by frost and freezing.

3.6. CLEANING

- 3.6.1. Obtain cleaning materials in accordance with manufacturer's instructions and brick manufacturer's written instructions for cleaning and verify cleaning procedures outlined in CSA A371 with manufacturers. Follow brick manufacturer's written instructions for cleaning masonry. Test sample area, 10 m² (100 sq ft), to judge effectiveness of cleaning procedures and obtain Consultant's review with no objections recorded.
- 3.6.2. Keep wall clean and free of mortar stains during laying. Allow mortar droppings which adhere to wall to dry out but not set. Then rub with small piece of masonry followed by brushing to remove all traces. On completion of masonry construction, after mortar is thoroughly set and cured, clean masonry thoroughly.
- 3.6.3. Protect windows, trim and metal from cleaning agents.
- 3.6.4. Remove mortar with wood paddles and scrapers before wetting. Saturate masonry with clean water and flush off loose mortar and dirt. Clean blockwork using water, scrubbing brushes and wood paddles only.

- 3.6.5. Clean masonry to be left exposed, using procedures as outlined herein and, where this is inadequate, try following recommendations outlined in BIA's Technical Note No. 20, June 2006.
- 3.6.6. Particular care should be taken when cleaning lighter coloured clay bricks even with non-acid based cleaning solutions. Dark red or brown residue resulting from cleaning operations when allowed to run down face of brick could streak and discolour exterior facing. Protect lighter coloured Products by masking them from run off or by taking measures recommended by brick manufacturers.
- 3.6.7. Should these methods prove inadequate consult masonry manufacturer before undertaking unusual cleaning procedures and obtain Consultant's prior consent.
- 3.6.8. Clean adjacent surfaces completely, which have been soiled or otherwise marred.

3.7. PROTECTION

- 3.7.1. Protect masonry from absorbing water from precipitation and condensation.
- 3.7.2. Keep masonry materials and Products completely free from frost, snow and ice.
- 3.7.3. Protect masonry with protective coverings continuously from placement to 10 Days after placement.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL

| SPECIFICATION REVISION LOG | | |
|----------------------------|------------|-------------------|
| REVISION NUMBER | DATE | ISSUED FOR |
| 01 | 2024-10-04 | PROGRESS ISSUANCE |
| 02 | 2024-11-01 | PROGRESS ISSUANCE |
| 03 | 2024-11-15 | BUILDING PERMIT |
| 04 | 2025-01-31 | ISSUED FOR BID |
| | | |
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| | | |
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PART 1 - GENERAL

1.1. DEFINITIONS

- 1.1.1. The following Definitions shall apply in this Specification:
- 1.1.2. Contract Documents
 - 1.1.2.1. The Contract Documents consist of the Drawings, Specifications and Reports which form part of the agreed Contract.
- 1.1.3. Consultant
 - 1.1.3.1. The Consultant is the Architect, SEOR, persons or entities engaged by the Owner. The term Consultant means the Consultant or the Consultant's authorized representative.
- 1.1.4. Contractor
 - 1.1.4.1. The term Contractor is defined to include any of the following: Construction Manager, General Contractor, Structural Steel Erector, Structural Steel Fabricator, Subcontractor or Supplier.
- 1.1.5. Owner
 - 1.1.5.1. The Owner is the person or entity identified as such in the Contract. The term Owner means the Owner or the Owner's authorized agent or representative, but does not include the Consultant.
- 1.1.6. SEOR
 - 1.1.6.1. The SEOR is defined as the Structural Engineer of Record for the Contract.

1.2. WORK INCLUDED

- 1.2.1. Comply with Division 1 - General Requirements and all documents referred to therein.
- 1.2.2. Provide all labour, materials, plant and equipment to complete the structural steel Work indicated in the Contract Documents and specified in this Section.

1.2.3. It is the responsibility of the Contractor to verify the availability of the steel sections specified in the Contract Documents at time of tender, and to immediately notify the Consultant if any of the steel sections are not readily available and need to be substituted. Substitutions made after tender will be at the expense of the Contractor.

1.2.4. It is the responsibility of the Contractor to verify that steel members which are shown to be curved or cranked in the Contract Documents, can be fabricated as shown without any reduction in the load carrying capacity of the member. If curved or cranked steel members cannot be fabricated as shown in the Contract Documents, the Contractor shall identify, at the time of tender, which steel members cannot be fabricated as shown in the Contract Documents, and to propose alternative steel sections for consideration by the Consultant. Any cost associated with any alterations to such members identified after tender will be at the expense of the Contractor.

1.3. SECTION INCLUDES

1.3.1. This Section includes: Structural steel framing members bearing assemblies, and qualification requirements.

1.4. RELATED WORK SPECIFIED ELSEWHERE

1.4.1. Section 03 20 00 - Concrete Reinforcement: Concrete reinforcement.

1.4.2. Section 03 30 00 - Cast-in-Place Concrete: Cast-in-Place concrete and Grouting beneath column bases and bearing assemblies on concrete members.

1.4.3. Section 04 04 15 - Masonry Anchorage and Reinforcement: Anchors for casting into concrete and embedding into masonry.

1.4.4. Section 04 20 00 - Engineered Masonry: Grouting beneath base plates bearing on masonry.

1.4.5. Section 05 31 10 - Steel Deck:

1.4.6. Reinforcement of edges of openings in steel deck that are not larger than 450 mm in roof deck and 300 mm in floor deck.

1.4.7. Section 09 91 00 - Painting: Painting.

1.5. REFERENCE STANDARDS, CODES, AND ACTS

1.5.1. Conform to the requirements of the local building code identified on the Structural General Notes as amended by all subsequent Regulations issued to the date of this Specification and applicable acts of authorities having jurisdiction.

1.5.1.1. All references to the Standards and publications noted below shall be to the edition referenced in the local building code identified on the Structural General Notes, or to the edition referenced in the latest published editions or revisions of all Standards published by the Canadian Standards Association issued to the date of this Specification, whichever is the later edition or revision.

1.5.1.2. All references noted below, which are not referenced by the local building code or the Standards published by the Canadian Standards Association, shall be to the latest edition and revision published to the date of this Specification.

1.5.1.3. Standards and publications referenced by the Standards noted below shall apply even if they are not included in the list. Where such reference is made, it shall be to that latest edition and revision published to the date of this Specification.

1.5.1.4. Where there are differences between the Contract Documents and the standards, codes or acts, the most stringent shall govern.

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- 1.5.2. AASHTO HB - Standard Specifications for Highway Bridges.
 - 1.5.3. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - 1.5.4. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
 - 1.5.5. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 1.5.6. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 1.5.7. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
 - 1.5.8. ASTM D621 - Test Methods for Deformation of Plastics Under Load.
 - 1.5.9. ASTM D792 - Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 1.5.10. ASTM D1457 - Standard Specification for PTFE Molding and Molding and Extrusion Materials.
 - 1.5.11. ASTM D2256/D2256M - Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method.
 - 1.5.12. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.
 - 1.5.13. ASTM F3043 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Alloy Steel, Heat Treated, 200 ksi Minimum Tensile Strength.
 - 1.5.14. ASTM F3111 - Standard Specification for Heavy Hex Structural Bolt/Nut/Washer Assemblies, Alloy Steel, Heat Treated, 200 ksi Minimum Tensile Strength.
 - 1.5.15. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
 - 1.5.16. AWS D1.1/D1.1M - Structural Welding Code - Steel.
 - 1.5.17. CCDC 2 - Stipulated Price Contract.
 - 1.5.18. CISC Code of Standard Practice - CISC Code of Standard Practice for Structural Steel.
 - 1.5.19. CISC/CPMA 1-73a - Standard 1-73 - Canadian Institute of Steel Construction and Canadian Paint Manufacturers Association.
 - 1.5.20. CISC/CPMA 2-75 - Standard 2-75 - Canadian Institute of Steel Construction and Canadian Paint Manufacturers Association.
 - 1.5.21. CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
 - 1.5.22. CSA S16 - Design of Steel Structures.
 - 1.5.23. CSA W47.1 - Certification of Companies for Fusion Welding of Steel.
 - 1.5.24. CSA W59 - Welded Steel Construction.
 - 1.5.25. Ontario Professional Engineers Act - Ontario Professional Engineers Act.
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- 1.5.26. Specification for Structural Joints Using ASTM A325 or A490 Bolts - Research Council on Structural Connections (RCSC) - Specification for Structural Joints Using ASTM A325 or A490 Bolts.
 - 1.5.27. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
 - 1.5.28. SSPC-SP 3 - Power Tool Cleaning.
 - 1.5.29. SSPC-SP 6 - Commercial Blast Cleaning.
 - 1.5.30. SSPC-SP 10 - Near-White Blast Cleaning.

1.6. CISC CODE OF STANDARD PRACTICE FOR STRUCTURAL STEEL

- 1.6.1. The CISC Code of Standard Practice shall govern the Work, subject to the modifications noted below.
 - 1.6.1.1. Revise Clause 1.4 Responsibility for Design as follows:
 - 1.6.1.1.1. **Clause 1.4: Responsibility for Design.** When the Owner provides the structural Drawings and Specifications, the Contractor shall not be responsible for determining the adequacy of the design nor liable for the loss or damage resulting from an inadequate design. *The SEOR shall be responsible for the overall behaviour of the structure, the sizing of steel members and their supports as required by the Building Code and the provision of connection forces indicated on the structural Drawings. The Contractor shall be responsible for the design and detailing of all connections and components, members and standardized assemblies. (See also Clause 5.6.)*
 - 1.6.1.2. Add the following to Clause 1.5, Responsibility for Erection Procedure:
 - 1.6.1.2.1. **Clause 1.5: Responsibility for Erection Procedure.** The Contractor shall ensure that in the event the Fabricator's contract does not include the erection of the structural steel, the Erector shall be responsible for determining the erection procedure, for checking the adequacy of the connections for the uncompleted structure, for providing erection bracing or connection details and for coordinating the erection of the steelwork with the Fabricator.
 - 1.6.1.3. With respect to Clause 3.3 Revisions to the Contract Documents, revise Clause 3.3.4 as follows:
 - 1.6.1.3.1. **Clause 3.3.4:** Unless specifically stated to the contrary, the issue of revision documents or changes indicated on submittal reviews is not authorization by the Owner to release these revisions for construction. Any and all revisions to the Contract shall be made in accordance with the provisions set out in the Contract Documents, and will be based on the Contractor's assessment of the impact of the proposed revisions on the Contract Price and schedule for completion of the Work.
 - 1.6.1.4. Revise Clause 3.4, Discrepancies as follows:
 - 1.6.1.4.1. **Clause 3.4: Discrepancies.** In case of discrepancies between Contract Documents, the provisions of Standard Construction Document – CCDC 2 shall govern, unless agreed or instructed otherwise. In case of discrepancies between the structural documents and Documents of other Sections, the documents for the Section responsible for deriving the required information shall govern.
 - 1.6.1.5. Revise Clause 4.1.1 as follows:
 - 1.6.1.5.1. **Clause 4.1.1:** At the time tenders are called, the Contractor shall receive a complete set of the Contract Documents *(including Drawings and Specifications)* for all design disciplines and specialty Consultants engaged on the project. When appropriate, these documents shall include complete structural Drawings, conforming to the requirements

for design drawings of the governing technical standard. Structural steel Specifications should include any special requirements controlling the fabrication and erection of the structural steel, surface preparation and coating, and should indicate the extent of non-destructive examination, if any, to be carried out.

1.6.1.6. Clause 4.1.2, delete the last two words in the last sentence.

1.6.1.7. Revise Clause 4.2 as follows:

1.6.1.7.1. **Clause 4.2: Architectural, Mechanical, Electrical and Additional Specialty Consultants Drawings.** Architectural, mechanical, electrical and additional specialty Consultants Drawings may be used as a supplement to the structural Drawings to define detail configurations and construction information.

1.6.1.8. Revise Clause 5.6 as follows:

1.6.1.8.1. **Clause 5.6: Review of Fabrication and Erection Documents.** Erection diagrams, standard and non-standard connection design details, shop details and fieldwork details shall be submitted for review by the SEOR in accordance with the provisions of the Contract Documents. The submittals will be reviewed and returned in accordance with the provisions of the Contract Documents. The documents will be reviewed on a sampling basis for general conformity with the Contract Documents only. The SEOR's review does not relieve the Contractor, Fabricator, Erector or their engineer(s) of any responsibility for same. (Note: The remainder of this clause, as noted in the CISC Code of Standard Practice, is to be deleted.)

1.6.1.9. Revise Clause 6.7 as follows:

1.6.1.9.1. **Clause 6.7: Inspection of Steelwork.** Should the Owner wish to have an independent inspection and/or non-destructive examination of the steelwork, they shall reserve the right to do so in the Contract Documents. The Contractor shall notify the inspection and testing company of the progress of the Work so that timely inspection and testing may be arranged. The cost of this inspection and testing is the responsibility of the Owner. However, deficiencies in the Work of the Contractor requiring re-inspection and re-testing due to the frequency of the deficiency shall be the responsibility of the Contractor.

1.7. TOLERANCES

1.7.1. Fabricated members and erected structural steel tolerances shall conform to the ones specified in the typical details and CSA S16.

1.7.2. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.

1.7.3. Fabricating, shall be such that the effects of galvanizing, bending, cambering and the like, on the alignment of the completed members is minimized.

1.8. QUALIFICATIONS

1.8.1. Any organization undertaking to weld shall be certified by the Canadian Welding Bureau to the requirements of Division 1, or Division 2.1 of CSA W47.1.

1.8.2. The Contractor shall ensure that the potential steel Subcontractors can successfully demonstrate that they have sufficient relevant experience of Work similar in size, scope, complexity and risk to that shown on the Contract Documents and described in this Section.

1.8.3. Design calculations shall be carried out by or under the direct supervision of a qualified Professional Engineer licensed in the Province having jurisdiction, with a minimum of 5 years Canadian experience in the design of structural steelwork, connections including design of weldments, or joist systems, as appropriate.

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- 1.8.4. The Contractor shall ensure that engineers responsible for welding design, procedures and practice are certified in accordance with CSA W47.1, section 6.1.
- 1.8.5. The Contractor shall ensure that professional Engineers responsible for the design of steelwork, connections, joist systems and the like, are insured in accordance with section 74(1) of Regulation 941 of the Ontario Professional Engineers Act or shall be covered under the Contractor's General Liability Insurance Policy. Note: If the professional engineer is insured in accordance with Regulation 941 of the Ontario Professional Engineers Act, the alternative outlined in section 74(2) is not acceptable.

1.9. DESIGN

1.9.1. General

- 1.9.1.1. Design connections for the loads indicated or implied in the Contract Documents in accordance with requirements of CSA S16.
- 1.9.1.2. If the Contractor requires additional information or clarification to aid in the design of the Work, this information shall be requested in a timely manner.

1.9.2. Connections

- 1.9.2.1. The Contractor shall be solely responsible for the design and detailing of all connections between the steel members including, but not limited to columns, beams, girders, trusses and braces, and between such members as spandrel angles and beams, hangers, stiffeners, etc., and their supporting members.
- 1.9.2.2. The Contractor shall also be responsible for the design and detailing of stiffeners, doubler plates and the like required to maintain the local strength and stability of a member and where these stiffeners and doubler plates are an integral part of the connection or where they affect the connection of other steel framing members. Examples include cranked sections, moment connections between columns and beams, connections to hollow structural sections and the like. Where connections are exposed to view, the detailing of stiffeners, double plates and the like is subject to review by the Consultant.
- 1.9.2.3. Use types of shop or field connections shown on the Contract Documents, or in the absence of such information, use the most appropriate type of connections given the applied loads and the arrangement of members.
- 1.9.2.4. Design connections to safely withstand the combined primary effects of axial force, shear, moment and torque and any secondary effects due to welding. Connections shall also safely withstand any temporary loads which may occur during the construction.
- 1.9.2.5. Where no axial force is indicated for beam to column connections, connect beams framing into columns such that the combined capacities of the connection are able to resist a total horizontal force of 2% of the factored axial load in the column, in any direction. The column bracing force shall be proportioned and resisted by the members framing into the joint according to their relative axial stiffnesses, unless noted otherwise in the Contract Documents.
- 1.9.2.6. Unless noted otherwise in the Contract Documents, the design of all beams and girders is based on the assumption that fastener holes through flanges will not exceed 15% of the gross flange area. If the area of holes exceeds 15%, the member size shall be altered or reinforced accordingly. Documentation noting the alteration is to be submitted for review.
- 1.9.2.7. Design bracing member connections for field adjustability to accommodate maximum construction tolerances and to achieve bracing preloads where specified in the Contract Documents.

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- 1.9.2.8. Design hanger connections where bolts are loaded in tension such that they may be locked after pretensioning.
 - 1.9.2.9. Design connections for fastening together double angles, double rectangular plates or bars, and the like, used to resist compression, tension, or bending in such a way that the slenderness ratio of any component, based on its least radius of gyration and the distance between interconnections, shall not exceed that of the built-up member. As a minimum, provide two intermediate battens or spacers along the length of all members.
 - 1.9.2.10. The following types of connections are to be designed as slip-critical connections:
 - 1.9.2.10.1. Connections that utilize oversized holes;
 - 1.9.2.10.2. Connections that utilize slotted holes, except those where the applied load is normal to the long dimension of the slot.
 - 1.9.2.10.3. Connections subject to fatigue or frequent load reversal; and
 - 1.9.2.10.4. Connections where slippage cannot be tolerated, including;
 - 1.9.2.10.4.1. All moment connections (unless end plate type moment connections are used);
 - 1.9.2.10.4.2. Connections where welds and bolts share in transmitting shear forces at a common faying surface.
 - 1.9.2.11. Bolts in the following types of connections are to be pretensioned in accordance with the requirements of CSA S16;
 - 1.9.2.11.1. Slip-critical connections,
 - 1.9.2.11.2. Connections governed by seismic requirements,
 - 1.9.2.11.3. Connections for all elements resisting crane loads,
 - 1.9.2.11.4. Connections for members directly supporting running machines or other live loads that produce impact or cyclic load,
 - 1.9.2.11.5. Connections where bolts are subject to tensile loads.
 - 1.9.2.11.6. Connections using oversized or slotted holes unless specifically designed to accommodate movement.
 - 1.9.2.12. Design connections that are exposed to weather so that moisture and foreign matter cannot be trapped or gain entry to the interior of hollow built up members.
 - 1.9.2.13. Design connections that are susceptible to the accumulation of moisture so that moisture and foreign matter cannot be trapped within the connectors or members framing into the connection.
 - 1.9.2.14. Design and detail connections so they do not encroach upon architectural clearance lines or finishes.
 - 1.9.2.15. Where connections between beams and columns and the like result in a loss of bearing for the steel deck, design and provide support for the steel deck, as required.
 - 1.9.2.16. Design and provide end bearing connections of inclined members such that the bearing plane between the inclined members and their supporting members is horizontal.
 - 1.9.2.17. Design connections to cast in plates to provide for the maximum deviation that can occur in erection and based upon the following:
 - 1.9.2.17.1. Specified steel erection tolerances,
 - 1.9.2.17.2. Maximum permissible tolerances in the location of inserts cast into concrete, specified in Section 03 10 00 - Concrete Forming.
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- 1.9.3. Bearing Assemblies
 - 1.9.3.1. General
 - 1.9.3.1.1. Design bearings assemblies so that they conform to the configurations shown in the Contract Documents and can safely transmit the loads and permit the movements also noted in the Contract Documents.
 - 1.9.3.2. Neoprene Bearing Pads
 - 1.9.3.2.1. Design and provide neoprene bearing pads of a suitable shape and material that can safely transmit the forces indicated in the Contract Documents while permitting the rotation and movements also indicated in the Contract Documents.
 - 1.9.3.3. Sliding Expansion Joint Bearings
 - 1.9.3.3.1. Design bearings so that they conform to the configurations shown in the Contract Documents and can safely transmit the loads indicated and permit ± 50 mm movement in any direction unless noted otherwise in the Contract Documents, at a maximum bearing stress not exceeding 14 MPa live load, and such that the maximum static or dynamic co-efficient of friction shall not be greater than 0.06 at a bearing stress of 10 MPa .
 - 1.9.3.4. Columns supporting loads from sliding expansion joint bearings have been designed to safely resist a maximum eccentricity of the sliding bearing load of _____.
 - 1.9.3.5. Polytetrafluoroethylene (PTFE) - type sliding bearings have been indicated in the Contract Documents. Other equivalent types of bearings may be submitted for approval provided they fully conform to all performance requirements such as load capacity, life expectancy, displacements and vibrations.
 - 1.9.4. Colour Coding
 - 1.9.4.1. When different grades of steel are supplied, use a colour coding technique to aid in the shop and field identification of these different grades. Each member used shall bear its particular colour code as required by CSA G40.20/G40.21.
 - 1.10. SUBMITTALS**
 - 1.10.1. Shop Drawings
 - 1.10.1.1. General
 - 1.10.1.1.1. The Contractor shall ensure that professional engineer(s) responsible for the structural steelwork, connections, joist systems and the like shall either:
 - 1.10.1.1.1.1. Seal and sign all necessary shop drawings, or
 - 1.10.1.1.1.2. Submit a sealed and signed letter prior to commencement of shop drawing preparation stating that they have been retained by the steel Fabricator to carry out the design of steel connections, joist systems and the like AND shall submit a second letter after shop drawing preparation is complete stating that the design of the steelwork, for which they are responsible, has been completed in accordance with the Contract Documents and relevant building codes, standards, and acts.
 - 1.10.1.1.2. Unless noted otherwise in the Contract Documents, provide adequate space on all shop drawings immediately above the drawings title block for the Consultant's Shop Drawing review stamp. Where requested by the Consultant, the stamp is to be inserted by this section directly into the shop drawing prior to submission. The stamp shall be positioned in the same location on each shop drawing, and in no case shall the allocated space be less than 63 mm x 75 mm. Request the details of these requirements from the Consultant no less than 2 weeks before the commencement of shop drawings.
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- 1.10.1.1.3. If the professional engineer(s) choose to seal and sign the shop drawings, as noted above, all shop drawings must be sealed and signed, except for erection diagrams which only contain design information (member sizes, forces, loads and the like) which is indicated on the Contract Documents. If any fieldwork details, notes to the Erector or notifications are made on the erection diagrams, then they must be sealed and signed by the Contractor's engineer.
 - 1.10.1.1.4. The structural Drawings shall not be reproduced in whole or in part, for use as shop, erection or setting drawings.
 - 1.10.1.1.5. Well in advance of fabrication; submit structural steel connection design details shop, erection, and setting drawings for review by the Consultant. Submit fieldwork details for review by the Consultant.
 - 1.10.1.1.6. Shop drawings shall be submitted for all structural steel Work and shall be submitted in complete packages so that individual parts and the assembled unit can be reviewed together. This section and the applicable drawings used in the development of the shop drawings shall be clearly referenced on each shop drawing to facilitate review. Detail member marks shall be cross referenced on the erection drawings to facilitate a quick identification of the members.
 - 1.10.1.1.7. All shop drawings submitted must clearly indicate the initials of the individual who checked the shop drawings before they were submitted for review.
 - 1.10.1.2. Connection Design Details
 - 1.10.1.2.1. Submit connection design details for review by the Consultant, prior to the submission of the detailed piece drawings.
 - 1.10.1.2.2. Connection design details shall be submitted for all standard and non-standard connections, and shall be referenced to the structural Drawings.
 - 1.10.1.3. Erection Drawings
 - 1.10.1.3.1. Submit erection drawings for review prior to preparation of detailed piece drawings.
 - 1.10.1.3.2. Erection drawings shall be included with each submission of detailed piece drawings, connection details and calculations.
 - 1.10.1.3.3. Erection drawings shall clearly indicate or highlight the member marks that are being submitted for review.
 - 1.10.1.3.4. Erection drawings shall clearly show all setting out dimensions for the structural steel frame, including dimensions that have been confirmed by Site measurement. Dimensions shall be tied to relevant grid lines or reference points.
 - 1.10.1.3.5. Indicate on erection diagrams steel lintels and other structural shapes which are embedded in masonry or cast-in-place concrete and not connected to structural steel.
 - 1.10.1.3.6. Erection drawings shall clearly show all AECS members and their respective Category.
 - 1.10.1.3.7. When erection drawings are being submitted for "marks only" or for "reference only", this shall be clearly indicated on the drawings or transmittal.
 - 1.10.1.4. Detailed Piece Drawings
 - 1.10.1.4.1. Submit detailed piece drawings for all structural members.
 - 1.10.1.4.2. As a minimum, show the following:
 - 1.10.1.4.2.1. layout;
 - 1.10.1.4.2.2. member sizes;
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- 1.10.1.4.2.3. connection details, including appropriate reference to connection design calculations;
 - 1.10.1.4.2.4. splice locations and details;
 - 1.10.1.4.2.5. truss details;
 - 1.10.1.4.2.6. holes;
 - 1.10.1.4.2.7. camber;
 - 1.10.1.4.2.8. finishes;
 - 1.10.1.4.2.9. grades of steel;
 - 1.10.1.4.2.10. bolt material and sizes;
 - 1.10.1.4.2.11. weld details, sizes and grade of electrodes;
 - 1.10.1.4.2.12. identify location and extent of all pretensioned bolts, slip critical bolts and class of surface preparation;
 - 1.10.1.4.2.13. clearly identify locations and details of all slip critical connections;
 - 1.10.1.4.2.14. sliding expansion joint bearing pad details including materials, size and thickness of pads, setting out dimensions and load capacity;
 - 1.10.1.4.2.15. architectural clearance lines and finishes where connections and the like may encroach with other Work.
 - 1.10.1.4.3. Fieldwork Details
 - 1.10.1.4.3.1. Submit details for all fieldwork in accordance with the requirements of Division 1 – General Requirements.
 - 1.10.1.4.3.2. The location of fieldwork details shall be clearly identified or referenced on the erection drawings.
 - 1.10.1.4.3.3. Prepare setting drawings showing dimensions and details for setting structural steel bearings, anchorages, assemblies and the like where they interface with other building components.
 - 1.10.1.4.3.4. Co-ordinate structural steel shop and erection drawings with shop drawings of other interfacing Work.
 - 1.10.1.4.3.5. Submit all non-prequalified welding procedures, stamped as approved by the Canadian Welding Bureau and correlated to the appropriate shop and erection drawings.
 - 1.10.1.4.3.6. Furnish inspection company with a copy of each shop, erection, and setting drawing bearing the Consultant's shop drawing stamp marked reviewed.
 - 1.10.1.4.4. As-Built Drawings
 - 1.10.1.4.4.1. Mark on a complete set of final drawings any changes, additions, or deletions that occur during construction as a result of the Contractor's Work, change orders or for any other reason.
 - 1.10.1.4.4.2. For all shop drawings marked "Reviewed as Noted" or "Revise and Resubmit", update and submit a record set of these drawings at the completion of the structural Work. Ensure that these drawings reflect the changes and are coordinated with the final drawings noted above.
 - 1.10.1.5. Surveys
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- 1.10.1.5.1. Preconstruction Survey: Where interface with existing construction occurs, the existing construction shall be surveyed and such survey submitted before related shop drawings are prepared.
 - 1.10.1.5.2. Work by Others: Examine all Work prepared to receive Work of this Section and report any defects affecting installation to the Consultant for correction. Commencement of Work will be construed as complete acceptance of preparatory Work by others. This Section alone shall be responsible for checking of the dimensions and coordination of the structural steel Work with the Work of other Specification Sections.
 - 1.10.1.5.3. Submit surveys showing position of structural steel members. Submit survey results on any given floor before concrete is placed on the floor. As a minimum include the following:
 - 1.10.1.5.3.1. Location of centreline of all columns with respect to grids at each floor level;
 - 1.10.1.5.3.2. Elevation of tops of girders, joists, trusses and beams at ends, midspan and at cantilevered ends, at all floors and roof, before and after placing of concrete.
 - 1.10.1.6. Calculations
 - 1.10.1.6.1. Submit calculations bearing the seal and signature of the qualified Professional Engineer licensed in the Province having jurisdiction and such further proof as may be necessary to show that non-standard connections, truss connections, steel joist systems, and the like conform to the requirements set forth in this section.
 - 1.10.1.7. Cambering Procedures
 - 1.10.1.7.1. Submit detailed cambering procedures for beams, girders, trusses, joists and the like for review prior to start of fabrication.
 - 1.10.1.8. Bearing Assemblies
 - 1.10.1.8.1. Submit shop drawings and technical specifications for the bearing assemblies, neoprene bearing pads, and sliding expansion joint bearings to the Consultant for review. Drawings shall bear the seal and signature of a qualified Professional Engineer licensed in the Province having jurisdiction.
 - 1.10.1.9. Erection Procedures
 - 1.10.1.9.1. Erection procedures and erection bracing are the sole responsibility of the Contractor.
 - 1.10.1.9.2. Well in advance of erection, submit procedures, methods, sequences of erection, temporary shoring, guying, erection bracing and equipment proposed for use in erecting structural steel. The erection procedure shall be supplemented by drawings and sketches to identify the location of the stabilizing elements. The procedure shall bear the seal and signature of the qualified licensed Professional Engineer licensed in the Province having jurisdiction.
 - 1.10.1.9.3. Submit for the Consultant's review, complete details of the pretensioning procedures, instrumentation and system of measurements to be used to verify the tensile stresses within the 6 Mpa tolerance.
 - 1.10.1.10. Substitution
 - 1.10.1.10.1. It is the Contractor's responsibility to verify the availability of the steel sections shown on the structural Drawings at time of tender, and to immediately notify the Consultant if any of the sections are not readily available and need to be substituted. Substitutions after the time of tender will be at the cost of the Contractor.
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- 1.10.1.10.2. If the Contractor wishes to make other substitutions for steel materials or sizes indicated in the Contract Documents, submit proposals with the tender including calculations for review by the Consultant.
 - 1.10.1.11. Mill Test Certificates
 - 1.10.1.11.1. Submit to the Consultant copies of mill test certificates covering chemical and physical properties of steel used in this Work, including mill test reports for all structural bolts, a minimum of 4 weeks prior to commencing fabrication.
 - 1.10.1.12. Colour Code
 - 1.10.1.12.1. Submit colour code proposed or other agreed methods to identify various grades of structural elements.
 - 1.10.1.13. Non-destructive Testing
 - 1.10.1.13.1. Submit all in-house non-destructive testing results of shop and field Work together with inspector/technician certification status and test procedures used.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Provide only new material manufactured in North American mills or the following international mills Corus UK Ltd (UK), ArcelorMittal S.A. (Luxembourg). free from defects impairing strength and durability. New materials shall be in accordance with the Standards referenced in this Section. Where sections identified are not available from the mills noted or where the Contractor chooses to use sections produced by other mills, provide new materials of minimum strength and minimum quality as indicated in the Contract Documents. For sections that are not produced by North American mills, or additional mills listed above the Contractor shall submit written requests for review of the alternate mill to the Consultant before proceeding with material procurement. The Consultant reserves the right to require physical test data (in addition to the mill test reports) proving that the steel from the proposed mill meets the requirements specified in the Contract Documents. Provide such data for each 100 tonnes of material supplied.
- 2.1.2. Structural Steel:
 - 2.1.2.1. Structural wide flange shapes (W) to conform to CSA G40.20/G40.21 grade 350W or ASTM A992/A992M grade 50 (ksi).
 - 2.1.2.2. Structural welded wide flange shapes (WWF) to conform to CSA G40.20/G40.21 grade 350W.
 - 2.1.2.3. Angles, plates and channels (L, C) to conform to CSA G40.20/G40.21 grade 300W.
 - 2.1.2.4. Hollow structural sections (HSS) to conform to ASTM A500/A500M GRADE C.
- 2.1.3. Bolts, Nuts and Washers: Conform to ASTM F3125/F3125M, ASTM F3043 and ASTM F3111. Galvanized A325 bolts over 22 mm diameter shall have a dry lubricant on threads such as Johnson's Stick Wax #140 or approved equivalent before installation.
- 2.1.4. Direct Tension Indicators: Provide direct tension indicators meeting ASTM F959/F959M at all slip critical and direct tension connections as defined by the Specification for Structural Joints Using ASTM A325 or A490 Bolts. This method of tension control is required at moment connections in rigid frames, cantilevers, and all trusses and roof steel, and where specifically called out on the Contract Drawings.
- 2.1.5. Welded Stud Shear Connectors: Headed studs shall be manufactured by Nelson Stud Welding, Inc. (or approved equivalent) and shall be made from mild steel conforming to

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- ASTM A108 grade 1010 through 1020. Headed studs shall be welded per manufacturer's recommendations; mechanical properties of headed studs shall be in accordance with AWS D1.1/D1.1M .
- 2.1.6. Deformed Bar Anchors: Shall be Nelson, flux filled deformed bar anchors, type D2L, or approved equivalent.
- 2.1.7. Shop Paint/Primer:
- 2.1.7.1. The shop primer or paint shall be compatible with spray fireproofing, intumescent paint and/or the top coat paint system specified in the Contract Documents or elsewhere, where applicable.
- 2.1.7.2. Shop Paint: To CISC/CPMA 1-73a or SSPC-Paint 15.
- 2.1.7.3. Shop Primer: To CISC/CPMA 2-75.
- 2.1.8. Minimum coating thickness for Hot Dip Galvanizing shall conform to ASTM A123/A123M.
- 2.1.9. Inorganic Zinc-Rich Primer: Cathacoat 304V as supplied by Devoe Coatings, an Akzo Nobel N.V. brand (2 to 4 mils dry film thickness), Carbozinc 11 as supplied by Carboline Company (2 to 3 mils dry film thickness), or Zinc Clad II as supplied by The Sherwin-Williams Company (2 to 4 mils dry film thickness); or approved equivalent.
- 2.1.10. Organic Zinc-Rich Primer: Cathacoat 302HA as supplied by Devoe Coatings, an Akzo Nobel N.V. brand (3 to 4 mils dry film thickness) or Zinc Clad 200 as supplied by The Sherwin-Williams Company (3 to 5 mils dry film thickness); or approved equivalent.
- 2.1.11. Epoxy Paint: Devran 224HS as supplied by Devoe Coatings, an Akzo Nobel N.V. brand (4 to 6 mils dry film thickness) or Macropoxy 646 Fast Cure Epoxy as supplied by Sherwin-Williams Company (4 to 6 mils dry film thickness); or approved equivalent.
- 2.1.12. Zinc-Rich Touch-up Paint: Galvafruid as supplied by W. R. Meadows Limited or Zinc Clad 5 as supplied by The Sherwin-Williams Company); or approved equivalent.
- 2.1.13. Sliding Expansion Joint Bearings: as manufactured and supplied by Goodco Z-tech or by Sorbtex (R.J. Searce Association Burlington), or an approved equivalent consisting of a bottom plate of teflon bonded to an elastomer backing and a top plate of stainless steel bonded to a steel backing.
- 2.1.14. Neoprene Bearings: molded or cut from a sheet of high-grade neoprene synthetic rubber compound of durometer hardness as indicated in the Contract Documents and conforming to current issue of the AASHTO HB specification.
- 2.1.15. Polytetrafluoroethylene (PTFE) Slide Bearings:
- 2.1.15.1. PTFE self-lubricating sliding surfaces shall be composed of 100% virgin unfilled PTFE fabric manufactured from oriented multifilament PTFE Fluorocarbon fibers. The resin from which these fibers are produced shall be 100% virgin material meeting the requirements of ASTM D1457. Specific gravity shall be 2.13 to 2.19 as determined by ASTM D792, Test A1, A2 or A3.
- 2.1.15.2. The PTFE fabric shall have a minimum thickness of 0.8 mm and a maximum thickness of 3 mm after compression. The test for cold flow shall be ASTM D621 at 13 MPa for 24 hours at 21°C, Properties of PTFE fiber shall be as follows:
- 2.1.15.2.1. Load Borne without Cold Flow: 400 MPa
- 2.1.15.2.2. Ultimate Tensile Strength: 380 MPa
- 2.1.15.2.3. Elongation at Break: 19%
- 2.1.15.2.4. Initial Modulus: 2,500 MPa
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- 2.1.15.2.5. Maximum Coefficient of Friction at 24 MPa, Static or Dynamic: 3%
 - 2.1.15.2.6. The application Test Method for determination of Ultimate Tensile Strength and Elongation at Break shall be ASTM D2256/D2256M.
 - 2.1.15.3. The Coefficient of Friction shall be evaluated in a test which simulates the application parameters. The Static Coefficient of Friction shall be determined at breakaway by dividing the horizontal force to start motion by the vertically applied force which shall be equivalent to application pressure. The Dynamic Coefficient of Friction shall be determined by the same method, but at a speed not exceeding 25 mm per minute in order to approximate actual conditions.
 - 2.1.15.4. Welding to a steel plate which has a bonded PTFE surface may be permitted providing welding procedures are established which restrict the maximum temperature reached by the bond area to less than 150°C as determined by temperature indicating wax pencils or other suitable means.
 - 2.1.15.5. The PTFE fabric shall be mechanically interlocked with the steel substrate plate under factory controlled conditions in a manner approved by the engineer. The interlock shall be equally distributed over not less than 25% of the bearing area and shall be sufficiently strong to develop 10% of the allowed vertical load in the horizontal shear plane. Adhesive material may be used to supplement the mechanical bond but the 10% development shall be by mechanical interlock only.
 - 2.1.15.6. The stainless steel mating to the PTFE shall be an accurate flat of cylindrical surface with a surface finish of 0.000508 mm.

PART 3 - EXECUTION

3.1. FABRICATION

- 3.1.1. Prior to fabrication of structural steel, take field measurements where connections are to be made to existing Work and open up all areas to allow the installation of the new structural Work, as well as the connection of new Work to the existing Work. Take any and all necessary field measurements. Modify installation methods and methods for connecting to suit Site conditions found and to the approval of the Consultant.
- 3.1.2. Provide holes up to 12 mm in diameter, as required, to permit the attachment of other materials. Ensure cross sectional area of section is not reduced by more than 10% at any point on its length.
- 3.1.3. Provide 20 mm drain holes in closed sections to prevent water build-up during erection. Ensure drain holes remain free to drain throughout construction and are not plugged by subsequent construction activities.
- 3.1.4. Splices, other than those shown in the Contract Documents, shall not be permitted in members without the Consultant's approval. If approval is given to permit welded splices, they shall be non-destructively tested at no extra cost to the Owner.
- 3.1.5. Unless noted otherwise in the Contract Documents, provide a 10 mm cap plate for all hollow members. Provide continuous seal weld around cap plate.
- 3.1.6. Seal all hollow built-up members exposed to weather with continuous seal welds, incorporating structural welds where indicated in the Contract Documents or as required.
- 3.1.7. Where masonry walls are shown built into structural steel columns and beams in the Contract Documents, provide and install masonry anchors on columns at 600 mm on centres and anchors on beams at 1,500 mm on centres.

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- 3.1.8. Thickness of baseplates 100 mm or greater is nominal and allows for a maximum reduction of 6 mm for milling to the requirements of CSA S16. Identify grade of steel for these plates which may not conform to clause 2.1.2.3
- 3.1.9. Cambers
- 3.1.9.1. Provide the camber indicated in the Contract Documents to trusses, joists, beams and girders in such a manner as to provide a uniform parabolic profile. Ensure that the method used to provide camber does not reduce the safe load carrying capacity or cause distortion of the members.
- 3.1.9.2. Camber stated on the Drawings is the required camber after erection.
- 3.1.10. Openings
- 3.1.10.1. Conform to the requirements indicated in the Contract Documents for location, size, and reinforcement of openings through structural steel.
- 3.1.10.2. No openings other than those indicated on the structural Drawings will be permitted without the Consultant's approval.
- 3.1.11. Cutting of Heavy Sections
- 3.1.11.1. Where ASTM A6/A6M Groups 4 or 5 rolled shapes or plates 50 mm or thicker are to be jointed by partial or full penetration welds in tension, preheating shall be required for all thermal cutting operations. Preheat shall be sufficient to prevent cracking but in no case less than 65°C. Weld access holes and copes shall be ground to a smooth radius after cutting and testing for cracks by the magnetic particle method. All cut edges shall be free of sharp notches and gouges.
- 3.1.12. Holes & Cutting
- 3.1.12.1. All holes shall be accurately drilled or punched. Burning or drifting unfair holes will not be permitted. Holes that must be enlarged shall be reamed. Holes for the attachment of Work by other Sections shall be provided as required. Drift pins shall be allowed only to bring together the several parts for connection.
- 3.1.12.2. Holes shall be provided in members to permit connections to the Work of other Sections or contracts.
- 3.1.12.3. The use of manual gas-cutting in the shop shall be used only if automatic or semi-automatic methods are not possible. Cope for pipes and ducts as indicated in the Contract Documents.
- 3.1.13. Bolting
- 3.1.13.1. Drive bolts accurately into the holes without damaging the threads and heads. Bolts heads and nuts shall rest squarely against metal surfaces.
- 3.1.13.2. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, provide beveled washers to give full bearing to the thread or nut.
- 3.1.13.3. Bolt threads of unfinished bolts shall be upset to prevent the nuts from backing off.
- 3.1.13.4. Label and ship anchor rods and base plates in sets indicating size and locations of columns and deliver in ample time prior to the start of related concrete Work. Furnish templates together with instructions for setting of anchor rods. Ascertain that anchor rods and other embedded items are set properly during the progress of the Work. Provide 75 mm x 75 mm x 7 mm plate washers between top of base plate and bottom of anchor rod nuts.
- 3.1.14. Welding of Structural Steel
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- 3.1.14.1. Pre-weld Inspection
 - 3.1.14.1.1. The surface to be welded and the filler material to be used shall be subject to inspection by quality control personnel before welding is performed.
 - 3.1.14.2. Method and Type
 - 3.1.14.2.1. All welding shall be electric arc welding and shall comply in all respects with the codes and Specifications noted in this Section, incorporating the Specifications for design, fabrication, and inspection of welded structures and the qualifications of welders and supervisors. The heat, input, length of weld, and sequence weld and cooling process shall be controlled to prevent distortions.
 - 3.1.14.2.2. For weldments comprised of plates in more than one plane and whose configuration could cause restraint to uniform cooling of the weldment, conform to detailed welding procedures prepared by the Contractor's Engineer.
 - 3.1.14.2.3. For weldments comprised of plates thicker than 50 mm or of heavy shapes groups 4 & 5, take adequate precaution to control welding and cooling processes in order to control thermal shrinkage stresses. Use stress relieving techniques where necessary. Each welder shall mark his identification symbol on this Work. Where such plates or shapes are spliced or connected using complete joint penetration (CJP) groove welds, the steel shall be supplied with Charpy V-notch (CVN) testing.

3.2. ERECTION

- 3.2.1. General
 - 3.2.1.1. Refer to erection procedures and construction sequencing indicated in the Contract Documents.
 - 3.2.1.2. Bracing members and anchor rods shown in the Contract Documents are for the finished structure and may not be adequate to resist forces present during construction.
 - 3.2.1.3. Maintain erection bracing until completion of entire structure including floor and roof decks and slabs, masonry walls and/or other elements which are part of the lateral load resisting system.
 - 3.2.1.4. Carry out erection operations, including installation of any temporary guying and shoring required, ensuring that the existing structure or members already erected are not loaded in excess of their safe load carrying capacity.
 - 3.2.1.5. Erection bracing must be adequate to restrict lateral drift per storey to an appropriate amount to ensure the steel erection can be completed within the necessary tolerances.
 - 3.2.1.6. During construction, forces or reactions in the steel frame members and their connections might exceed those on which the design is based. Determine the magnitude of such forces and reactions and take such measures as are necessary to ensure that the safety and stability of the structure is maintained until the entire structure, including floor and roof slabs is complete.
 - 3.2.1.7. Nuts on bolts shall be prevented from working loose by use of lock washers, lock nuts, jam nuts, thread burring or other approved methods.
 - 3.2.1.8. Runoff tabs shall be removed where required by the governing technical standard, or where they interfere with clearances required by other disciplines or would be exposed to view in the completed building.
 - 3.2.1.9. Where steel bars or strap anchors are shown connected to structural steel members in the Contract Documents, weld these bars/anchors to the steel members in a manner to fully develop the strength of the bars/anchors.
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- 3.2.1.10. Note that erection of structural steel may be dependent on the Work and progress of related Sections. For example, portions of the roof structure may have to be erected after roof mechanical units are in place. Co-ordinate this Work with the appropriate Sections.
- 3.2.1.11. Report to the Consultant where members cannot be erected within the specified tolerances without modification or special procedures. Take corrective measures to the Consultant's approval.
- 3.2.2. Pre-Steel Erection Conference
- 3.2.2.1. At least 60 days prior to the commencement of steel erection, the Contractor shall hold a pre-erection conference to review the detailed requirements and staging for the steel erection.]
- 3.2.2.2. The Contractor shall require responsible representatives of every party who is concerned with the steel erection to attend the conference, including but not limited to the following:
- 3.2.2.2.1. The Contractor
- 3.2.2.2.2. Steel Erector
- 3.2.2.2.3. Steel Erector's Surveyor
- 3.2.2.2.4. Steel Deck Contractor
- 3.2.2.2.5. All Inspection and Testing Agencies
- 3.2.2.2.6. Consultant
- 3.2.2.2.7. Owner's Representative
- 3.2.2.3. Minutes of the meeting shall be recorded and distributed to all parties concerned within 5 days of the meeting.
- 3.2.2.4. The minutes shall include a detailed outline of the steel erection procedure including a schedule of milestone dates for erection staging surveying and sign-offs which will represent the agreements reached by all parties involved.
- 3.2.3. Sequence of Construction
- 3.2.3.1. During winter months the pouring of some slabs on deck may be delayed. The Contractor is to provide any additional guying or bracing to compensate for the temporary loss of diaphragm action and additional dead load, as deemed necessary.
- 3.2.3.2. Equipment: Operate all machinery, apparatus and staging required for the erection of steelwork in a safe manner. Install, maintain and remove without damage to the other Work, scaffolding, erection bracing and other equipment, etc. as may be necessary or required.
- 3.2.3.3. Bracing: Securely brace the frame during erection to safely resist all dead loads, lateral loads and other erection stresses. Fully tighten all bolts as soon as possible as the Work progresses. Design erection bracing or guying to limit lateral floor-to-floor displacement to an appropriate amount to ensure steel erection can be completed within necessary tolerances.
- 3.2.3.4. Errors: Immediately report to the Consultant any errors in shop fabrication or deformations resulting from handling and transportation that prevent the proper assembly and fitting of parts. Make suggestions for corrective Work and obtain approval of the method of correction. Approved corrections shall be made expeditiously at no additional cost to the Owner.
- 3.2.3.5. Column Base Plates: Column base plates shall be supported and aligned on steel shims or setting bolts. After the supported members have been plumbed and properly
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positioned, the anchor nuts shall be tightened, in preparation for grouting. Wedges and shims shall be cut off flush with the edges of plates and shall be left in place. All base plates greater than 600 mm in any dimension shall be set on steel angle seats or shim packs. Base plates larger than 900 mm shall be set on steel angle seats only.

- 3.2.3.6. Leveling Plates: Leveling plates shall be set to the established lines and elevations. Provide steel shims as required for proper positioning of column/baseplate.
- 3.2.4. Bolting and Welding of Structural Steel
- 3.2.4.1. Splices: Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact. Splices will be permitted only where indicated on the Contract Drawings or the reviewed shop drawings.
- 3.2.4.2. Driftpins: These may be used only to bring together the several parts, and shall not be used in such a manner as to distort or damage the steel. Poor matching of holes shall be corrected by drilling to the next larger size and the use of larger size bolts. Plug welding and redrilling will not be permitted, unless a specific instance arises and is approved by the Consultant.
- 3.2.4.3. Hammering: Hammering which may injure or distort the members will not be permitted.
- 3.2.4.4. Additional Material: If the Contractor furnishes additional material for the purpose of erection or if the erection method requires that material be added to certain members, the required modifications and the additional metal parts shall be paid for by the Contractor.
- 3.2.5. Bracing
- 3.2.5.1. Install permanent bracing members by applying a nominal tension such that they will be initially under tension in the completed building.
- 3.2.6. Bearing on Concrete or Masonry
- 3.2.6.1. Set steel baseplates and bearing assemblies true and level at the proper elevation so that upon grouting, they will have full bearing. Unless noted otherwise by the grout supplier, do not vibrate the formwork or baseplate during grout placement. Grout shall be placed on one side only and pushed back under the baseplate with strapping.
- 3.2.6.2. When directed by the Consultant, lift at least 3 grouted bases so that the adequacy of grouting can be examined. If defects are found, more bases will have to be raised.
- 3.2.7. Sliding Expansion Joint Bearings
- 3.2.7.1. Conform to manufacturer's instructions. Ensure that bearing assemblies are accurately positioned and in their correct orientation to permit maximum movement in each direction. Bolts in slotted hole connection shall be "finger tightened" to a snug fit only and threads burred or other approved methods used to prevent nuts from working loose. Take care not to over-tighten these bolts.
- 3.2.8. Lintels
- 3.2.8.1. Unless a reinforced block or concrete lintel is noted, provide loose steel lintels, to the details shown in the Contract Documents, over openings and recesses including those for mechanical or electrical services in masonry walls or partitions.
- 3.2.8.2. New Steel Work to the Existing Building
- 3.2.8.2.1. Prior to proceeding with any Work at the existing building, verify that existing members being connected are of the size and section indicated on the Drawings. If they are not inform the Consultant immediately. Do not proceed until the Consultant has given instructions.

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- 3.2.8.2.2. Make Site measurements as required to verify dimensions of existing Work before proceeding with the Work. The Contractor shall be responsible for costs incurred due to proceeding without verifying Site dimensions.
- 3.2.8.2.3. Adequately shore existing structure to ensure that no movements or damage occurs until the permanent structure shown in the Contract Documents is installed.

3.3. PROTECTION

- 3.3.1. Cleaning Steel
- 3.3.1.1. Clean structural steel and joists in accordance with the below:
- 3.3.1.2. Clean surfaces within 50 mm of any field weld location of materials that would prevent proper welding or produce objectionable fumes while welding Work is being performed.
- 3.3.2. Painting
- 3.3.2.1. Except where steel is to be galvanized, shop paint structural steel and joists in accordance with the below:
- 3.3.2.1.1. Enviroment: Inside Vapour Barrier
- 3.3.2.1.1.1. Preparation: SSPC-SP 3 Power Tool Cleaning
- 3.3.2.1.1.2. Primer/Paint: CISC/CPMA 1-73a or Leave unpainted.
- 3.3.2.1.2. Enviroment: Inside Vapour Barrier (steel exposed to view or AESS)
- 3.3.2.1.2.1. Preparation: SSPC-SP 6 Commercial Blast Cleaning
- 3.3.2.1.2.2. Primer/Paint: CISC/CPMA 2-75.
- 3.3.2.1.2.3. Note additional requirements for AESS elsewhere in the Specification.
- 3.3.2.1.3. Enviroment: Pool Enclosures (exposed to view or AESS).
- 3.3.2.1.3.1. Preparation: SSPC-SP 10 Near White Blast Cleaning
- 3.3.2.1.3.2. Primer/Paint: Zinc-rich primer and epoxy paint
- 3.3.2.1.3.3. Note additional requirements for AESS elsewhere in the Specification.
- 3.3.2.1.4. Enviroment: High Humidity
- 3.3.2.1.4.1. Preparation: SSPC-SP 6 Commercial Blast Cleaning.
- 3.3.2.1.4.2. Primer/Paint: Zinc-rich primer.
- 3.3.2.1.5. Enviroment: Outside Vapour Barrier (steel)
- 3.3.2.1.5.1. Preparation: SSPC-SP 6 Commercial Blast Cleaning.
- 3.3.2.1.5.2. Primer/Paint: Zinc-rich primer.
- 3.3.2.1.6. Enviroment: Outside Vapour Barrier – All remaining steel
- 3.3.2.1.6.1. Primer/Paint: Galvanize
- 3.3.2.1.6.2. Note additional requirements for galvanizing elsewhere in the Specification.
- 3.3.2.1.7. Enviroment: Outside Vapour Barrier – Steel exposed to salt water.
- 3.3.2.1.7.1. Preparation: SSPC-SP 10 Near White Blast Cleaning.
- 3.3.2.1.8. Enviroment: Chemical Exposures
- 3.3.2.1.8.1. Preparation: SSPC-SP 10 Near White Blast Cleaning
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- 3.3.2.1.8.2. Primer/Paint: Zinc-rich primer and epoxy paint
 - 3.3.2.2. Do not paint steel items inside the vapour barrier that are to be encased in concrete and surfaces that are to have concrete placed against them or that are to be covered in cementitious fireproofing.
 - 3.3.2.3. Where shear connectors are to be field welded through the low flute of the steel deck, the top surface of the top flange, which is to receive the shear studs, is to be unpainted and free of heavy rust, mill scale, sand, or other foreign materials which will interfere with the stud welding operation.
 - 3.3.2.4. Except where steel is to be galvanized, immediately after cleaning, apply a shop coat paint or primer to steelwork, to dry surfaces by spray, to a minimum dry film thickness of 0.051 mm. Allow to dry in dust free areas.
 - 3.3.2.5. Upon completion of erection, clean with mechanical brush and apply primer to welds, bolts and at locations where original primer is damaged.
 - 3.3.3. Galvanizing
 - 3.3.4. In accordance with ASTM A123/A123M, fully galvanize cooling tower structural steel, structural steel lintels, masonry shelf angles, parking garage stairs and other steel materials exposed to weather including connection material and inserts.
 - 3.3.4.1. Where the galvanizing process may distort the members, submit procedures for review by the Consultant and make good to tolerances noted in the Contract Documents.
 - 3.3.4.2. Galvanize members after shop welding has been completed.
 - 3.3.4.3. Do not weld to galvanized steel members. Where welding is necessary, remove galvanizing by grinding.
 - 3.3.4.4. Identify at time of tender any splices that are required due to the size, length or weight constraints imposed by the galvanizing process.
 - 3.3.4.5. High strength bolts grade A490M shall not be galvanized.
 - 3.3.5. Cold Weather Protection
 - 3.3.5.1. During cold weather, protect members from damage due to water freezing in confined areas.
 - 3.3.6. Corrosion
 - 3.3.6.1. Protect milled surfaces to prevent corrosion prior to erection.

3.4. QUALITY CONTROL

- 3.4.1. Visual Inspection
 - 3.4.1.1. As a minimum, carry out visual inspection of all shop and field welds in accordance with CSA W59.
 - 3.4.2. Non-Destructive Testing (NDT)
 - 3.4.2.1. Non-destructive testing shall be carried out by radiography, magnetic particle or ultra sonic methods, whichever is more appropriate.
 - 3.4.2.2. In addition to visual inspection, the Contractor is to include the following requirements for non-destructive testing:
 - 3.4.2.3. Any deficient welds identified by means of NDT, shall be repaired at the Contractor's expense.
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- 3.4.2.4. Welds found deficient in dimensions, but not in quality may be enlarged by additional welding. Any weld found deficient in quality shall be removed by chipping or gouging and the weld shall be remade.
 - 3.4.2.5. Include for full NDT of all shop welded splices.
 - 3.4.3. Additional Testing for Steel Produced by "Other Mills".
 - 3.4.3.1. Physical samples of the finished structural steel material shall be taken at the Consultant's discretion for verification or determination of either the mechanical properties and or the chemical composition. All physical samples tested shall meet the requirements set out in CSA G40.20/G40.21.
 - 3.4.4. General
 - 3.4.4.1. Bring to the attention of the Consultant any defects in the Work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.
 - 3.4.4.2. The Consultant's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

3.5. NOTIFICATION

- 3.5.1. Prior to commencing significant segments of the Work, give the Consultant and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review Work previously completed. Failure to meet this requirement may be cause for the Consultant to classify the Work as defective.

3.6. INSPECTION AND TESTING

- 3.6.1. The Owner will appoint the Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Company shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct.
- 3.6.2. When defects are revealed, the Consultant may request, at the Contractor's expense, additional inspection or testing to ascertain the full extent of the defect.
- 3.6.3. Inspection and testing may also include the non-destructive testing of the full butt welds, testing of headed studs on beams, and on connections to be cast into concrete.

3.7. DEFECTIVE MATERIALS AND WORK

- 3.7.1. Where evidence exists that defective Work has occurred or that Work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength made and the like in order to help determine whether the Work must be replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the Work may be acceptable.
- 3.7.2. All testing shall be conducted in accordance with the requirements of the Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.

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- 3.7.3. Materials or Work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to the Total Performance of the Work regardless of previous inspection. If rejected, defective materials or Work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 05 12 00

**SECTION 05 31 10
STEEL DECK**

| SPECIFICATION REVISION LOG | | |
|----------------------------|------------|-------------------|
| REVISION NUMBER | DATE | ISSUED FOR |
| 01 | 2024-10-04 | PROGRESS ISSUANCE |
| 02 | 2024-11-01 | PROGRESS ISSUANCE |
| 03 | 2024-11-15 | BUILDING PERMIT |
| 04 | 2025-01-31 | ISSUED FOR BID |
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PART 1 - GENERAL

1.1. DEFINITIONS

- 1.1.1. The following Definitions shall apply in this Specification:
- 1.1.2. Contract Documents
- 1.1.2.1. The Contract Documents consist of the Drawings, Specifications and Reports which form part of the agreed Contract.
- 1.1.3. Consultant
- 1.1.3.1. The Consultant is the Architect, SEOR, persons or entities engaged by the Owner. The term Consultant means the Consultant or the Consultant's authorized representative.
- 1.1.4. Contractor
- 1.1.4.1. The term Contractor is defined to include any of the following: Construction Manager, General Contractor, Structural Steel Erector, Structural Steel Fabricator, Subcontractor or Supplier.
- 1.1.5. Owner
- 1.1.5.1. The Owner is the person or entity identified as such in the Contract. The term Owner means the Owner or the Owner's authorized agent or representative but does not include the Consultant.
- 1.1.6. SEOR
- 1.1.6.1. The SEOR is defined as the Structural Engineer of Record for the Contract.

1.2. WORK INCLUDED

- 1.2.1. Comply with Division 1, General Requirements and all documents referenced therein.
- 1.2.2. Provide all labour, materials, plant and equipment to complete the steel deck work including, but not limited to, the following:
- 1.2.2.1. Steel deck and accessories, including all gauge metal closures;

1.2.2.2. Framing for openings up to and including 450 mm in roof deck and 300 mm in floor deck; and

1.2.2.3. Shear stud connectors.

1.3. SECTION INCLUDES

1.3.1. This Section includes: steel deck, and qualification requirements.

1.4. RELATED WORK SPECIFIED ELSEWHERE

1.4.1. Section 03 20 00 - Concrete Reinforcement: Concrete reinforcement.

1.4.2. Section 03 30 00 - Cast-in-Place Concrete: Cast-in-Place Concrete.

1.4.3. Section 04 20 00 - Engineered Masonry : Placement of anchors for bearing plates or angles embedded unit masonry.

1.4.4. Section 05 12 00 - Structural Steel05 12 00 - Structural Steel: Support framing for openings larger than 450 mm in roof deck, 300 mm in floor deck and deck edge supports where loss of bearing for the steel deck occurs.

1.5. REFERENCE STANDARDS, CODES, AND ACTS

1.5.1. Conform to the requirements of the local building code identified on the Structural General Notes as amended by all subsequent Regulations issued to the date of this Specification and applicable acts of authorities having jurisdiction.

1.5.2. All references to the Standards and publications noted below shall be to the edition referenced in the local building code identified on the Structural General Notes, or to the edition referenced in the latest published editions or revisions of all Standards published by the Canadian Standards Association issued to the date of this Specification, whichever is the later edition or revision.

1.5.3. All references noted below, which are not referenced by the local building code or the Standards published by the Canadian Standards Association, shall be to the latest edition and revision published to the date of this Specification.

1.5.4. Standards and publications referenced by the standards noted below shall apply even if they are not included in the list. Where such references are made, they shall be to the latest edition and revision published to the date of this Specification.

1.5.5. Where there are differences between the Specifications and Drawings and the codes, standards, or acts, the most stringent shall govern.

1.5.6. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.

1.5.7. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.5.8. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

1.5.9. AWS D1.1/D1.1M - Structural Welding Code - Steel.

1.5.10. CSA W47.1 - Certification of Companies for Fusion Welding of Steel.

1.5.11. CSA W59 - Welded Steel Construction.

1.5.12. CSSBI 10M - Standard for Steel Roof Deck.

1.5.13. CSSBI 12M - Standard for Composite Steel Deck.

1.5.14. CSSBI B13 - Design of Steel Deck Diaphragms.

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- 1.5.15. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.
 - 1.5.16. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
 - 1.5.17. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.6. QUALIFICATIONS

- 1.6.1. Organizations and welders undertaking to weld under this Contract shall be certified by the Canadian Welding Bureau under the requirements of CSA W47.1 as applicable.
- 1.6.2. The Contractor shall ensure that the manufacturer and the steel deck erector shall each demonstrate a minimum of 10 years of relevant experience with the steel deck systems specified in the Contract Documents.
- 1.6.3. Design calculations shall be carried out by or under the direct supervision of a qualified Professional Engineer licensed by the authority having jurisdiction, with a minimum of 5 years Canadian experience in the design of steel deck.

1.7. DESIGN

- 1.7.1. Design steel deck in accordance with the requirements of the Building Code.
- 1.7.2. The minimum steel core thickness shall be 0.76 mm except that for steel deck which is considered architecturally exposed to view the minimum steel core thickness shall be 0.91 mm.
- 1.7.3. Design floor deck such that the live load deflection of deck shall not exceed $l/360$ of the span.
- 1.7.4. Design roof deck such that the live load deflection of deck shall not exceed $l/300$ except when deck supports non-structural services or finishes that are identified as being susceptible to damage. In this case, design roof deck such that deflection of deck shall not exceed $l/360$ of the span.
- 1.7.5. Design roof deck such that deflection does not exceed $l/300$ of the span when supporting a 1.3 kN point load acting over a 300 mm strip of deck.
- 1.7.6. Design deck anchorage to the supporting structure to safely resist the net uplift forces indicated in the Contract Documents. Design anchorages for deck supporting concrete slabs for net uplift during construction.
- 1.7.7. Wherever structural framing permits, steel deck shall be designed and fabricated to span continuously over at least four supports (three spans).
- 1.7.8. Determine structural properties of the concrete slab and composite construction in accordance with requirements of The Building Code.
- 1.7.9. Design and install composite deck and metal edge and closure strips to safely support construction and other loads before the composite action of the deck system takes place, without excessive deflection. Design and detail temporary intermediate supports for the composite deck where required. Identify areas where this is required and submit shop drawings showing the proposed temporary support detail.
- 1.7.10. Design framing for openings through the deck up to a maximum width of 300 mm in floor deck and 450 mm in roof deck measured perpendicular to the span of the deck.
- 1.7.11. Detail metal edge and closure strips to prevent the loss of grout when the deck is concreted.
- 1.7.12. Headed studs have been designed to ensure composite action between the steel framing members and the slab on deck floor system. The design of these studs has been based

on an assumed steel deck profile where the average flute width is at least twice the height of the deck.

1.8. SUBMITTALS

1.8.1. Shop Drawings

1.8.1.1. Submit shop and erection drawings and load tables for review by the Consultant.

1.8.1.2. Unless noted otherwise in the Contract Documents on all shop drawings provide adequate space immediately above the drawing's title block for a Consultant's Shop Drawing review stamp. Where requested by the Consultant, the stamp is to be inserted by this section directly into the shop drawing prior to submission. The stamp shall be positioned in the same location on each shop drawing, and in no case shall the allocated space be less than 63 mm x 75 mm. Request the details of these requirements from the Consultant no less than 2 weeks before the commencement of shop drawings.

1.8.1.3. Each drawing submitted shall bear the signature and stamp of a qualified Professional Engineer licensed by the authority having jurisdiction.

1.8.1.4. The structural Drawings shall not be reproduced, in whole or in part, for use as shop drawings.

1.8.1.5. As a minimum, the shop drawings shall show the following:

1.8.1.5.1. Types of deck and their locations, including the setting out points for the deck;

1.8.1.5.2. Sufficient detail sections showing the deck's orientation to support members to facilitate erection of deck;

1.8.1.5.3. Design loads, including diaphragm forces;

1.8.1.5.4. Connections to supports including welding details and details for pins and screws if appropriate;

1.8.1.5.5. Net uplift pressures, including pressures during construction;

1.8.1.5.6. Openings and their reinforcement, coordinated with the mechanical and electrical contractor's sleeving drawings;

1.8.1.5.7. Base steel thickness;

1.8.1.5.8. Surface protective coating;

1.8.1.5.9. Metal edge and closure strips;

1.8.1.5.10. Acoustic details, if applicable;

1.8.1.5.11. Locations of shoring (if required) and the shoring loads imposed on the structures below;

1.8.1.5.12. Locations, size, type, and welding requirements of welded stud shear connectors;

1.8.1.5.13. Diaphragm shear stiffness factor, as required; and

1.8.1.5.14. Areas where insufficient bearing on supporting steel members will be provided due to steel connections, vertical bracing connections or the like. Coordinate with Section 05 12 00 - Structural Steel for additional bearing details required in these locations.

1.8.1.6. Provide the inspection company with a copy of each reviewed drawing bearing the Consultant's shop drawing review stamp.

1.8.2. Calculations

1.8.2.1. Submit calculations bearing the seal and signature of the qualified Professional Engineer licensed by the authority having jurisdiction and such further proof as may be necessary

to show that the steel deck and all related accessories conform to the requirements set forth in this Section.

1.8.3. As-Built Drawings

1.8.3.1. Mark on a complete set of final drawings any changes, additions, or deletions that occurred during construction.

1.8.3.2. For all shop drawings marked "Reviewed as Noted" or "Revise and Resubmit", update and submit a record set of these drawings at the completion of the structural Work. Ensure that these drawings reflect the changes and are coordinated with the final drawings noted above.

1.8.4. Mill Test Reports

1.8.4.1. Submit all mill test reports covering chemical and physical properties of materials used in this Work a minimum of 4 weeks prior to commencing fabrication.

PART 2 - MATERIALS

2.1. STEEL DECK

2.1.1. Sheet Steel: ASTM A653/A653M, Structural Quality; with Z180 or A25 minimum coating for steel deck not considered architecturally exposed to view or weather. Deck which is considered architecturally exposed to view or weather or deck in high humidity areas shall have Z275 minimum coating.

2.1.2. The composite steel deck and concrete slab shall comply with the fire-rating requirements.

2.1.3. Provide steel deck profile with interlocking side joints.

2.1.4. Related Deck Accessories: Metal closure strips, wet concrete stops, cover plates, and cant strips.

2.1.5. Stud Shear Connectors: ASTM A108 (Grade 1015). Headed studs shall be welded per manufacturer recommendations.

2.1.6. Mechanical Fasteners: Fasteners shall have knurled shank; minimum 12 mm diameter steel washers; electroplated zinc coating conforming to ASTM B633, Sc. 1, Type III; meeting CSSBI design requirements, such as Hilti X-EDNK22 THQ12, X-EDN19 THQ12, or X-ENP-19 L15 fasteners. For use on open web steel joists with top flange thicknesses between 3 mm to 6 mm, use Hilti X-EDNK22 THQ12 fasteners. For open web steel joists or beams with a top flange thickness of 5 mm to 10 mm use Hilti X-EDN19 THQ12 fasteners. For flanges equal to or greater than 6 mm, use Hilti X-ENP-19 L15 fasteners. Verify performance and applicability of application with the manufacturer by performing test fastenings prior to the installation of the deck.

2.1.7. Side Lap Connectors: Sidelap connectors to connect steel deck units at overlaps can consist of Hilti SLC 01 for gauges 18 to 26 or the Hilti SLC 02 for gauges 16 to 22.

2.1.8. Welding Materials: Type required for materials being welded.

2.1.9. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 type I - Inorganic or SSPC-Paint 20 type II - Organic

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. General

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- 3.1.1.1. Install steel deck to manufacturer's written instructions and to CSSBI requirements, (including but not limited to CSSBI 10M and CSSBI B13).
 - 3.1.1.2. Install composite steel deck to manufacturer's written instructions and to CSSBI requirements, (including but not limited to CSSBI 12M and CSSBI B13).
 - 3.1.1.3. Install steel deck such that it is free of dirt, scale, foreign matter, dents, or deformations. Deck, which is considered architecturally exposed to view, that is dented or deformed is subject to acceptance by the Consultant.
 - 3.1.1.4. Lap ends of deck units not receiving concrete slab a minimum of 50 mm and only over supporting members.
 - 3.1.1.5. Where steel deck spans parallel to beams that are to have studs added to top flange, arrange bottom flutes to be centred over beams. If this is not possible, interrupt decking so that studs can be placed on beams to allow composite action to take place.
 - 3.1.1.6. Bear deck on masonry, concrete, and wood support surfaces with 100 mm minimum bearing. Align and level the deck.
 - 3.1.1.7. Bear deck on steel supports with 75 mm bearing. Align and level the deck.
 - 3.1.1.8. Fasten steel deck to supporting members to safely resist the forces indicated in the Contract Documents but with not less than 19 mm diameter fusion welds at 300 mm on center at intermediate supports and 19 mm diameter fusion welds at 150 mm on center at end supports parallel with the deck flute and at each transverse flute.
 - 3.1.1.9. Weld to CSA W59.
 - 3.1.1.10. Mechanically clinch or fasten male/female side laps to resist the forces indicated in the Contract Documents but at not more than 600 mm on centre maximum.
 - 3.1.1.11. Make fusion welds of deck to supporting members well within bearing width of supporting members.
 - 3.1.1.12. Provide gauge metal closures along edges of all deck parallel to span where deck is not otherwise continuously supported, at all changes in direction of the span of the deck, at all discontinuities of sloped deck, and at all openings through concrete slabs on steel deck.
 - 3.1.1.13. Level and align cellular deck within 3 mm horizontally and vertically. Butt ends, allow for maximum 3 mm gap. Install sheet steel covers over gaps wider than 3 mm. Tape and seal joints watertight.
 - 3.1.2. Openings Through Deck
 - 3.1.2.1. Obtain opening and sleeving information from Subcontractors responsible for the related Work of other Sections before proceeding with the work. Coordinate with the Work of other Sections as necessary.
 - 3.1.2.2. Indicate openings and reinforcement for openings on fabrication and erection drawings.
 - 3.1.2.3. Cut openings and reinforce edges as required for pipes, ducts, and the like. The maximum size of an unreinforced opening is 150 mm square or in diameter. Reinforce openings having a dimension over 150 mm but not exceeding 300 mm in floor deck or 450 mm in roof deck. The location of holes through decking shall be to the approval of the Consultant.
 - 3.1.2.3.1. No holes shall be permitted through cells of energized units.
 - 3.1.2.4. Where possible, leave deck intact and use block outs to form concrete edges at openings. (Cut deck after concrete has reached a minimum of 70% of its 28 day specified strength.)
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- 3.1.3. Supports from Deck
 - 3.1.3.1. No hangers or brackets supporting mechanical and electrical services, artwork, ceilings, bulkheads, lighting and the like from the roof deck are permitted, unless the deck is designed specifically for the imposed loads.
 - 3.1.4. Welded Stud Shear Connectors
 - 3.1.4.1. Weld headed studs to the supporting structural steel through the steel deck as per the requirements of CSA W59, except where studs are required to be welded to the steel in the shop.
 - 3.1.4.2. Where stud shear connectors are shop welded to supporting steel members, accurately layout and predrill holes in the deck to facilitate installation of the deck in the field. The use of torch cutting of holes is not permitted.
 - 3.1.5. Protection
 - 3.1.5.1. Immediately after any deck which does not receive a concrete slab is permanently secured in place, touch up top surface of deck with primer, where the shop applied coating is damaged during installation or by welding of the deck in place.
 - 3.1.6. Closures
 - 3.1.6.1. Seal off spaces between flutes with closures of neoprene or closed cell expanded p.v.c. at partitions, walls, and other locations indicated in the Contract Documents. At exterior walls, provide insulated closures.
 - 3.1.6.2. Where steel deck rests on exterior masonry walls, fill web spaces with closures as recommended by manufacturer.
 - 3.1.6.3. Where flutes are at right angles to exterior walls, and deck exposed on underside extends beyond these walls, install interior and exterior closures. In addition, provide roofer with sufficient quantity of glass fibre pads to close off topside flutes directly over face of wall or use closures as recommended by manufacturer.
 - 3.1.6.4. Where flutes run at right angles to interior partitions, fill web spaces with double run of steel closures or as recommended by manufacturer.
 - 3.1.6.5. Where flutes are parallel to interior partitions, install steel closure flashings to provide neat juncture between two materials or as recommended by manufacturer.
 - 3.1.6.6. Closures are not required between interior partitions and underside of deck in areas having suspended ceiling, unless specified by the Consultant.
 - 3.1.6.7. Attach metal cell closures at locations required to contain poured concrete.

3.2. QUALITY CONTROL

- 3.2.1. Implement a system of quality control to ensure that the minimum standards specified in this Section are attained.
- 3.2.2. Bring to the attention of the Consultant any defects in the Work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.
- 3.2.3. The Consultant's general review during construction and inspection and testing by independent inspection and testing agencies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of its contractual responsibility.

3.3. NOTIFICATION

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- 3.3.1. Prior to commencing significant segments of the Work, give the Consultant and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review the Work. Failure to meet this requirement may be cause for the Consultant to classify the Work as defective.

3.4. INSPECTION AND TESTING

- 3.4.1. The Owner will appoint the Independent Inspection and Testing Company to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Company shall be responsible only to the Consultant, and shall make only such inspection or tests as the Consultant may direct.
- 3.4.2. Inspection and testing will include the testing of stud shear connectors.

3.5. DEFECTIVE MATERIALS AND WORK

- 3.5.1. Where evidence exists that defective Work has occurred or that Work has been carried out incorporating defective materials, the Consultant may have tests, inspections, or surveys performed such as concrete core strength tests, analytical calculations of structural strength, and the like, in order to help determine whether the Work must be replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the Work may be acceptable.
- 3.5.2. All testing shall be conducted in accordance with the requirements of the Building Code, except where this would in the Consultant's opinion cause undue delay or give results not representative of the rejected Products in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- 3.5.3. Products or Work which fails to meet the specified requirements may be rejected by the Consultant whenever found at any time prior to the Total Performance of the work regardless of previous inspection. If rejected, defective materials or Work shall be removed and replaced or repaired to the satisfaction of the Consultant, promptly, at no expense to the Owner.

END OF SECTION 05 31 10

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide structural metal stud framing system including but not limited to following:
 - 1.2.1.1. structural metal stud framing system in exterior and interior wall assemblies including:
 - 1.2.1.1.1. wall studs subjected to lateral loads (no axial loads other than self weight and weight of applied finishes).
 - 1.2.1.1.2. steel bridging.
 - 1.2.1.1.3. top and bottom track.
 - 1.2.1.1.4. head, sill and jamb members for wall openings.
 - 1.2.1.1.5. studs, bridging and track connections.
 - 1.2.1.1.6. top and bottom connections to structure complete details to accommodate structure deflections.
 - 1.2.1.2. exterior sheathing.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of adhesive and insulation: Section 07 21 00, Building Insulation.
 - 1.2.2.2. Provisions of flexible air vapour barriers to maintain integrity of air/vapour barrier: Section 07 25 00, Miscellaneous Air/Vapour Barriers.
 - 1.2.2.3. Provision of sealants and caulking: Section 07 92 00, Joint Sealants.
 - 1.2.2.4. Provision of non-structural interior metal stud framing: Section 09 21 16, Gypsum Board Assemblies.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. OBC: Ontario Building Code.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM A653/A653M-23
 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.2.2. ASTM A792/A792M-23
 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process
 - 1.3.2.3. ASTM C1177/C1177M-17
 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - 1.3.2.4. ASTM C1325-22ae1
 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units
 - 1.3.2.5. ASTM D3273-21
 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

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| 1.3.2.6. | ASTM E84-23 | - Standard Test Method for Surface Burning Characteristics of Building Materials |
| 1.3.2.7. | ASTM E96/E96M-22ae1 | - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials |
| 1.3.2.8. | ASTM E136-22 | - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C |
| 1.3.2.9. | CSA S136-16(21) | - North American Specification for the Design of Cold-Formed Steel Structural Members |
| 1.3.2.10. | CSA W47.1:19 | - Certification of companies for fusion welding of steel structures |
| 1.3.2.11. | CSA W59-18(23) | - Welded steel construction |
| 1.3.2.12. | CAN/ULC-S101-14 | - Standard Methods of Fire Endurance Tests of Building Construction and Materials |
| 1.3.2.13. | CAN/ULC-S102-18 | - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |
| 1.3.2.14. | CAN/ULC-S114-18 | - Standard Method of Test for Determination of Non-Combustibility in Building Materials |
| 1.3.2.15. | CAN/ULC-S742-20 | - Standards for Air Barrier Assemblies - Specification |

1.4. SUBMITTALS

- 1.4.1. Product Data: Submit Product data for mechanical fasteners indicating sizes, load capacities and type of corrosion protection.
- 1.4.2. Shop Drawings:
- 1.4.2.1. Submit Shop Drawings of work of this Section in accordance with Section 01 30 00.
- 1.4.2.2. Submit Shop Drawings showing, in as large a scale as possible, details and erection diagrams, indicate member sizes, locations, thicknesses exclusive of coating, coating materials, provision for expansion and contraction, details of other pertinent components of work and adjacent constructions to which this work shall be attached. Include connection details for attaching framing to itself and for attachments to structure. Show splice details where details permitted. Indicate profiles, dimensions, openings, requirements of related work and critical installation procedures. Show temporary bracing required for erection purposes.
- 1.4.2.3. Ensure a licensed engineer specified herein is responsible for:
- 1.4.2.3.1. production and review of Shop Drawings.
- 1.4.2.3.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.4.3. Submit 1 representative piece of each framing component, including mechanical fasteners to be used. Length of pieces submitted shall be 300 mm (12") long.
- 1.4.4. If requested by Consultant, submit calculations certified by a licensed engineer to design structures and registered in Province of Ontario, substantiating sizes for members and connections based on the design loads before fabrication and erection. Indicate design loads on Shop Drawings.
- 1.4.5. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
- 1.4.5.1. One 300 mm x 300 mm (12" x 12") sample of exterior sheathing.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:

- 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.5.1.2. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
- 1.5.2. Certifications: Ensure maximum deflections under specified loads conform to L/360. Limit deflection so integrity of air/vapour barrier will be maintained at design loading. Permanent deformation of members due to applied loads is not permitted. Notwithstanding limits specified herein, structural steel framing system shall not deflect under design loads sufficient to cause noise, breaking of sealants, or to break integrity of insulation thermal blanket or air/vapour barrier seal.
- 1.5.3. Mock-Ups: Conform to requirements of Section 01 40 00. Construct 1 typical site mock-up of structural metal stud framing assemblies. Provide mock-up approximately 2400 mm x 2400 mm (8' x 8'). Do not commence work of this Section until mock-up has been reviewed with no objections recorded by Consultant.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Delivery and Acceptance Requirements:
 - 1.6.1.1. Deliver materials in original, unopened containers or bundles stored in a place providing protection from damage and exposure to exterior elements.
 - 1.6.1.2. Transport materials in a manner to prevent damage.
- 1.6.2. Storage and Handling Requirements: Store and handle materials in a manner to prevent damage. Store units off ground and protected from mud and rain splashes.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Bailey Metal Products Ltd.; www.bmp-group.com
 - 2.1.1.2. CertainTeed Corporation; www.certainteed.com
 - 2.1.1.3. CGC Inc.; www.cgcinc.com
 - 2.1.1.4. Dass Metal Studs; www.dassmetal.com
 - 2.1.1.5. Fusion Building Products; www.imperialgroup.ca
 - 2.1.1.6. Georgia-Pacific Canada, Inc.; www.buildgp.com
 - 2.1.1.7. Roll Formed Specialty; www.rollformed.com
 - 2.1.1.8. Unifix Inc.; www.unifixinc.ca

2.2. MATERIALS

- 2.2.1. Description:
 - 2.2.1.1. Regulatory Requirements: Work of this Section to conform to requirements of local jurisdictional authorities.

2.2.2. Performance/Design Criteria:

- 2.2.2.1. Exterior cladding for this Project is based on "Rain Screen" design principle as recommended by Division of Building Research of National Research Council of Canada. This principle requires that construction behind cladding act as an air and vapour barrier to prevent passage of moisture-laden air and diffusion of water vapour. Construction behind cladding shall accommodate installation of sealants, insulation, compartmentalization of air space, air/vapour barrier system and drainage slots as required and shown. To ensure provision for continuity of thermal blanket, vapour/air barrier within construction specified herein and with adjacent barrier construction is part of responsibility of this Section.
- 2.2.2.2. Base design on Limit States Design principles using factored loads and resistance. Determine resistance and resistance factors in accordance with OBC and CSA S136 requirements.
- 2.2.2.3. Determine loads and load factors in accordance with OBC requirements. For wind load calculations, base velocity pressure on 1 in 30 probability of being exceeded in any 1 year for design strength and 1 in 10 for deflection.
- 2.2.2.4. Conform to requirements of fire rated assemblies which have been tested in accordance with CAN/ULC-S101 and provide fire resistance rating noted on Drawings.
- 2.2.2.5. Design metal framing based on stud depth shown on Drawings. Adjust stud material thicknesses and spacings as required to meet design criteria. Use of greater or lesser depths only if reviewed with Consultant.
- 2.2.2.6. Design metal framing based on wall stud spacing at 300 mm (12") or 400 mm (16") maximum. Use lesser stud spacing if required to meet design criteria.
- 2.2.2.7. Design metal framing for wall studs system supporting brick veneer with minimum design thickness exclusive of coating of 1.12 mm (0.044").
- 2.2.2.8. Design metal framing with minimum design thickness for bridging channel of 1.22 mm (0.044"). Use greater bridging channel thickness to meet design criteria.
- 2.2.2.9. Design metal framing with minimum design thickness for clips shall be 1.52 mm (0.052"). Use greater clip thickness to meet design criteria.
- 2.2.2.10. Design metal framing exterior wall systems and their connections to withstand their own weight, weight of exterior sheathing, motion of operable elements, minimum design loads, pressure, suction of wind and internal pressure. Limit maximum flexural stud deflection under specified wind loads to L/360.
- 2.2.2.11. Design connections to accommodate vertical deflection movement of structure, frame shortening and vertical tolerances without imposing axial loads on to framing. Leave a minimum gap of 13 mm (1/2"). Larger gaps may be required to accommodate structural movement. Co-ordinate with design requirements.
- 2.2.2.12. Limit free play and movement in connections perpendicular to plane of framing to +/-0.51 mm (0.02") relative to building structure.
- 2.2.2.13. Design components and assemblies to accommodate specified erection tolerances of structure.
- 2.2.2.14. Design bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Do not rely on collateral sheathing to help restrain member rotation and translation perpendicular to minor axis. Provide bridging at 1500 mm (60") oc maximum. Space bridging at equal intervals over span length of member. Closer spacings may be required to satisfy structural design requirements.
- 2.2.2.15. Design anchorage and splice details for bridging.
- 2.2.2.16. Design for local loading due to anchorage of cladding and interior wall mounted fixtures where required to meet design requirements.
- 2.2.2.17. Use bolts, welding or sheet metal screws for connections between wind bearing steel stud members.

- 2.2.2.18. Provide head, sill and jamb members and connections to frame openings larger than 100 mm (4") in any dimension.
- 2.2.2.19. Anchor top and bottom track to structure at a maximum spacing of 800 mm (32") oc. Closer spacings may be required to satisfy structural design requirements.
- 2.2.2.20. Construct work to provide for expansion and contraction of components as will be caused by ambient temperature range without causing buckling, failure of joint seals, undue stress on fasteners or other effects detrimental to appearance or performance.
- 2.2.2.21. Compute section properties on basis of nominal core thickness.
- 2.2.2.22. Design bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress affects due to torsion between lines of bridging.
- 2.2.2.23. Structural Design: Employ a licensed engineer specified herein to:
 - 2.2.2.23.1. design components for work of this Section requiring structural performance.
 - 2.2.2.23.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.2.3. Structural Metal Stud Framing:
 - 2.2.3.1. Ensure steel conforms to requirements of CSA S136 and is identified as to specification, grade, mechanical properties and coating type and thickness.
 - 2.2.3.2. Ensure steel has metallic coatings conforming to 1 of following ASTM Standards:
 - 2.2.3.2.1. ASTM A653/A653M.
 - 2.2.3.2.2. ASTM A792/A792M.
 - 2.2.3.2.3. Ensure interior structural steel studs and tracks have a minimum coating of Z180 (G60) galvanizing in accordance with ASTM A653/A653M. Other coatings (e.g. aluminum-zinc alloy to ASTM A792/A792M) providing equal or better corrosion protection may be used.
 - 2.2.3.2.4. Ensure wind bearing steel studs and tracks have a minimum coating of Z275 (G90) galvanizing in accordance with ASTM A653/A653M. Other coatings (e.g. aluminum-zinc alloy to ASTM A792/A792M) providing equal or better corrosion protection may be used.
 - 2.2.3.3. Wind bearing steel studs and tracks minimum 150 mm (6") wide, minimum 33 mils designation thickness (0.836 mm (0.0329") base steel thickness) of following minimum grades conforming to requirements of CSA S136:
 - 2.2.3.3.1. Grade A (33 ksi yield) @ min 43 mils designation thickness (1.087 mm (0.0428") base steel thickness).
 - 2.2.3.3.2. Grade D (50 ksi yield) @ min 54 mils designation thickness (1.367 mm (0.0538") base steel thickness) and 68 mils designation thickness (1.720 mm (0.0677") base steel thickness).
 - 2.2.3.4. Design Deflection at Maximum Wind Load: Maximum L/360.
 - 2.2.3.5. Size: 150 mm (6") unless otherwise indicated.
 - 2.2.3.6. Design Wind Loading: As noted herein in accordance with OBC.
 - 2.2.3.7. Maximum Span: As noted herein.
 - 2.2.3.8. Top Track: Telescopic 2 piece slip track. Fill deflection cavity with batt insulation.
 - 2.2.3.9. Bottom Track: Provide 9 mm (3/8") diameter weep holes draining through exterior flange at 800 mm (32") oc.
 - 2.2.3.10. Colour code ends of individual gauges of studs as follows:
 - 2.2.3.10.1. 43 mils designation thickness (1.087 mm (0.0429") base steel thickness): yellow.

- 2.2.3.10.2. 54 mils designation thickness (1.367 mm (0.0538") base steel thickness): green.
- 2.2.3.10.3. 68 mils designation thickness (1.720 mm (0.0677") base steel thickness): orange.
- 2.2.3.10.4. 97 mils designation thickness (2.454 mm (0.0966") base steel thickness): red.
- 2.2.3.10.5. 118 mils designation thickness (2.997 mm (0.1180") base steel thickness): blue.
- 2.2.3.11. Design structural metal stud framing system without relying on sheathing or metal airseal to resist torsion and weak axis buckling.
- 2.2.3.12. Provide bridging at a maximum of 1200 mm (4') oc.
- 2.2.4. Zinc-Rich Paint: Repair damaged galvanized surfaces with "METALHIDE® ONE PAC | 97-676" by PPG Architectural Coatings; www.ppg.com, "Zinc Clad® 5 Organic Zinc-Rich Primer" by The Sherwin-Williams Company; www.sherwin-williams.com or "ZRC® Cold Galvanizing Repair Compound" by ZRC Worldwide; www.zrcworldwide.com.
- 2.2.5. Bituminous Paint: To provide dielectric separation and which will dry to be tack-free and able to withstand high temperatures.
- 2.2.6. Exterior Sheathing: Provide 1 of following:
 - 2.2.6.1. Glass mat reinforced, treated core gypsum board conforming to ASTM C1177/C1177M, non-combustible according to ASTM E136/CAN/ULC-S114, flame spread 0, smoke developed 0 to ASTM E84/CAN/ULC-S102 and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 13 mm (1/2") or 16 mm (5/8") thick gypsum board 1200 mm (4') wide by maximum practical length, tapered edge as required, "DensGlass® Sheathing" by Georgia-Pacific Canada, Inc., "GlasRoc Sheathing" by CertainTeed Corporation or "Securock Glass-Mat Sheathing" by CGC Inc.
 - 2.2.6.2. Cementitious core surfaced with fibreglass reinforcing mesh on back and front, long edges wrapped, complying with ASTM C1325, 9 mm (3/8") thick, "PermaBase Sheathing Board, by Unifix Inc.
- 2.2.7. Sheathing Air Barrier System (Vapour Permeable):
 - 2.2.7.1. Air Leakage of Sheathing Assembly: Not more than 0.05 L/s/m² (0.01 cfm/sq ft) when tested at 75 Pa (1.57 psf) air pressure difference in accordance with CAN/ULC-S742, Class A1.
 - 2.2.7.2. Water Vapour Permeance of Sheathing: Not less than 20 perms when tested in accordance with ASTM E96/E96M, Procedure B. System is considered vapour permeable.
 - 2.2.7.3. System Description: Weather-resistant barrier and air barrier assembly installed at exterior stud walls under exterior cladding, consisting of following components:
 - 2.2.7.3.1. WRB/AB Sheathing: Coated fiberglass mat gypsum sheathing.
 - 2.2.7.3.2. Fluid-applied flashing to seal sheathing joints, inside and outside corners, penetrations, rough openings and material transitions.
 - 2.2.7.3.3. Backer rods and accessory materials.
 - 2.2.7.4. WRB/AB Sheathing: Glass mat reinforced, treated core gypsum board conforming to ASTM C1177/C1177M, non-combustible according to ASTM E136/CAN/ULC-S114, flame spread 0, smoke developed 0 to ASTM E84/CAN/ULC-S102, 16 mm (5/8") thick gypsum board 1200 mm (4') wide by maximum practical length, "DensElement® Sheathing" by Georgia-Pacific Canada, Inc.
 - 2.2.7.5. Liquid Flashing: Compound made with Silyl Terminated Polymer (STP) Technology for sealing rough openings, penetrations, joints, sheathing fasteners and seams; "DensDefy™ Liquid Flashing" by Georgia-Pacific Canada, Inc.
 - 2.2.7.6. Liquid Transition Membrane: Fluid-applied, single component STP air- and water-resistive barrier; "DensDefy™ Liquid Barrier" by Georgia-Pacific Canada, Inc.

- 2.2.8. Fabrication:
- 2.2.8.1. Do not commence fabrication until Shop Drawings and erection drawings have been reviewed and samples have been reviewed with no objections recorded.
- 2.2.8.2. Insofar as practical, execute fitting and assembly in shop with various parts or assemblies ready for erection at building site.
- 2.2.8.3. Provide cutouts centred in webs of members to accommodate services. Limit dimensions of unreinforced cutouts to suite design requirements and effects on strength and stiffness of members.
- 2.2.8.4. Take field measurements and levels required to verify or supplement those shown on Drawings for proper layout and installation of work. Coordinate dimensional tolerances in adjacent building elements and confirm prior to commencement of work.
- 2.2.8.5. Accurately machine file and fit frames rigidly together at joints, corners and mitres. Match components carefully to produce perfect continuity of line and design.
- 2.2.8.6. Fabrication Tolerances: Provide light-weight steel framing true and plumb within following tolerances:
- 2.2.8.6.1. Track and Framing:
- 2.2.8.6.1.1. Member Depth: ± 0.76 mm, (± 0.03 ").
- 2.2.8.6.1.2. Flange Width: ± 0.76 mm (± 0.03 ") (where exterior board is attached directly to flange).
- 2.2.8.6.1.3. Minimum Flange Width: 32 mm (1-1/4").
- 2.2.8.6.1.4. Lip length: +3 mm (+1/8").
- 2.2.8.6.1.5. Thickness: -0 mm (-0").
- 2.2.8.6.1.6. Corner Angles: $\pm 3^\circ$.
- 2.2.8.6.1.7. Framing Length: ± 3 mm ($\pm 1/8$ ").

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. ERECTION

- 3.2.1. Ensure erection conforms to reviewed Shop Drawings. Methods of construction may be either piece by piece (stick-built) or by fabrication into panels (panelized) either on or off site.
- 3.2.2. Erect work plumb, true and in proper alignment and relationship to established lines and grades. Submit modifications required to accommodate as built conditions (other than minor dimensional changes) for review.
- 3.2.3. Employ temporary bracing whenever necessary to withstand all loads to which structure may be subjected during erection and subsequent construction. Leave temporary bracing in place as long as required for safety and integrity of structure. Ensure during erection a margin of safety consistent with requirements of OBC and CSA S136 is provided.

- 3.2.4. Wind Bearing Stud Erection:
- 3.2.4.1. Install studs at 300 mm (12") or 400 mm (16") oc maximum. Ensure studs seat into top and bottom tracks. Ensure gap between end of stud and web of track does not exceed 4.8 mm (3/16"). Allow 19 mm (3/4") minimum at top of framing for anticipated floor slab deflection, unless otherwise noted on Structural Drawings.
 - 3.2.4.2. Align adjacent or abutting members in same plane to within 0.5 mm (0.02") maximum.
 - 3.2.4.3. Ensure spacing of studs is not more than +/-3 mm (+/-1/8") from design spacing. Ensure cumulative error in spacing does not exceed requirements of finishing materials.
 - 3.2.4.4. Align web cut-outs in studs as required for installation of through-the-knockout style bridging and services.
 - 3.2.4.5. Make field measurements necessary to insure proper fit of members.
 - 3.2.4.6. Reinforce cut-outs where distance from centreline of cut-out to end of member is less than 300 mm (6"). Submit reinforcing detail for review.
 - 3.2.4.7. Ensure holes field cut into lightweight steel framing members conform to requirements specified herein.
 - 3.2.4.8. Replace damaged members from site.
 - 3.2.4.9. Unless a closer spacing is shown on shop requirements of OBC and Drawings, anchor top and bottom tracks securely to structure at 800 mm (32") oc maximum. Place 1 additional anchor within 100 mm (4") of end of each piece of track and additionally as required by Shop Drawings.
 - 3.2.4.10. Install additional studs at abutting walls, openings, terminations against other materials and on each side at corners unless explicitly detailed otherwise on Shop Drawings.
 - 3.2.4.11. Place insulation in jamb and header assemblies that may be inaccessible after their installation into wall. Insure insulation is kept dry and not compressed.
 - 3.2.4.12. Handling and lifting of prefabricated panels shall not cause permanent distortion to any member or collateral material.
- 3.2.5. Fasteners and Welds:
- 3.2.5.1. Ensure connected parts are in contact. Provide clamping before welding or installing screws.
 - 3.2.5.2. Ensure companies engaged in welding are certified by Canadian Welding Bureau to CSA W47.1. Ensure companies have welding procedures approved and welders qualified for base material types and thicknesses being welded.
 - 3.2.5.3. Ensure welds conform to CSA S136 or CSA W59, whichever is applicable.
 - 3.2.5.4. For material less than 1.6 mm (1/16") thick, Shop Drawings may show nominal weld leg sizes. For such material, ensure effective throats of welds are not less than thickness of thinnest connected part.
 - 3.2.5.5. Touch-up welds and coatings damaged by welding with zinc rich paint. Prior to touching-up prepare surface in accordance with paint manufacturer's recommendations.
 - 3.2.5.6. Sheet metal screw thread types, drilling capability and installation conform to manufacturer's recommendations. Ensure sheet metal screws are minimum diameter indicated on Shop Drawings but not less than a #8. Provide sheet metal screws covered by sheathing materials with low profile heads. Penetration beyond joined materials shall be not less than 3 exposed threads. Secure steel stud framing to bottom track with minimum #8 x 13 mm (1/2") long screws both sides of framing.
 - 3.2.5.7. Base resistance for sheet metal screws on manufacturer's lower bond test values multiplied by appropriate resistance factor, diameter is given in CSA S136.

- 3.2.5.8. Install concrete anchors in accordance with manufacturer's recommendations. Ensure connections between light-weight steel framing members are bolts, welding or sheet metal screws. Welded connections are only permitted if touched-up with zinc-rich paint.
- 3.2.5.9. Install veneer anchors in accordance with manufacturer's recommendations. Ensure connectors attach to web side of stud with fasteners loaded in shear and have thin vertical edge to minimize accumulation of mortar droppings.
- 3.2.6. Mechanically fasten track and clip angles to concrete slab by drill-in fastenings. Bear cost of repair satisfactory to Consultant of concrete chipped by drilling or fixing operations.
- 3.2.7. Secure framing at top with sliding connection. Provide inner and outer track deflection head under steel beams and decks.
- 3.2.8. Field Cutting:
 - 3.2.8.1. Cut members using saw or shear. Torch cutting is not permitted.
 - 3.2.8.2. Limit field cut holes into light-weight steel framing to 64 mm (2-1/2") maximum across member web 110 mm (4-3/8") maximum along member length, 610 mm (24") oc minimum.
 - 3.2.8.3. Apply 1 coat of zinc-rich paint to galvanized surfaces which have been damaged or had coating removed.
 - 3.2.8.4. Co-ordinate with other Sections for installation of anchors and ties required for work specified under other Sections.
- 3.2.9. Exterior Sheathing:
 - 3.2.9.1. Provide exterior sheathing in accordance with manufacturer's instructions.
 - 3.2.9.2. Minimum Fastening Requirements:
 - 3.2.9.2.1. Perimeter Edge of Each Board: 200 mm (8") oc max.
 - 3.2.9.2.2. Intermediate Supports: 300 mm (12") oc max.
 - 3.2.9.3. Provide exterior sheathing neatly with tight butt joints and without gaps and holes.
 - 3.2.9.4. Bear edges of exterior sheathing fully onto structural framing.
 - 3.2.9.5. Do not crush exterior sheathing edges.
 - 3.2.9.6. Do not countersink fasteners below exterior paper skin of exterior sheathing boards.
 - 3.2.9.7. Secure exterior sheathing to exposed leg of inner track of telescopic 2-piece top track.
 - 3.2.9.8. Provide ready to receive air/vapour barrier membrane.
- 3.2.10. Sheathing Air Barrier System (Vapour Permeable):
 - 3.2.10.1. Ensure manufacturer's technical representative in present at start of system installation. Have them provide training of site personnel on proper procedures for sealing and transition procedures to ensure airtightness of system.
 - 3.2.10.2. Install and fasten WRB/AB sheathing according to manufacturer's detailed installation instructions.
 - 3.2.10.3. Fastener and Penetration Treatment: Treat sheathing fasteners with specified fluid applied flashing used for sealing joints.
 - 3.2.10.4. Sealing Sheathing Joints, Inside and Outside Corners, Fasteners, Rough Openings and Material Transitions:
 - 3.2.10.4.1. Seal WRB/AB sheathing joints with liquid flashing.
 - 3.2.10.4.2. Apply liquid flashing over joint in a zigzag or ribbon pattern. Cover a minimum of 25 mm (1") on both sides of joint.
 - 3.2.10.4.3. With a straight edge tool, spread evenly over sheathing joint.

- 3.2.10.4.4. Apply at a rate to achieve a minimum wet mil thickness of 0.381 mm (16 mils) over entire joint area.
- 3.2.10.5. Sealing WRB/AB Sheathing Vertical Corners:
 - 3.2.10.5.1. Apply liquid flashing over inside and/or outside corner in a zigzag or ribbon pattern. Cover a minimum of 50 mm (2") on both sides of corner.
 - 3.2.10.5.2. With a straight edge tool, spread evenly over sheathing corner.
 - 3.2.10.5.3. Apply at a rate to achieve a minimum wet mil thickness of 0.381 mm (16 mils) over corner area.
- 3.2.10.6. Sealing WRB/AB Sheathing Fasteners: Apply liquid flashing material to fasteners and wipe down with a straight edge tool; provide a minimum 0.381 mm (16 mil) thick coating over fastener.
- 3.2.10.7. Sealing WRB/AB Sheathing Rough Openings:
 - 3.2.10.7.1. Apply a bead of liquid flashing into entire width of inside corners of opening dispensed from a tube type container.
 - 3.2.10.7.2. Apply liquid flashing onto:
 - 3.2.10.7.2.1. Sills of openings.
 - 3.2.10.7.2.2. Jambs of openings.
 - 3.2.10.7.2.3. Headers of openings.
 - 3.2.10.7.3. Apply liquid flashing over entire width of opening sill, jamb and header on exterior set windows and doors. Apply liquid flashing over entire width of opening sill, jamb and header on interior set windows and doors. Apply in a zigzag or ribbon pattern.
 - 3.2.10.7.4. Apply liquid flashing over sheathing adjacent to opening sill, jamb and header in a zigzag or ribbon pattern. Cover a minimum of 50 mm (2") of sheathing surface adjacent to opening.
 - 3.2.10.7.5. With a straight edge tool, spread liquid flashing over entire width of sill, jamb, header and sheathing surface adjacent to opening.
 - 3.2.10.7.6. Apply at a rate to achieve a minimum wet mil thickness of 0.381 mm (16 mils) over opening area.
- 3.2.10.8. Sealing WRB/AB Sheathing Material Transitions:
 - 3.2.10.8.1. Ensure sheathing joint and transition gaps to receive liquid transition membrane are less than 6 mm (1/4").
 - 3.2.10.8.2. Seal gaps larger than 6 mm (1/4") with liquid flashing as recommended by manufacturer.
 - 3.2.10.8.3. Fill gaps more than 6 mm (1/4") and less than 25 mm (1") with a backer rod to support liquid flashing at transition joint.
 - 3.2.10.8.4. If necessary, prime adjacent material with primer per material manufacturer's recommendations.
 - 3.2.10.8.5. Apply liquid flashing over sheathing and adjacent material in a zigzag or ribbon pattern. Ensure flashing is a minimum of 50 mm (2") on each substrate material surface.
 - 3.2.10.8.6. With a straight edge tool, spread liquid flashing over material transition joint.
 - 3.2.10.8.7. Apply at a rate to achieve a minimum wet mil thickness of 0.381 mm (16 mils).
- 3.2.10.9. Sealing Exterior Wall Penetrations:
 - 3.2.10.9.1. Seal exterior wall penetrations to prevent air and water infiltration. Seal penetrations with liquid flashing.
 - 3.2.10.9.2. For round or square pipe/duct penetrations use specified liquid flashing, refer to manufacturer's Technical Guide for instructions for proper sealing.

- 3.2.11. Tolerances: For purpose of this work, camber is defined as deviation from straightness of a member or any portion of a member with respect to its major axis and sweep is defined as deviation from straightness of a member or any portion of a member with respect to its minor axis:
- 3.2.11.1. Ensure out of plumbness does not exceed L/500 of member length; out of straightness (camber or sweep) not to exceed L/1000 of member length.
- 3.2.11.2. For track, camber not to exceed L/1000 of member length.
- 3.2.11.3. Do not space framing more than 3 mm (1/8") from design spacing. Ensure cumulative error in spacing does not exceed requirements of finishing materials.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Tests and Inspections: Inspection includes:
 - 3.3.1.1. Consultant may appoint an independent air seal system consultant for:
 - 3.3.1.1.1. checking mill test reports are properly correlated to materials; welded and screwed connections, connections to main structure member, sizes, location and material and coating thicknesses.
 - 3.3.1.1.2. sampling fabrication and erection procedures for general conformity to requirements of Contract Documents.
 - 3.3.1.1.3. checking fabricated members against specified member shapes.
 - 3.3.1.1.4. sample checking of screwed and bolted joints.
 - 3.3.1.1.5. sample checking that tolerances are not exceeded.
 - 3.3.1.1.6. general inspection of field cutting and alterations required by other trades.
 - 3.3.1.1.7. submission of reports to Consultant, Owner and local jurisdictional authorities covering work inspected with details of deficiencies discovered.
 - 3.3.1.2. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
- 3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Keep installed work clean as work progresses.
- 3.4.2. Clean and Make Good surfaces soiled or otherwise damaged in connection with this work. Pay cost of replacing finishes or materials that cannot be satisfactorily touched up, cleaned or have been damaged by improper cleaning materials and methods.
- 3.4.3. Upon completion of this work, remove debris, equipment and excess material resulting from this work from site.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide metal fabrications including but not limited to following:
 - 1.2.1.1. steel ladders.
 - 1.2.1.2. doors, openings and windows.
 - 1.2.1.3. operable partition supports.
 - 1.2.1.4. rolling door steel jamb framing.
 - 1.2.1.5. overhead door jambs and headers.
 - 1.2.1.6. overhead door track and operator anchorage.
 - 1.2.1.7. lateral support for masonry walls.
 - 1.2.1.8. bollards.
 - 1.2.1.9. metal supports associated with architectural woodwork.
 - 1.2.1.10. roof coping.
 - 1.2.1.11. miscellaneous steel fabrications and/or framing required for structural support not specifically described on Structural Drawings, engineered to suit applications indicated on Drawings.
 - 1.2.1.12. other miscellaneous sections and framing required to complete the Work and/or inferable in Contract Documents but not explicitly shown on Drawings.
 - 1.2.1.13. other miscellaneous sections and framing as defined under "Appendix F" of CISC Code of Standard Practice for Structural Steel.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Installation of miscellaneous metal fabrications in concrete: Section 03 10 00, Concrete Forming and Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Concrete fill in stair treads, risers and landings and pipe bumpers: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.3. Installation of metal fabrications in masonry: Section 04 20 00, Masonry Units.
 - 1.2.2.4. Provision of building structural steel: Section 05 12 00, Structural Steel.
 - 1.2.2.5. Provision of metal decking: Section 05 31 10, Steel Deck.
 - 1.2.2.6. Provision of metal pan stairs, landings and balustrades: Section 05 51 00, Metal Stairs and Balustrades.
 - 1.2.2.7. Provision of architectural woodwork: Section 06 40 00, Architectural Woodwork.
 - 1.2.2.8. Provision of metal siding: Section 07 46 19, Metal Siding System.
 - 1.2.2.9. Provision of finish paint system: Section 09 91 00, Painting.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. CISC: Canadian Institute of Steel Construction; www.cisc-icca.ca.

1.3.1.2. DFT: Dry Film Thickness.

1.3.1.3. OBC: Ontario Building Code.

1.3.1.4. SSPC: The Society for Protective Coatings (formerly known as Steel Structures Painting Council); www.sspc.org.

1.3.2. Reference Standards:

- | | | |
|-----------|----------------------|---|
| 1.3.2.1. | ASME B46.1-2019 | - Surface Texture (Surface Roughness, Waviness, and Lay) |
| 1.3.2.2. | ASTM A53/A53M-22 | - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| 1.3.2.3. | ASTM A123/A123M-17 | - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| 1.3.2.4. | ASTM A153/A153M-23 | - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| 1.3.2.5. | ASTM A240/A240M-23a | - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications |
| 1.3.2.6. | ASTM A269/A269M-22 | - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service |
| 1.3.2.7. | ASTM A276/A276M-17 | - Standard Specification for Stainless Steel Bars and Shapes |
| 1.3.2.8. | ASTM A307-21 | - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength |
| 1.3.2.9. | ASTM A480/A480M-23b | - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip |
| 1.3.2.10. | ASTM A510/A510M-20 | - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel |
| 1.3.2.11. | ASTM A511/A511M-21a | - Standard Specification for Seamless Stainless Steel Mechanical Tubing |
| 1.3.2.12. | ASTM A653/A653M-23 | - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| 1.3.2.13. | ASTM A967/A967M-17 | - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts |
| 1.3.2.14. | ASTM C881/C881M-20a | - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete |
| 1.3.2.15. | ASTM C1107/C1107M-20 | - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) |
| 1.3.2.16. | CSA G40.20-13(23) | - General requirements for rolled or welded structural quality steel |
| 1.3.2.17. | CSA G40.21-13(23) | - Structural quality steel |
| 1.3.2.18. | CSA W48:23 | - Filler metals and allied materials for metal arc welding |

- 1.3.2.19. CSA W59-18(23) - Welded steel construction
- 1.3.2.20. CSA W117.2:19 - Safety in welding, cutting, and allied processes
- 1.3.2.21. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning
- 1.3.2.22. CISC Code of Standard Practices for Structural Steel, Eight Edition

1.4. SUBMITTALS

- 1.4.1. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to minimum requirements indicate following:
 - 1.4.1.1. large scale details of members, materials and connections.
 - 1.4.1.2. jointing details.
 - 1.4.1.3. methods of setting, sealing, securing, anchorage.
 - 1.4.1.4. field connections.
 - 1.4.1.5. Ensure a licensed engineer specified herein is responsible for:
 - 1.4.1.5.1. production and review of Shop Drawings.
 - 1.4.1.5.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.4.2. Samples: Submit samples of exposed metal fabrications in accordance with Section 01 30 00 representing final finish.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
 - 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
 - 1.5.1.2. Welding: Provide welding in accordance with CSA W59 performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau.
 - 1.5.1.3. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
- 1.5.2. Certifications:
 - 1.5.2.1. Submit certification from a licensed engineer registered in Province of Ontario, who shall affix his/her seal and signature to certificate, stating structure is capable of supporting its own weight and specified live loads.
 - 1.5.2.2. Welders employed on this Project may be asked by Consultant at any time for their welding certificate.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Delivery and Acceptance Requirements: Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, undercover storage locations. Do not load areas beyond the designed limits.
- 1.6.2. Storage and Handling Requirements:
 - 1.6.2.1. Handle and store metal materials at job site in such a manner to prevent damage to other materials, (to existing buildings) or property.
 - 1.6.2.2. Handle components with care and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material that will not damage surface of steel members.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Performance/Design Criteria:
 - 2.1.1.1. Ramp Railing Structural Performance: Provide railings capable of withstanding effects of gravity loads and following loads and stresses within limits and under conditions indicated:
 - 2.1.1.1.1. Uniform load of 730 N/m (50 lbf/ft) applied in any direction.
 - 2.1.1.1.2. Concentrated load of 890 N (200 lbf) applied in any direction.
 - 2.1.1.2. Structural Design: Employ a licensed engineer specified herein to:
 - 2.1.1.2.1. design components for work of this Section requiring structural performance.
 - 2.1.1.2.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.1.2. Structural Shapes, Plates, Etc.: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.
- 2.1.3. Hollow Structural Sections (HSS): New material conforming to CSA G40.20 and CSA G40.21, Grade 350W, Class H.
- 2.1.4. Stainless Steel:
 - 2.1.4.1. Seamless and Welded Austenitic Stainless Steel Tubing: Type 304 in accordance with ASTM A269/A269M, Seamless - ASTM A511/A511M tube polished to a "No. 4 Finish" typically having a surface roughness average (Ra) ranging from 20 - 25 micro inches when measured in accordance with ASME B46.1.
 - 2.1.4.2. Bars and Shapes: Type 304 to ASTM A276/A276M, Square Bar, Round Bar, Angle, Channel and/or Flat Bar polished to "No. 4 Finish" typically having a surface roughness average (Ra) ranging from 20 - 25 micro inches when measured in accordance with ASME B46.1.
 - 2.1.4.3. Flat-Rolled Plate and Sheet: Type 304 in accordance with ASTM A240/A240M and ASTM A480/A480M, plate and sheet polished to "No. 4 Finish" typically having a surface roughness average (Ra) ranging from 20 - 25 micro inches when measured in accordance with ASME B46.1.
 - 2.1.4.4. Provide highest architectural quality in various forms, straight and true. Ensure there are no scratches, scars, creases, buckles, ripples or chatter marks. Provide finish surfaces suitable for polishing where required. Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolourations or other imperfections.
 - 2.1.4.5. Refer to Drawings for stainless steel work.
- 2.1.5. Welding Materials: Conforming to CSA W48 and CSA W59.
- 2.1.6. Common or Ordinary Bolts and Anchor Bolts: Unfinished bolts conforming to ASTM A307, Grade A, with hexagon heads and nuts where exposed in the finish work. Supply common bolts of lengths required to suit thickness of material being joined, but not projecting more than 6 mm (1/4") beyond nut, without the use of washers. Supply anchor bolts of lengths noted but projecting not less than 13 mm (1/2") beyond nut unless otherwise noted.
- 2.1.7. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.
- 2.1.8. Galvanized Primer Paint: "METALHIDE® ONE PAC | 97-676" by PPG Architectural Coatings; www.ppg.com, "Zinc Clad® 5 Organic Zinc-Rich Primer" by The Sherwin-Williams Company; www.sherwin-williams.com or "ZRC® Cold Galvanizing Repair Compound" by ZRC Worldwide; www.zrcworldwide.com.

- 2.1.9. Steel Pipe Handrails: Conforming to ASTM A53/A53M, Type "S", Schedule 40, Grade A steel pipe of sizes shown.
- 2.1.10. Grout: Provide 1 of following:
 - 2.1.10.1. Epoxy Resin Grout: 2-component, mineral-filled epoxy resin conforming to ASTM C881/C881M, of type, grade and class to suit requirements; "Sika AnchorFix®-3001" by Sika Canada Inc., "REZI-WELD™-3/2 Epoxy Grout-Patch Kit" by W.R. Meadows of Canada or "EUCO #452 EPOXY SYSTEM" by Euclid Chemical Canada Inc.
 - 2.1.10.2. Pre-mixed, non-shrink, non-metallic, cementitious grout, containing no chlorides, conforming to ASTM C1107/C1107M; "M-Bed Standard" by Sika Canada Inc., "CG-86 Construction Grout" by W.R. Meadows of Canada or "NS Grout" by Euclid Chemical Canada Inc.
- 2.1.11. Galvanizing: Hot dipped galvanizing with minimum zinc coating of 600 g/m².
- 2.1.12. Galvanized Sheet Steel: Supply 0.91 mm (20 ga) core thickness commercial quality to ASTM A653/A653M, CS Type A, with Z275 (G90) zinc coating designation to ASTM A653/A653M.
- 2.1.13. Welded Steel Wire Mesh: 50 mm x 50 mm x 3.4 mm (2" x 2" x 0.135") diameter, welded carbon steel wire mesh conforming to ASTM A510/A510M by Gerard Daniel Worldwide, Canadian Division.
- 2.1.14. Metal Gratings: Maximum 20 mm x 20 mm porosity, in accordance with City of Toronto, Toronto Green Standards. Provide "Wheels n' Heels® InVent®" by Ohio Gratings, Inc. [with slip resistant finish] or "BBF-12" by Borden Gratings [with "ALGRIP®" finish]. Grating, frames and fasteners are Type 304 stainless steel and sandblasted to SSPC-SP 6/NACE No. 3 post fabrication and passivated in accordance with ASTM A967/A967M. Provide complete with anchors, bases and fasteners.
- 2.1.15. Handrail Wall Brackets: In accordance with OBC requirements and to meet design requirements indicated on Drawings.
- 2.1.16. Fabrication:
 - 2.1.16.1. Fabricate each item of work of this Section in accordance with following general requirements:
 - 2.1.16.1.1. members square and straight.
 - 2.1.16.1.2. members plumb and true.
 - 2.1.16.1.3. joints accurately and tightly fitted.
 - 2.1.16.1.4. intersecting members in true, flush planes.
 - 2.1.16.1.5. fasteners concealed.
 - 2.1.16.1.6. steel connections.
 - 2.1.16.2. Fabricate, fit and assemble work in shop where possible. Where shop fabrication is not possible, make trial assembly in shop.
 - 2.1.16.3. Provide hangers, rods, bars, bolts, anchors, brackets, rivets, bearing plates and bracing, fitting, drilling, stopping, soldering, as required for a complete assembly.
 - 2.1.16.4. Isolate dissimilar metals including stainless steel and galvanized steel using dielectric separator to prevent galvanic corrosion.
 - 2.1.16.5. Weld connections unless otherwise indicated.
 - 2.1.16.6. Shop Welding:
 - 2.1.16.6.1. Execute welding to avoid damage or distortion to the Work. Should there be, in the opinion of Consultant or Inspection Company, doubt as to adequacy of welds, they shall be tested for efficiency and any work not meeting Standards be removed and replaced with new work satisfactory to Consultant. Carry out welding in accordance with following standards:
 - 2.1.16.6.1.1. CSA W48 - for Electrodes (If rods are used, only coated rods are allowed).

- 2.1.16.6.1.2. CSA W59 - for design of connections and workmanship.
- 2.1.16.6.1.3. CSA W117.2 - for safety.
- 2.1.16.6.2. Thoroughly clean welded joints and steel exposed for a sufficient space to properly perform welding operation. Neatly finish welds. Ensure welds exposed to view and finish painted are continuous and ground smooth.
- 2.1.16.7. Provide exposed metal fastenings and accessories of same material, texture, colour and finish as base metal to which they are applied or fastened.
- 2.1.17. Finishes:
 - 2.1.17.1. Cleaning and Shop Painting:
 - 2.1.17.1.1. Clean steel to SSPC-SP 6/NACE No. 3 and remove loose mill scale, weld flux and splatter.
 - 2.1.17.1.2. Shop prime steel except for steel to receive sprayed fire-resistive materials with 1 coat of primer paint to DFT of 0.025 mm (1 mil). Paint on dry surfaces, free from rust, scale and grease. Do not paint when temperature is lower than 7 deg C (45 deg F). Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature and humidity conditions.
 - 2.1.17.1.3. Shop prime non-galvanized perimeter steel members and structural steel members to receive sprayed fire-resistive materials with 1 coat of high-performance corrosion protection primer to DFT of 0.025 mm (1 mil). Paint on dry surfaces, free from rust, scale or grease. Do not paint when temperature is lower than 7 deg C (45 deg F). Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature and humidity conditions.
 - 2.1.17.1.4. Shop prime galvanized steel with galvanized primer paint.
 - 2.1.17.1.5. Clean but do not paint surfaces being welded in the field and surfaces in contact after assembly.
 - 2.1.17.2. Hot Dip Galvanizing:
 - 2.1.17.2.1. After fabrication, hot dip galvanize specific miscellaneous steel items noted on Drawings and/or called for herein. Plug relief vents air tight. After galvanizing, remove plugs, ream holes to proper size and re-tap threads. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with "METALHIDE® ONE PAC | 97-676" by PPG Architectural Coatings; www.ppg.com, "Zinc Clad® 5 Organic Zinc-Rich Primer" by The Sherwin-Williams Company; www.sherwin-williams.com or "ZRC® Cold Galvanizing Repair Compound" by ZRC Worldwide; www.zrcworldwide.com in accordance with manufacturer's printed directions.
 - 2.1.17.2.2. Galvanize members exposed to elements when in final location; members embedded on exterior side of exterior walls; members imbedded in concrete; members specified in this Section or noted on Drawings.
 - 2.1.17.2.3. Hot-dip galvanize members in accordance with requirements of following ASTM standards with minimum coating weights or thicknesses as specified:
 - 2.1.17.2.3.1. Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating g/m² (oz/sq ft) of actual surface, for 4.8 mm (3/16") and less thickness members 460 g/m² (1.5 oz/sq ft), for 6 mm (1/4") and heavier members 705 g/m² (2.3 oz/sq ft).
 - 2.1.17.2.3.2. Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in g/m² (oz/sq ft) of surface shall be in accordance with Table 1 of ASTM A153/A153M, for the various classes of materials used on the Project.
 - 2.1.17.2.3.3. Steel Sheet: ASTM A653/A653M; weight of zinc coating, per sq ft on both sides of sheet. Coating designation Z275 (G90), minimized spangle and chemically treated.
 - 2.1.17.3. Colour: To be selected by Consultant.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Erect work of this Section plumb, square, true and level.
- 3.2.2. Securely anchor work of this Section and rivet, weld or bolt to structural framing of the building. Where secured to concrete, provide bolts for setting in concrete. Provide expansion bolt supports to masonry.
- 3.2.3. Provide necessary fitting, setting and cutting required in connection with the fitting of work of this Section to other parts of the Work.
- 3.2.4. Field Painting: Paint bolt heads, washers, nuts, field welds and previously unpainted items. Touch up with matching paint, shop primer damaged during transit and installation.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Tests and Inspections:
 - 3.3.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
- 3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. On completion of installation, carefully clean metal work.

3.5. SCHEDULES

3.5.1. STEEL LADDERS

- 3.5.1.1. Provide galvanized steel ladders for following locations:
 - 3.5.1.1.1. One ladder in each elevator pit from 1500 mm (5') above last floor served to bottom of pit.
 - 3.5.1.1.2. On vertical exterior walls for roof access where indicated.
- 3.5.1.2. Obtain exact locations of ladders from Consultant where not otherwise indicated.
- 3.5.1.3. Provide 6 mm (1/4") galvanized steel checker plate platform and 38 mm x 38 mm x 6 mm (1-1/2" x 1-1/2" x 1/4") angle framing for ladders.
- 3.5.1.4. Provide a hot dip galvanized steel safety cage from 2200 mm (7' - 0") from the finished roof to 900 mm (36") above the parapet.

3.5.2. OPERABLE PARTITION SUPPORTS

- 3.5.2.1. Provide structural steel plates and support rods in accordance with the operable door manufacturer's detail requirements.
- 3.5.2.2. Brace support system against lateral movement.
- 3.5.2.3. Finish: Alkyd prime painted.

- 3.5.3. ROLLING DOOR STEEL JAMB FRAMING
 - 3.5.3.1. Provide steel jamb framing for rolling fire doors and shutters as detailed.
 - 3.5.3.2. Finish: Galvanized finish.
- 3.5.4. OVERHEAD DOOR JAMBS AND HEADERS
 - 3.5.4.1. Provide HSS, channel framing and 6 mm (1/4") plate steel closures to profile as indicated.
 - 3.5.4.2. Finish: Galvanized steel.
- 3.5.5. OVERHEAD DOOR TRACK AND OPERATOR ANCHORAGE
 - 3.5.5.1. Provide inside jamb extensions, centre spring mount and motor supports in accordance with manufacturer's instructions.
 - 3.5.5.2. Finish: Prime painted.
- 3.5.6. LATERAL SUPPORTS FOR MASONRY WALLS
 - 3.5.6.1. Lateral Support of Interior Masonry Walls: Supply 75 mm x 75 mm x 6 mm (3" x 3" x 1/4") steel angles 300 mm (12") long to be secured to underside of structure as part of the work of Section 04 20 00.
 - 3.5.6.2. Lateral Support of Exterior Walls, Inner Wythe: Supply 100 mm (4") x block width x 6 mm (1/4") bent steel plate 300 mm (12") long to be secured to underside of structure as part of the work of Section 04 20 00.
 - 3.5.6.3. Finish: Galvanized for exterior walls, prime painted for interior walls.
- 3.5.7. BOLLARDS
 - 3.5.7.1. Bollards: 6 mm (1/4") thick x 300 mm (12") round diameter HSS.
 - 3.5.7.2. Finish: Galvanized.
 - 3.5.7.3. Concrete fill and bases provided as part of work of Section 03 30 00.
 - 3.5.7.4. Bollards installed as part of work of Section 03 30 00.
- 3.5.8. ARCHITECTURAL WOODWORK
 - 3.5.8.1. Provide miscellaneous steel items required as part of work of Section 06 40 00, e.g.: valance supports, vanity support brackets.
 - 3.5.8.2. Finish: Prime painted.
- 3.5.9. ROOF COPING
 - 3.5.9.1. 2.657 mm (12 ga) galvanized steel bent plate, Z275 (G90) coating.
- 3.5.10. MISCELLANEOUS SECTIONS AND FRAMING
 - 3.5.10.1. Provide miscellaneous steel sections as defined under "Appendix F" of CISC Code of Standard Practice for Structural Steel which are not shown or identified on Structural Drawings or specified under another Section of Specifications.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide steel stairs and balustrades including but not limited to following:
 - 1.2.1.1. steel stairs with metal pan treads and landings.
 - 1.2.1.2. support steel, hangers, posts, reinforced steel pan construction for treads, main and intermediate landings, steel railings, face plate trim and closure plates at landings.
 - 1.2.1.3. metal pan stair balustrades.
 - 1.2.1.4. wall and floor mounted ballustrades and fixings to main structure.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Installation of miscellaneous metal fabrications in concrete: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Concrete fill in stair treads, risers and landings: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.3. Installation of miscellaneous metal fabrications in masonry: Section 04 20 00, Masonry Units.
 - 1.2.2.4. Building structural steel: Section 05 12 00, Structural Steel.
 - 1.2.2.5. Provision of metal decking: Section 05 31 10, Steel Deck.
 - 1.2.2.6. Supply of temporary wood treads and landings: Section 06 10 00, Rough Carpentry.
 - 1.2.2.7. Provision of finish paint system: Section 09 91 00, Painting.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. SSPC: The Society for Protective Coatings (formerly known as Steel Structures Painting Council); www.sspc.org.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM A53/A53M-22
 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 1.3.2.2. ASTM A307-21
 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 1.3.2.3. ASTM A653/A653M-23
 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.2.4. CSA G40.20-13(23)
 - General requirements for rolled or welded structural quality steel
 - 1.3.2.5. CSA G40.21-13(23)
 - Structural quality steel
 - 1.3.2.6. CSA W48:23
 - Filler metals and allied materials for metal arc welding
 - 1.3.2.7. CSA W59-18(23)
 - Welded steel construction
 - 1.3.2.8. SSPC-SP 6/NACE No. 3-06
 - Commercial Blast Cleaning

- 1.3.2.9. SSPC-SP 7/NACE No. 4 - Brush-Off Blast Cleaning
- 1.3.2.10. SSPC-SP 10/NACE No. 2 - Near-White Metal Blast Cleaning

1.4. SUBMITTALS

- 1.4.1. Shop Drawings:
 - 1.4.1.1. Submit Shop Drawings of the work of this Section in accordance with Section 01 30 00. In addition to minimum requirements indicate following:
 - 1.4.1.1.1. large scale details of members, materials and connections, attachments, reinforcing, anchorage and location of exposed fastenings.
 - 1.4.1.1.2. jointing details.
 - 1.4.1.1.3. methods of setting, sealing, securing, anchorage.
 - 1.4.1.1.4. field connections.
 - 1.4.1.2. Ensure a licensed engineer specified herein is responsible for:
 - 1.4.1.2.1. production and review of Shop Drawings.
 - 1.4.1.2.2. sealing and signing each Shop Drawing and any associated calculations performed.
 - 1.4.1.3. Submit Shop Drawings for following work bearing the stamp of a licensed engineer registered in the Province of Ontario:
 - 1.4.1.3.1. steel stairs.
 - 1.4.1.3.2. handrails and balustrades.
- 1.4.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.4.2.1. Steel Sheet: minimum 300 mm (12") square and of specified thickness.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
 - 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
 - 1.5.1.2. Welding: Provide welding in accordance with CSA W59 performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau.
 - 1.5.1.3. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
- 1.5.2. Structural Design and Inspection:
 - 1.5.2.1. Design following without limitations:
 - 1.5.2.1.1. stairs including landings and supports.
 - 1.5.2.1.2. balustrades, handrails and railings.
- 1.5.3. Certifications: Submit certification from a licensed engineer carrying a minimum \$2,000,000.00 professional liability insurance and is registered in Province of Ontario, who shall affix his/her seal and signature to certificate, stating steel stairs and balustrades is capable of supporting its own weight and specified live loads.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Delivery and Acceptance Requirements: Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, undercover storage locations. Do not load areas beyond the designed limits.
- 1.6.2. Storage and Handling Requirements:
 - 1.6.2.1. Handle and store metal materials at job site in such a manner to prevent damage to other materials, to existing buildings or property.
 - 1.6.2.2. Handle components with care and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of steel members.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Performance/Design Criteria:
 - 2.1.1.1. Railing Structural Performance: Provide railings capable of withstanding effects of gravity loads and following loads and stresses within limits and under conditions indicated:
 - 2.1.1.1.1. Uniform load of 730 N/m (50 lbf/ft) applied in any direction.
 - 2.1.1.1.2. Concentrated load of 890 N (200 lbf) applied in any direction.
 - 2.1.1.2. Structural Design: Employ a licensed engineer specified herein to:
 - 2.1.1.2.1. design components for work of this Section requiring structural performance.
 - 2.1.1.2.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.1.2. Structural Shapes, Plates, Etc.: New material conforming to CSA G40.20 and CSA G40.21, Grade 350W.
- 2.1.3. Hollow Structural Sections: New material conforming to CSA G40.20 and CSA G40.21, Grade 350W, Class H.
- 2.1.4. Welding Materials: Conforming to CSA W48 and CSA W59.
- 2.1.5. Common or Ordinary Bolts and Anchor Bolts: Unfinished bolts conforming with ASTM A307, Grade A, with hexagon heads and nuts where exposed in the finish work. Supply common bolts of lengths required to suit thickness of material being joined, but not projecting more than 6 mm (1/4") beyond nut, without the use of washers. Supply anchor bolts of lengths noted but projecting not less than 13 mm (1/2") beyond nut unless otherwise noted.
- 2.1.6. Primer Paint: Supply "SPEEDHIDE® | 6-208 SERIES" by PPG Architectural Coatings; www.ppg.com.
- 2.1.7. Steel Pipe Handrails: Conforming to ASTM A53/A53M, Type "S", Schedule 40, Grade A steel pipe of sizes shown.
- 2.1.8. Galvanized Sheet Steel: Supply 0.91 mm (20 ga) core thickness commercial quality to ASTM A653/A653M, Grade A, with Z275 zinc coating designation to ASTM A653/A653M.
- 2.1.9. Fabrication:
 - 2.1.9.1. Fabricate each item of work of this Section in accordance with following general requirements:
 - 2.1.9.1.1. members square and straight.
 - 2.1.9.1.2. members plumb and true.

- 2.1.9.1.3. joints accurately and tightly fitted.
- 2.1.9.1.4. intersecting members in true, flush planes.
- 2.1.9.1.5. fasteners concealed.
- 2.1.9.1.6. steel connections.
- 2.1.9.2. Fabricate, fit and assemble work in shop where possible. Where shop fabrication is not possible, make trial assembly in shop.
- 2.1.9.3. Provide hot rolled structural steel channel stringers, other framing members, steel shapes; channels, angles and plates. Provide treads, risers, soffits, metal pans and landings as detailed. Ensure treads, landings, metal pans and risers are 3 mm (1/8") thick minimum, unless otherwise indicated. Provide stair handrails and pickets spaced as shown. Provide wall railings to match balustrade railings complete with brackets.
- 2.1.9.4. Provide hangers, rods, bars, bolts, anchors, brackets, rivets, bearing plates and bracing, fitting, drilling, stopping, soldering, as required for a complete assembly.
- 2.1.9.5. Insulate dissimilar metals to prevent galvanic corrosion.
- 2.1.9.6. Weld connections unless otherwise indicated.
- 2.1.9.7. Provide exposed welds continuous.
- 2.1.9.8. File and grind exposed welds smooth and flush.
- 2.1.9.9. Provide exposed metal fastenings and accessories of the same material, texture, colour and finish as the base metal to which they are applied or fastened.
- 2.1.10. Finishes:
- 2.1.10.1. Provide work of this Section free from:
 - 2.1.10.1.1. wrinkles, waves, cracks or other defects which would reduce the strength or mar the appearance of finished work.
 - 2.1.10.1.2. distortion, weld splatter, weld burn and defects detrimental to appearance.
 - 2.1.10.1.3. File and grind marks and other imperfections to a smooth surface.
- 2.1.10.2. Touch-up surfaces damaged due to cutting, welding, threading and installation.
- 2.1.10.3. Do not provide trademarks or labels on exposed finished surfaces.
- 2.1.10.4. Interior Finish: Prime paint finish unless indicated otherwise.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Where fastenings, anchors, or angles/plates for welding have to be built in by other trades, supply necessary templates, instructions and supervise to ensure satisfactory installation. Provide weld plates and anchorages for building in by other Sections as indicated and required.
- 3.2.2. Erect treads, metal pans, grating treads, stringers, hanger assemblies, landings, closures, balustrades and handrails of this Section plumb, square, true and level.

- 3.2.3. Weld connections between handrails and balusters and in lengths of handrails continuously. Weld balustrades to steel stairs. Secure wall handrails to walls.
- 3.2.4. Ensure ends of tube railings have closure plates continuously welded to railing.
- 3.2.5. Securely anchor work of this Section and rivet, weld or bolt to structural framing of the building. Where secured to concrete, provide bolts for setting in concrete. Provide expansion bolt supports to masonry.
- 3.2.6. Provide 1 coat of bituminous paint to metal surfaces in contact with concrete, masonry or dissimilar metals.
- 3.2.7. Grind off surplus welding material smooth and flush. Ensure internal and external corners have sharp lines. Remove grind marks.
- 3.2.8. Provide necessary fitting, setting and cutting required in connection with fitting of work of this Section to other parts of the Work.
- 3.2.9. Provide WWF 51 x 51 x MW9.1 x MW9.1 welded wire mesh reinforcement in tread pans, which are designated to receive concrete fill.
- 3.2.10. Prior to filling tread pans with concrete install and secure-in-place, non-slip inserts.
- 3.2.11. After filling tread pans with concrete, install aluminum oxide aggregate into inserts.
- 3.2.12. Erect stair work to line, plumb, square, true and level, with runs of stairs registering level with floor levels.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Tests and Inspections:
 - 3.3.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
 - 3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. On completion of installation, carefully clean metal work. Touch up damaged portions of primed finish coat where necessary.

3.5. ATTACHMENTS

- 3.5.1. Schedules:
 - 3.5.1.1. METAL PAN STAIRS AND BALUSTRADE (INTERIOR)
 - 3.5.1.1.1. Stringers: minimum 250 x 12.5 MC prime painted steel channel sections.
 - 3.5.1.1.1.1. Stringer end cover plate: minimum 6 mm (1/4") continuous prime painted steel, welded.
 - 3.5.1.1.1.2. Finish: Primer.
 - 3.5.1.1.2. Tread and riser carrier bars (horizontal and vertical): minimum 30 mm x 30 mm x 6 mm (1-1/4" x 1-1/4" x 1/4") prime painted steel angles, welded to the steel stringers.
 - 3.5.1.1.2.1. Finish: Primer.
 - 3.5.1.1.3. Treads and Landings: minimum 2.657 mm (12 ga) sheet steel, welded.
 - 3.5.1.1.3.1. Finish: Primer.
 - 3.5.1.1.3.2. Pan depth: 38 mm (1-1/2").
 - 3.5.1.1.3.3. Projection: 25 mm (1").

- 3.5.1.1.3.4. Reinforce tread and landing nosings with 2 - 3.416 mm (10 ga) gusset plates.
- 3.5.1.1.3.5. Provide concrete to fill metal pans.
- 3.5.1.1.4. Risers: closed, minimum 2.657 mm (12 ga) sheet steel, welded.
- 3.5.1.1.4.1. Finish: Primer.
- 3.5.1.1.5. Balustrade:
 - 3.5.1.1.5.1. Balustrade Posts: minimum 75 mm (3") diameter.
 - 3.5.1.1.5.2. Balustrade Pickets: minimum 12 mm (1/2") diameter.
 - 3.5.1.1.5.3. Balustrade and Wall Bracket Finish: prime finish.
 - 3.5.1.1.5.4. Balustrade and Wall Handrail Covering: vinyl, by Rehau Inc. Profile and colour selected later by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide glazed decorative metal railings including but not limited to following:
 - 1.2.1.1. interior tempered laminated safety structural glass balustrades with custom stainless steel handrails and guardrail cap.
 - 1.2.1.2. stainless steel shoe caps.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of structural steel support structure: Section 05 12 00, Structural Steel.
 - 1.2.2.2. Provision of glazing types: Section 08 06 80, Glazing Schedule.
 - 1.2.2.3. Provision of gypsum board and associated framing: Section 09 21 16, Gypsum Board Assemblies.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. GANA: Glass Association of North America; www.glass.org.
 - 1.3.1.2. NAAMM: National Association of Architectural Metal Manufacturers; www.naamm.org.
 - 1.3.1.3. OBC: Ontario Building Code.
 - 1.3.1.4. PVB: Polyvinyl Butyral.
- 1.3.2. Reference Standards:
 - 1.3.2.1. AAMA CW-12-84 - Structural Properties of Glass
 - 1.3.2.2. ASTM B36/B36M-18 - Standard Specification for Brass Plate, Sheet, Strip and Rolled Bar
 - 1.3.2.3. ASTM B455/B455M-20 - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes
 - 1.3.2.4. ASTM C1048-19 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
 - 1.3.2.5. ASTM C1107/C1107M-20 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - 1.3.2.6. ASTM C1172-19 - Standard Specification for Laminated Architectural Flat Glass
 - 1.3.2.7. ASTM E488/E488M-22 - Standard Test Methods for Strength of Anchors in Concrete Elements
 - 1.3.2.8. ASTM E894-23 - Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings
 - 1.3.2.9. ASTM E935-21 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings

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| 1.3.2.10. | ASTM E2353-21 | - Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades |
| 1.3.2.11. | ASTM E2358-17 | - Standard Specification for the Performance of Glass in Permanent Glass Railing Systems, Guards, and Balustrades |
| 1.3.2.12. | BS EN 14179-1:2016 | - Glass in building heat soaked thermally toughened soda lime silicate safety glass. Definition and description |
| 1.3.2.13. | CAN/CGSB-12.1-17 | - Safety glazing |
| 1.3.2.14. | CSA G40.20-13(23) | - General requirements for rolled or welded structural quality steel |
| 1.3.2.15. | CSA G40.21-13(23) | - Structural quality steel |
| 1.3.2.16. | CSA W48:23 | - Filler metals and allied materials for metal arc welding |
| 1.3.2.17. | CSA W59-18(23) | - Welded steel construction |
| 1.3.2.18. | CSA W117.2:19(23) | - Safety in welding, cutting, and allied processes |
| 1.3.2.19. | GANA 01-0300 | - Glass Information Bulletin – Proper Procedures for Cleaning Architectural Glass Products |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
- 1.4.2. Scheduling:
- 1.4.2.1. Coordinate installation of anchorages for railings. Supply setting drawings, templates and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors, to be embedded in concrete or masonry. Deliver such items to site in time for installation.
- 1.4.2.2. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit Product data for handrails and railings, structural glass system, grout, anchoring cement and paint Products indicated.
- 1.5.2. Shop Drawings:
- 1.5.2.1. Submit Shop Drawings in accordance with Section 01 30 00. Submit large scale details of members, materials and connections, attachments, reinforcing and anchorage.
- 1.5.2.2. Submit jointing details showing methods of setting, sealing, securing, anchorage and field connections. Submit necessary templates and instructions where fastenings or anchors have to be built in by other trades.

- 1.5.2.3. Ensure a licensed engineer specified herein is responsible for:
 - 1.5.2.3.1. production and review of Shop Drawings.
 - 1.5.2.3.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.5.2.4. Calculations: Submit calculations proving structural glass systems performance and compliance with specified loads, signed and sealed by a licensed engineer registered to practice in the Province of Ontario.
- 1.5.3. Samples:
 - 1.5.3.1. Submit samples in accordance with Section 01 30 00. Submit samples of materials, fittings and finishes required for the Project. Prepare samples on metal of same alloy and gauge to be used for work.
 - 1.5.3.2. Provide 300 mm x 300 mm (12" x 12") samples of glass and 300 mm (12") long samples of trim, closures, handrails, sealants and gaskets.
 - 1.5.3.3. Submit sample of spring plate and attachments complete with glass, bolt and accessories.
- 1.5.4. Quality Assurance Submittals:
 - 1.5.4.1. Provide test reports indicating products meet or exceed specified requirements.
 - 1.5.4.2. Compatibility Test Report: From sealant manufacturer, indicating sealant compatibility with interlayer and is approved for full contact with sealant.
 - 1.5.4.3. Edge Stability Number (ESN) Test Report: Edge stability over a minimum period of 5 years in silicone butt-joined laminated glass with interlayer for sealant intrusion and delamination effects. ESN values more than 0 are not permitted.
- 1.5.5. Test Reports: Submit test reports from an independent laboratory certifying fully suspended structural glass balustrade system proposed for use has been tested. System tested must be similar in type of materials and design shown on Consultant's drawings, utilizing counter sunk bolted attachments through glass. In addition, tested specimen must be equivalent in glass type and panel configuration shown on Drawings. If existing test reports are submitted, then those tests have been carried out to loads at least equal to or greater than those called for in this specification. If test reports are not available, test system. Costs for testing will be borne by glass system manufacturer.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
 - 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
 - 1.6.1.2. Laminator: Laminators trained by interlayer manufacturer in best practices and listed in good standing with manufacturer's current list of authorized laminators.
 - 1.6.1.3. Welding: Provide welding in accordance with CSA W59 performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau.
 - 1.6.1.4. Licensed Professionals: Employ a full time licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
- 1.6.2. Mock-Ups:
 - 1.6.2.1. Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1.6.2.2. Build on-site mock-ups for each form and finish of railing consisting of 2 full panels, top cap, handrail and anchorage system components that are full height and are not less than 1500 mm (60") in length.

- 1.6.2.3. After review with no objections recorded, mock-ups serve as a standard for material, workmanship and finishes and may become part of final installation.
- 1.6.3. Certifications: Welders employed on this Project may be asked by Consultant at any time for their welding certificate.
- 1.6.4. Preconstruction Testing Service:
 - 1.6.4.1. Engage a qualified independent testing agency to test for compliance with specified requirements for performance and test methods. Conduct tests using specimens and assemblies representative of proposed materials and construction.
 - 1.6.4.2. Fabricate and install test assemblies using personnel who will perform same tasks for Project.
 - 1.6.4.3. Select sizes and configurations of assemblies to adequately demonstrate capability and to comply with performance requirements.
 - 1.6.4.4. Notify Consultant 7 Days in advance of dates and times when assemblies will be constructed.
 - 1.6.4.5. When testing is complete, remove assemblies; do not reuse materials on Project.
- 1.6.5. Test glazed decorative metal railings in accordance with ASTM E2353.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements: Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, undercover storage locations. Do not load areas beyond designed limits.
- 1.7.2. Storage and Handling Requirements:
 - 1.7.2.1. Handle and store metal materials at site in a manner to prevent damage to other materials, to existing buildings or property where applicable.
 - 1.7.2.2. Handle components with care and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of steel members.
 - 1.7.2.3. Store laminated glass according to fabricator's written instructions.
 - 1.7.2.4. Protect laminated glass from condensation, temperature changes and exposure to direct sun.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; delamination, bond failure and extensive colour fading of glass laminate.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Performance/Design Criteria:
 - 2.1.1.1. Ensure design of railings, support steel, as well as welding and fixings complies with OBC, Fire Regulations, Health and Safety Regulations and any other regulations applying to these types of installations.
 - 2.1.1.2. Design railings to withstand vertical and horizontal live load requirements in OBC, transferred through supports and anchorages to building structure.
 - 2.1.1.3. Ensure gap between outer edge of balcony and portion of guard protecting balcony is 38 mm (1-1/2") maximum.

- 2.1.1.4. Design railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on following:
 - 2.1.1.4.1. Glass: 25% of mean modulus of rupture (50% probability of breakage), as listed in "Mechanical Properties" in AAMA CW-12.
- 2.1.1.5. Structural Performance: In accordance with ASTM E2358, System Type V: One-side Support with Protective Top Rail-Glazing as Structural Member, Performance Level: Level 1 (Type L1), provide railings capable of withstanding effects of gravity loads and following loads and stresses within limits and under conditions indicated:
 - 2.1.1.5.1. Handrails:
 - 2.1.1.5.1.1. Uniform load of 730 N/m (50 lbf/ft) applied in any direction.
 - 2.1.1.5.1.2. Concentrated load of 890 N (200 lbf) applied in any direction.
 - 2.1.1.5.2. Top Rails of Guards:
 - 2.1.1.5.2.1. Uniform load of 730 N/m (50 lbf/ft) applied in any direction.
 - 2.1.1.5.2.2. Concentrated load of 890 N (200 lbf) applied in any direction.
 - 2.1.1.5.2.3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2.1.1.5.3. Infill of Guards:
 - 2.1.1.5.3.1. Concentrated load of 1623 N (365 lbf) applied horizontally on an area of 929 cm² (1 sq ft).
 - 2.1.1.5.3.2. Uniform load of 2.87 kPa (60 lbf/sq ft) applied horizontally.
 - 2.1.1.5.3.3. Infill load and other loads need not be assumed to act concurrently.
 - 2.1.1.5.4. Glass-Supported Railings: Support each section of top rail by a minimum of 3 glass panels or by other means so top rail will remain in place if any 1 panel fails.
- 2.1.1.6. Structural Design: Employ a licensed engineer specified herein to:
 - 2.1.1.6.1. design components for work of this Section requiring structural performance.
 - 2.1.1.6.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.1.2. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolourations or blemishes.
- 2.1.3. Brackets, Flanges, Railings, Shoe Caps and Anchors: Same metal and finish as supported rails, unless otherwise indicated. Thicknesses as indicated on Drawings.
- 2.1.4. Bronze Railings: Stainless steel of size and profile as shown on Drawings.
- 2.1.5. Shoe: Bronze shoe meeting performance criteria listed herein of profile shown on Drawings.
- 2.1.6. Copper-Alloy, Bronze:
 - 2.1.6.1. Extruded Shapes: ASTM B455/B455M, alloy UNS No. C38500 (extruded architectural bronze).
 - 2.1.6.2. Plate, Sheet, Strip and Flat Bars: ASTM B36/B36M, alloy UNS No. C28000 (muntz metal, 60% copper).
- 2.1.7. Steel and Iron:
 - 2.1.7.1. Structural Shapes, Plates, Etc.: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.
 - 2.1.7.2. Hollow Structural Sections (HSS): New material conforming to CSA G40.20 and CSA G40.21, Grade 350W, Class H.

- 2.1.8. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type for Consultant's review.
- 2.1.9. Glass:
 - 2.1.9.1. Free from bubbles, waves, discolouration and other defects. Ensure glass (particularly heat-strengthened, tempered and laminated) bears manufacturer's labels on bottom inner right hand corner indicating quality.
 - 2.1.9.2. Ensure glass meets following roller wave distortion criteria:
 - 2.1.9.2.1. maximum peak to valley measurement of 0.127 mm (0.005") for every 300 mm (12") in any direction.
 - 2.1.9.2.2. roller distortion and/or ripples runs in same direction for entire Project.
 - 2.1.9.2.3. unless precluded by manufacturing process, orient roller-wave in the horizontal direction. Ensure glass is heat-treated through the horizontal tempering process.
 - 2.1.9.2.4. Limit deviation from flatness over any 300 mm (12") span (vertical displacement from peak to valley) within 267 mm (10-1/2") of leading and trailing edges to 0.2 mm (0.006").
 - 2.1.9.3. Heat-Strengthened Glass (HSGL): Clear transparent heat-strengthened glass conforming to ASTM C1048, Kind HS. Perform heat-strengthening using horizontal tong free method and ensure surface compression is between 27.6 MPa (4000 psi) and 48.3 MPa (7000 psi).
 - 2.1.9.4. Tempered Glass (TGL):
 - 2.1.9.4.1. Clear transparent tempered glass conforming to ASTM C1048, Kind FT and meeting requirements of CAN/CGSB-12.1. Ensure surface compression is equal to or greater than 68.9 MPa (10 000 psi). Ensure tempered glass is heat-soaked in accordance with BS EN 14179-1.
 - 2.1.9.4.2. Ensure heat soaking records are kept in accordance with Section 01 70 00 and glass remains traceable.
 - 2.1.9.4.3. Retest heat soak batches with breakage greater than 1 in 100 units. Batches with additional breakages will be rejected and not used on this Project.
 - 2.1.9.4.4. "Statistical Heat Soak", "Partial Batch" and "On-Line" heat soaking are not permitted.
 - 2.1.9.4.5. Tempered glass at a height greater than 3 m (10') above a trafficable walkway and has 1 or more unframed edges or is point-fixed will treated as inclined glazing with requirements for secondary retention in case of breakage.
 - 2.1.9.4.6. Ensure glass does not have tong marks.
 - 2.1.9.4.7. Written warranties against nickel sulfide inclusions in lieu of heat soaking will not be permitted.
 - 2.1.9.4.8. Ensure edges are ground flat and polished unless otherwise noted.
 - 2.1.9.4.9. Ensure edgework, holes and notches in tempered glass panels are completed before tempering and comply with following requirements:
 - 2.1.9.4.9.1. Dimensional tolerance on panel size will be +/-0.8 mm (+/-1/32") of theoretical dimension required.
 - 2.1.9.4.9.2. Squareness of each panel will be within 1.6 mm (1/16").
 - 2.1.9.4.9.3. Bow allowance is 0.1%.
 - 2.1.9.4.9.4. Positional tolerances on all holes will be +/-0.8 mm (+/-1/32") from a single datum point.
 - 2.1.9.4.10. Prestress glass around holes to a level which is compatible with design and use of fittings. Check by differential surface refractometer on stress level.

- 2.1.9.5. Laminated Glass (LGL): Conforming to ASTM C1172, Kind LT and meeting requirements of CAN/CGSB-12.1, monolithic laminated structural glass assembly consisting of 2 sheets of clear transparent heat-strengthened glass (HSGL) laminated with clear structural PVB interlayer conforming to requirements specified herein. Ensure mismatch of glass lites after laminating process is +3.2 mm (1/8"), -1.6 mm (1/16") maximum for exposed edges after installation. Provide edge seal protection at exposed edges of glass.
- 2.1.9.6. Glass Units (GL): For single glass unit types, refer to Section 08 06 80.
- 2.1.9.7. Glazing Cement and Accessories for Structural Glazing: Provide glazing cement, setting blocks, shims and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
- 2.1.9.8. Glazing Gaskets for Stainless Steel Supports: Provide glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing stainless steel rail supports on glass.
- 2.1.10. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- 2.1.11. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work, unless otherwise indicated.
- 2.1.12. Anchors: Provide cast-in-place or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete, as determined by testing per ASTM E488/E488M conducted by a qualified independent testing agency.
- 2.1.13. Welding Materials: Conforming to CSA W48 and CSA W59.
- 2.1.14. Non-Shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior applications.
- 2.1.15. Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at site to create pourable anchoring, patching and grouting compound.
- 2.1.16. Fabrication:
 - 2.1.16.1. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish and anchorage, but not less than required to support structural loads.
 - 2.1.16.2. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
 - 2.1.16.3. Cut, drill and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 0.8 mm (1/32"), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 - 2.1.16.4. Form work true to line and level with accurate angles and surfaces.
 - 2.1.16.5. Cut, reinforce, drill and tap as indicated to receive finish hardware, screws and similar items.
 - 2.1.16.6. Welded Connections:
 - 2.1.16.6.1. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 2.1.16.6.2. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

- 2.1.16.6.3. Obtain fusion without undercut or overlap.
- 2.1.16.6.4. Remove flux immediately.
- 2.1.16.6.5. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- 2.1.16.7. Mechanical Connections:
 - 2.1.16.7.1. Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 2.1.16.7.2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- 2.1.16.8. Form changes in direction as follows:
 - 2.1.16.8.1. As detailed on Drawings.
 - 2.1.16.8.2. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
 - 2.1.16.8.3. Close exposed ends of hollow railing members with prefabricated end fittings.
- 2.1.16.9. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 6 mm (1/4") or less.
- 2.1.16.10. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, flanges, miscellaneous fittings and anchors to interconnect railing members to other work, unless otherwise indicated.
- 2.1.16.11. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- 2.1.16.12. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- 2.1.17. Finishes:
 - 2.1.17.1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2.1.17.2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
 - 2.1.17.3. Isolate dissimilar metals using dielectric separator to prevent galvanic corrosion.
 - 2.1.17.4. Appearance of Finished Work: Noticeable variations in abutting, adjacent or same piece are not permitted.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Coordinate custom design and fabrication of multi-dimensional preformed silicone seals with construction of joints and adjacent elements constructed by others. Field verify dimensions and configurations prior to fabricating silicone seals. Verify requirements for joint movement.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Fit exposed connections together to form tight, hairline joints.
- 3.2.2. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment and elevation; measured from established lines and levels and free of rack.
- 3.2.3. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
- 3.2.4. Set posts plumb within a tolerance of 1.6 mm in 3 m (1/16" in 10').
- 3.2.5. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 3 mm in 3.66 m (1/8" in 12').
- 3.2.6. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- 3.2.7. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
- 3.2.8. Railing Connections:
 - 3.2.8.1. Non-Welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler coloured to match finish of railings.
 - 3.2.8.2. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" whether welding is performed in the shop or in the field.
- 3.2.9. Anchoring Posts:
 - 3.2.9.1. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, non-metallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
 - 3.2.9.2. Form or core-drill holes not less than 125 mm (5") deep and 19 mm (3/4") larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts and fill annular space between post and concrete with non-shrink, non-metallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
 - 3.2.9.3. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
 - 3.2.9.4. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 3.2.9.4.1. For stainless steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
 - 3.2.9.4.2. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- 3.2.10. Glass Panels:
 - 3.2.10.1. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
 - 3.2.10.2. Attach base channel to building structure, then insert and connect factory-fabricated and factory-assembled glass panels if glass was bonded to base and top rail channels in factory.
 - 3.2.10.3. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
 - 3.2.10.4. Adjust spacing of glass panels so gaps between panels are equal before securing in position.

- 3.2.10.5. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Tests and Inspections:

- 3.3.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.

- 3.3.1.2. Extent and Testing Methodology: Consultant in conjunction with testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Railings will be tested according to ASTM E2353, ASTM E2358, ASTM E894 and ASTM E935 for compliance with performance requirements.

- 3.3.1.3. Remove and replace railings where test results indicate they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Consultant and will comply with specified requirements.

- 3.3.1.4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

- 3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water and wiping dry.

- 3.4.2. Clean and polish glass in accordance with GANA 01-0300 including removal of markings indicating presence of glass.

3.5. PROTECTION

- 3.5.1. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Performance.

- 3.5.2. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide rough carpentry including but not limited to following:
 - 1.2.1.1. miscellaneous interior carpentry.
 - 1.2.1.2. temporary wood treads on steel stairs and landings.
 - 1.2.1.3. equipment mounting panels.
 - 1.2.1.4. roofing carpentry.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of concrete formwork: Section 03 10 00, Concrete Forming.
 - 1.2.2.2. Removal of temporary treads and landings: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.3. Provision of steel pan stairs and landings to receive temporary wood infills: Section 05 51 00, Metal Stairs and Balustrades.
 - 1.2.2.4. Provision of architectural woodwork: Section 06 40 00, Architectural Woodwork.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CCA: Chromated Copper Arsenate.
 - 1.3.1.2. COFI: Council of Forest Industries; www.cofi.org.
 - 1.3.1.3. NLGA: National Lumber Grades Authority; www.nlga.org
 - 1.3.1.4. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
 - 1.3.1.5. UL: Underwriters Laboratories Inc.; www.ul.com.
- 1.3.2. Definitions:
 - 1.3.2.1. Exposed Framing: Framing not concealed by other construction.
 - 1.3.2.2. Dimension Lumber: Lumber of 50 mm (2") nominal or greater but less than 5" nominal in least dimension.
 - 1.3.2.3. Timber: Lumber of 125 mm (5") nominal or greater in least dimension.
- 1.3.3. Reference Standards:
 - 1.3.3.1. CAN/CSA-O80 Series-15(20) - Wood Preservation
 - 1.3.3.2. CSA O121-17 - Douglas Fir Plywood
 - 1.3.3.3. CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4. QUALITY ASSURANCE

- 1.4.1. Certifications:
 - 1.4.1.1. Grading:
 - 1.4.1.1.1. Provide lumber bearing the grading stamps of an agency certified by the Canadian Lumber Standards Administration Board for identification.
 - 1.4.1.1.2. Provide roof sheathing bearing the COFI grading stamp for identification.
 - 1.4.1.1.3. Provide "treated" and "fire treated" wood and plywood bearing the stamp of the Canadian Wood Preservers Bureau.

1.5. DELIVERY, STORAGE AND HANDLING

- 1.5.1. Storage and Handling Requirements:
 - 1.5.1.1. Store lumber in a dry place and protect from dampness and damage.
 - 1.5.1.2. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Softwood Lumber: Of grades conforming to NLGA's "Standard Grading Rules for Canadian Lumber", graded as follows:
 - 2.1.1.1. Light Framing: Species Group D, Standard Grade.
 - 2.1.1.2. Studding: Species Group D, Stud Grade.
 - 2.1.1.3. Structural Light Framing: Species Group D, No. 1 Grade.
 - 2.1.1.4. Appearance Lumber: Species Group B, Appearance Grade.
- 2.1.2. Hardwood Lumber: Of grades conforming to grading rules of U.S. National Hardwood Lumber Association, solid Yellow Birch, select or better.
- 2.1.3. Concealed Framing Lumber: No. 2 White Pine, No. 2 Red Pine, or No. 1 Construction Eastern Spruce, Balsam Fir or Jack Pine, kiln dried, free from sap, shakes, splits, knots and other defects.
- 2.1.4. Grounds, Nailing Strips and Blocking: No. 2 White Pine, No. 2 Red Pine, or No. 1 Construction Eastern Spruce, kiln dried, free from sap, shakes, splits, knots and other defects.
- 2.1.5. Exterior Plywood: 19 mm (3/4") thick, waterproof, grade stamped exterior grade Douglas Fir plywood, select grade, unsanded conforming to CSA O121.
- 2.1.6. Glue: Waterproof.
- 2.1.7. Field Applied Wood Preservative: For field cut ends, supply "Wolman™ Woodlife® Coppercoat™" by Rust-Oleum; www.rustoleum.com or same CCA preservative as used for shop impregnation.
- 2.1.8. Rough Hardware: Supply rough hardware to frame and fix rough carpentry. This includes bolts, anchors, nails, expansion shields and other fastenings required. Hot dip galvanize hardware for exterior work; elsewhere, provide cadmium plated hardware. Provide spiral thread nails except as indicated otherwise.
- 2.1.9. "Treated" Wood and Plywood (Decay and Termite Resistant):
 - 2.1.9.1. Provide vacuum/pressure impregnated lumber treated in accordance with CAN/CSA-O80 Series.
 - 2.1.9.2. Retention/Penetration Standards: Conforming to CAN/CSA-O80 Series.
 - 2.1.9.3. Provide treated wood kiln dried to maximum 12% moisture content.
 - 2.1.9.4. Cut end liquid wood preservative as recommended by manufacturer of treated wood.

- 2.1.9.5. Permitted Products: "K-33® CCA" by Timber Specialties Co.; www.timberspecialties.com or "Wolman® AG" by Lonza; www.wolmanizedwood.com.
- 2.1.10. "Fire Treated" Wood and Plywood:
 - 2.1.10.1. Flame Spread: Max 25 in 30 minutes in accordance with CAN/ULC-S102.
 - 2.1.10.2. Provide fire treated wood kiln dried to max 19% moisture content.
 - 2.1.10.3. Do not resurface or rip fire treated wood if it affects the ULC Label.
 - 2.1.10.4. Provide fire treated material bearing stamp of Canadian Wood Preservers Bureau and ULC stamp.
 - 2.1.10.5. Permitted Product: "Dricon® FRT" by Lonza; www.wolmanizedwood.com.
- 2.1.11. Interior Fire Retardant Treated Lumber and Plywood: Pressure treated lumber and plywood with fire retardant chemicals to meet an UL FR-5 rating with a surface-burning characteristics rating of 25 or less for flamespread, fuel contributed and smoke developed. Ensure each piece of fire retardant treated lumber and plywood bears a ULC label or imprint attesting to this rating.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Properly frame together parts of the Work with members accurately cut to size, closely fitted, well spiked and erected in a substantial manner, plumb, level, square and true to dimension.
- 3.2.2. Locate joints over bearing or supporting surfaces.
- 3.2.3. Provide running members full length wherever possible.
- 3.2.4. Design for expansion and contraction of the materials.
- 3.2.5. After cutting, drilling and fitting "treated" wood and plywood but before installation, apply 1 full coat of wood preservative to exposed surfaces, including ends of blocking, furring, nailers and rough carpentry.
- 3.2.6. Provide fasteners and rough hardware for a rigid and secure installation.
- 3.2.7. Miscellaneous Interior Carpentry: Provide "fire treated" plywood, blocking, furring, nailers, rough carpentry, grounds and nailing strips as indicated and/or as required for proper installation.
- 3.2.8. Equipment Mounting Panels:
 - 3.2.8.1. Provide 19 mm (3/4") thick exposed plywood backboard panels. Refer to Electrical Drawings for sizes and locations and securely mount panels to wall surfaces.
 - 3.2.8.2. Provide "fire treated" plywood.
- 3.2.9. Roof Carpentry:
 - 3.2.9.1. Install continuous wood nailers around roof perimeters, curbs and roof openings at edges of insulation. Use cadmium plated self tapping screws for securing wood to metal deck and cadmium plated lag screws for securing wood to concrete as shown. Install cut cant strips and continuous nailers on copings and curbs as detailed.

- 3.2.9.2. Install continuous wood nailers along roof control joints, building and roof expansion joints as shown. Fasten nailers as specified.
- 3.2.10. Temporary Wood Treads: Install and secure 50 mm x 250 mm (2" x 10") full length, temporary spruce treads and landings on steel stairs shown to receive concrete fill.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. PROTECTION

- 3.4.1. Protect rough carpentry from weather.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide architectural woodwork including but not limited to following:
 - 1.2.1.1. wood casework.
 - 1.2.1.2. laminated casework.
 - 1.2.1.3. casework drawers and doors.
 - 1.2.1.4. edgebanding for casework and casework doors.
 - 1.2.1.5. countertops.
 - 1.2.1.6. casework hardware.
 - 1.2.1.7. interior frames.
 - 1.2.1.8. trim and mouldings.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Building in and anchoring of steel frames in masonry partitions: Section 04 20 00, Masonry Units.
 - 1.2.2.2. Provision of solid surface countertops: Section 06 61 16, Solid Surfacing Fabrications.
 - 1.2.2.3. Supply of hollow metal doors and frames: Section 08 11 13, Hollow Metal Doors and Frames.
 - 1.2.2.4. Supply of plastic laminate wood doors: Section 08 15 00, Plastic Laminate Wood Doors.
 - 1.2.2.5. Supply of door hardware: Section 08 71 00, Door Hardware.
 - 1.2.2.6. Glass and glazing: Section 08 80 00, Glass and Glazing.
 - 1.2.2.7. Building in and anchoring of steel frames in gypsum board partitions: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.8. Provision of pre-engineered sound absorption wall and ceiling panel system: Section 09 84 13, Fixed Sound-Absorptive Panels.
 - 1.2.2.9. Filling nail holes and provision of finish painting: Section 09 91 00, Painting.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AWMAC/WI: Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute; www.awmac.com.
 - 1.3.1.2. HUD: Department of Housing and Urban Development.
 - 1.3.1.3. MDF: Medium Density Fibreboard.
 - 1.3.1.4. NAAWS: North American Architectural Woodwork Standards – 4.0, 2021, as amended.
 - 1.3.1.5. NEMA: National Electrical Manufacturers Association; www.nema.org.

- 1.3.2. Reference Standards:
 - 1.3.2.1. 24 CFR Part 3280 - Manufactured Home Construction and Safety Standards
 - 1.3.2.2. ANSI/NPA A208.2-09 - Medium Density Fiberboard (MDF) For Interior Applications
 - 1.3.2.3. ANSI/NEMA LD 3-05 - High-Pressure Decorative Laminates
 - 1.3.2.4. ASTM E84-23 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.2.5. CSA O153-M80(08) - Poplar Plywood

1.4. SUBMITTALS

- 1.4.1. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00 and Section 01 of NAAWS. Clearly indicate material being supplied and show connections, attachments, reinforcing, anchorage and location of exposed fastenings.
- 1.4.2. Samples: Submit samples in accordance with Section 01 30 00 in following sizes:
 - 1.4.2.1. minimum 300 mm (12") long x 300 mm (12") wide x 25 mm (1") thick solid wood.
 - 1.4.2.2. minimum 300 mm (12") square and of specified thickness, veneer mounted on 19 mm (3/4") particle board and finished as specified.
 - 1.4.2.3. each type of hardware.
 - 1.4.2.4. each plastic laminate in manufacturer's standard chip size.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
 - 1.5.1.1. Provide work of this Section in accordance with NAAWS produced by AWMAC/WI, except as specified otherwise herein and by reference are hereby made a part of this Section. Ensure any reference to grades and terminology in this Section is as defined in NAAWS.
 - 1.5.1.2. Requirements of this Section govern and modify NAAWS.
 - 1.5.1.3. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and be a member of AWMAC/WI.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Delivery and Acceptance Requirements:
 - 1.6.1.1. Do not deliver finished Products during rainy or damp weather.
 - 1.6.1.2. Do not deliver work of this Section until building and storage areas are sufficiently dry so Products will not be damaged by excessive changes in moisture content.
 - 1.6.1.3. Deliver Products of this Section in accordance with Section 13, 13.5.1.2 of NAAWS.
 - 1.6.1.4. Do not deliver damaged Products.
- 1.6.2. Storage and Handling Requirements:
 - 1.6.2.1. Store and handle Products of this Section in accordance with Section 13, 13.5.1.3 and 13.5.1.4 of NAAWS.
 - 1.6.2.2. Cover finished plastic laminate surfaces and varnished surfaces with heavy kraft paper and put in cartons for protection. Protect installed plastic laminate surfaces by acceptable means. Do not remove protective covers until immediately prior to final cleaning.

1.7. WARRANTY

- 1.7.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to, delamination of plastic laminate, opening of seams, warpage and extensive colour fading.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Performance/Design Requirements: Ensure millwork (e.g. countertops, wall cabinets, etc.) are capable of supporting structural loads without deflection in accordance with "Casework Integrity Testing" in "Appendix" of NAAWS.
- 2.1.2. Framing Lumber: Select Merchantable Western White Spruce, kiln dried, or sound material of any species may be used for concealed members, free from sap, shakes, knots, splits and other defects.
- 2.1.3. Architectural Lumber: Clear, straight, kiln dried, Select Yellow Birch for fitments and door jambs. Provide kiln dried lumber to 7% moisture content, free from blemishes that would be apparent after finish is applied.
- 2.1.4. Plywood: Architectural Grade Selected Birch veneer for exposed faces and Sound Grade (SO) Birch veneer for unexposed faces.
- 2.1.5. Solid Birch: Of uniform grain and colour, Premium Grade.
- 2.1.6. High Pressure, Paper Base, Decorative Laminates (PLAM):
- 2.1.6.1. Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.6.1.1. Abet Laminati; www.na.abetlaminati.com
- 2.1.6.1.2. Arborite; www.arborite.com
- 2.1.6.1.3. Formica Inc.; www.formica.com
- 2.1.6.1.4. Industrial Laminates/Norplex, Inc.; www.micarta.com
- 2.1.6.1.5. Nevamar Company, LLC; www.nevamar.com
- 2.1.6.1.6. Pionite Decorative Laminates; www.pionite.com
- 2.1.6.1.7. Wilsonart Canada; www.wilsonart.com
- 2.1.6.2. Provide types and thicknesses conforming to ANSI/NEMA LD 3 and Section 04, "Table: 04-009 – HPL TYPES and MINIMUM PERFORMANCE REQUIREMENTS" of NAAWS.
- 2.1.6.3. Colours and Finishes: Refer to "Material and Finish Schedule" appended to Section 00 01 20.
- 2.1.7. Plastic Laminate Adhesive: Provide in accordance with Section 04, 04.5.5.2 and "Adhesive Usage Guide" in "Appendix" of NAAWS.
- 2.1.8. Wood Cores:
- 2.1.8.1. MDF Core: Medium density panels, meeting requirements of ANSI/NPA A208.2, balanced design, manufactured from 100% recycled materials, without use of formaldehyde resins, meeting HUD rule 24 CFR Part 3280 for emissions, of minimum density of 770 kg/m³ (48 lb/cu ft) and surface character to match sample in Consultant's possession. Ensure fire retardant Product contains fire-retardant chemicals injected with raw materials during manufacturing and achieve a maximum Flame Spread rating of 25 with a maximum Smoke Developed of 200 when tested to ASTM E84. Do not use MDF panels in moist areas. "Excel+ MDF" by Uniboard Canada Inc.; www.uniboard.com or CanFibre Group Ltd.

- 2.1.8.2. Plywood Core (Veneer): Poplar plywood conforming to CSA O153-M, Grades A and B.
- 2.1.9. Casework Hardware: Provide following hardware:
 - 2.1.9.1. Shallow Drawer Slides: "8357" by Knappe & Vogt Manufacturing Company; www.knappeandvogt.com or "3832EC" by Accuride; www accuride.com, full extension type with a capacity of 34 kg (75 lb).
 - 2.1.9.2. Deep Drawer Slides: "8500" by Knappe & Vogt Manufacturing Company or "4005" by Accuride, full extension type with a capacity of 68 kg (150 lb).
 - 2.1.9.3. Flipper Door Slides (Non-adjustable): "1432" by Accuride; www accuride.com or Knappe & Vogt Manufacturing Company; www.knappeandvogt.com.
 - 2.1.9.4. Shelf Pins: Nickel-plated metal, minimum 5 mm diameter pin, "Art. No. 282-04-711" by Hafele Canada; www.hafele.ca or "331 ANO" by Knappe & Vogt Manufacturing Company; www.knappeandvogt.com. Provide 4 pins per shelf.
 - 2.1.9.5. Recessed Shelf Pilasters, Standards and Clips: Provide "255 ZC, zinc finished" pilaster and "256 ZC, zinc finished" clip supports by Knappe & Vogt Manufacturing Company; www.knappeandvogt.com or "120-10 Series" pilasters and "1903-2G" clip supports by Richelieu Hardware Ltd.; www.richelieu.com.
 - 2.1.9.6. Concealed Hinges: European style "CLIP top" by Blum Canada Ltd.; www.blum.com, "NEXIS IMPRESSO 65" by Grass Canada Inc.; www.grass.at or "Salice 200 Series, 165" by Hafele Canada; www.hafele.ca minimum 170 degree opening angle and is self closing. Supply manufacturer's recommended number of hinges to suit door size and thickness.
 - 2.1.9.7. Piano Hinges: Nickel plated [flash brass] finish; "Product #3225180" by Richelieu Hardware Ltd.; www.richelieu.com. Provide piano hinges along full length of door.
 - 2.1.9.8. Pulls (Doors and Drawers): To be selected later by Consultant.
 - 2.1.9.9. Door Locks: Keyed cylinder cam lock type C4 (satin brass, clear coated on brass base) finish.
 - 2.1.9.10. Drawer Locks: "0738 Drawer Lock" by CCL Security Products; www.cclsecurity.com, C4 (satin brass, clear coated on brass base) finish.
- 2.1.10. Provide locks for 50% of doors and drawers to be installed where located later by Consultant prior to occupancy.
- 2.1.11. Finishing:
 - 2.1.11.1. Prime unexposed surfaces including backs of fitments against walls and underside of fitments.
 - 2.1.11.2. Before priming, treat knots and sap streaks, with a coat of shellac/sealer and then prime with a wood primer.
 - 2.1.11.3. Shop finish natural finished wood surfaces.

2.2. COMPONENTS

- 2.2.1. Supply casework conforming to Section 10 of NAAWS as applicable.
- 2.2.2. Casework for Clear Finish:
 - 2.2.2.1. AWMAC/WI Quality Grade: Custom.
 - 2.2.2.2. Construction: Ensure casework conforms to Section 10 of NAAWS.
 - 2.2.2.3. Exposed Parts Core: Composition board (MDF).
 - 2.2.2.4. Exposed Parts Finish: [Oak] Custom Grade in accordance with Section 10, 10.2 SURFACE DEFINITIONS of NAAWS.
 - 2.2.2.5. Semi-Exposed Parts Core: Composition board (MDF).

- 2.2.2.6. Semi-Exposed Parts Finish: [Oak] Custom Grade in accordance with Section 10, 10.2 SURFACE DEFINITIONS of NAAWS.
- 2.2.3. Casework for Plastic Laminate Finish:
 - 2.2.3.1. AWMAC/WI Quality Grade: Custom.
 - 2.2.3.2. Construction: Ensure casework conforms to Section 10 of AWS.
 - 2.2.3.3. Exposed Parts Core: Composition board (MDF).
 - 2.2.3.4. Exposed Parts Finish: Plastic laminate; HGS for horizontal surfaces and VGS for vertical surfaces in accordance with Section 10, 10.2 SURFACE DEFINITIONS of NAAWS.
 - 2.2.3.5. Semi-Exposed Parts Core: Composition board (MDF).
 - 2.2.3.6. Semi-Exposed Parts Finish: Plastic laminate; HGS for horizontal surfaces and VGS for vertical surfaces in accordance with Section 10, 10.2 SURFACE DEFINITIONS of NAAWS.
 - 2.2.3.7. Concealed Parts Finish: Backing sheet as required for balance.
- 2.2.4. Edgebanding: As per Section 10, 10.5.6 of NAAWS.
- 2.2.5. Interior Frames:
 - 2.2.5.1. AWMAC/WI Quality Grade: Custom.
 - 2.2.5.2. Ensure frames are [Oak].
 - 2.2.5.3. Construction: Ensure frames conform to Section 06 of NAAWS.
 - 2.2.5.4. Ensure corner construction complies to Section 06, 06.6.1 of NAAWS.
- 2.2.6. Standing and Running Trim:
 - 2.2.6.1. Interior for Transparent Finish:
 - 2.2.6.1.1. AWMAC/WI Quality Grade: Custom.
 - 2.2.6.1.2. [Oak].
 - 2.2.6.2. Interior for Opaque Finish:
 - 2.2.6.2.1. AWMAC/WI Quality Grade: Custom.
 - 2.2.6.2.2. [Birch].
- 2.2.7. Field Touch-Up: Field touch-up is responsibility of installing trade or architectural woodwork manufacturer providing it is responsible for factory finishing. Field touch-up includes filling and touch-up of exposed job-made nail and screw holes, refinishing of raw surface resulting from job fitting, repair of job-inflicted scratches and mars and final cleaning up of finished surfaces.
- 2.2.8. Fabrication:
 - 2.2.8.1. Fabricate joints accurately fitted, coped where possible and well glued up. Fabricate joints mitred to perfect fit and alignments carefully matched.
 - 2.2.8.2. Fabricate finished woodwork in 1 piece where possible. Fabricate running members in the longest lengths obtainable.
 - 2.2.8.3. Fabricate to conceal fastenings.
 - 2.2.8.4. Provide plastic laminate work in shop where practical and/or possible.
 - 2.2.8.5. Fabricate exposed gables to match the required exposed finishes.
 - 2.2.8.6. Exposed wood construction:
 - 2.2.8.6.1. Fabricate joints carefully matched for grain and colour.

- 2.2.8.6.2. Fabricate millwork with slow fed machines free from sticker and/or sander markings, with sections and moulding work cut accurately to profiles.
- 2.2.8.6.3. Sandpaper woodwork, smooth removing burrs, feathers, sleeves, raised grain and sharp arises and leave exposed surfaces perfectly clean and smooth ready for finishing.
- 2.2.8.6.4. Provide edges noted to be solid, as minimum 6 mm (1/4") thick wood to match exposed veneer, glued to core prior to the application of face veneers.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Install work of this Section in accordance with appropriate Section of NAAWS.
- 3.2.2. Provide work of this Section true and straight and securely fastened in place.
- 3.2.3. Mitre exposed corners and butt joints.
- 3.2.4. Thoroughly fix and anchor work of this Section into position.
- 3.2.5. Mechanical and Electrical Fittings:
 - 3.2.5.1. Provide openings required to accommodate mechanical and electrical fittings as part of the work of this Section and provide a core sealant to protect counter cores which are exposed to accommodate:
 - 3.2.5.1.1. mechanical services and fittings.
 - 3.2.5.1.2. washroom accessories.
 - 3.2.5.2. Mechanical and electrical fittings and services will be provided as part of the work of Divisions 20, 21, 22, 23, 26, 27 and 28.
- 3.2.6. Installation of Hardware:
 - 3.2.6.1. Install architectural woodwork hardware in accordance with manufacturer's requirements and templates. Adjust architectural woodwork hardware to provide smooth operation and ensure clearances are maintained. Repair damage to adjacent surfaces resulting from failure to conform with this requirement.
 - 3.2.6.2. Provide lubricants required and use in manner to ensure smooth function of hardware consistent with manufacturer's recommendations.
 - 3.2.6.3. Verify fastening components are tightened securely. Align screws, bolts and similar fastenings such that relationship of screw head indentations, similar surfaces and slots are perpendicular to matching vertical or horizontal position when on same surface. Do not burr or otherwise mar edges of surfaces of hardware components. Repair defects caused by work of this Section in an acceptable manner.
- 3.2.7. Do not install damaged Products.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide solid surfacing fabrications including but not limited to following:
 - 1.2.1.1. millwork countertops with and without sinks and cove backsplashes.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of finish carpentry and architectural woodwork: Section 06 40 00, Architectural Woodwork.
 - 1.2.2.2. Provision of elastomeric joint sealants: Section 07 92 00, Joint Sealants.
 - 1.2.2.3. Provision of tile work: Section 09 30 00, Tiling.
 - 1.2.2.4. Provision of plumbing and plumbing fixtures: Division 22, Plumbing.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. MDF: Medium Density Fibreboard.
- 1.3.2. Definitions:
 - 1.3.2.1. Solid Polymer Surface: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.
- 1.3.3. Reference Standards:
 - 1.3.3.1. ANSI/NEMA LD 3-05 - High-Pressure Decorative Laminates (HPDL)
 - 1.3.3.2. ANSI/NPA A208.2-09 - Medium Density Fiberboard (MDF) For Interior Applications
 - 1.3.3.3. ASTM C920-18 - Standard Specification for Elastomeric Joint Sealants
 - 1.3.3.4. ASTM D638-14 - Standard Test Method for Tensile Properties of Plastics
 - 1.3.3.5. ASTM D785-08(15) - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
 - 1.3.3.6. ASTM D790-17 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - 1.3.3.7. ASTM E84-23 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.3.8. ASTM E228-17 - Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer
 - 1.3.3.9. ASTM G21-15 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
 - 1.3.3.10. ASTM G155-13 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
 - 1.3.3.11. CSA O115-M82 - Hardwood and Decorative Plywood

- | | | |
|-----------|-----------------|--|
| 1.3.3.12. | NSF/ANSI 51-19 | - Food Equipment Materials |
| 1.3.3.13. | CAN/ULC-S102-18 | - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |
| 1.3.3.14. | UL 723-18 | - Standard for Test for Surface Burning Characteristics of Building Materials |
| 1.3.3.15. | UL 2824-13 | - GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Product Data: Indicate Product description including solid surface sheets, sinks, bowls and illustrating full range of standard colours, fabrication information and compliance with specified performance requirements. Submit Product data with resistance to list of chemicals.
- 1.5.2. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.
- 1.5.3. Coordination Drawings: Submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall rated or non-rated, blocking requirements, locations and recessed wall items and similar items.
- 1.5.4. Samples: Submit samples in accordance with Section 01 30 00. Submit minimum 150 mm x 150 mm (6" x 6") samples. Cut sample and seam together for representation of inconspicuous seam. Indicate full range of colour and pattern variation. Reviewed samples with no objections recorded will be retained as standard for work.
- 1.5.5. Test and Evaluation Reports: Submit flammability test reports and food preparation zone test certifications confirming compliance with NSF/ANSI 51. Refer to www.nsf.org for the latest compliance to NSF/ANSI 51 for food zone - all food types.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data:
- 1.6.1.1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in Project closeout documents.
- 1.6.1.2. Provide a commercial care and maintenance kit and video. Review maintenance procedures and warranty details with Owner upon completion.

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers. Ensure fabricator and installer are approved by solid polymer manufacturer.

1.7.2. Mock-Ups:

1.7.2.1. Prior to final review of Shop Drawings, erect 1 full size mock-up of each component at Project site demonstrating quality of materials and execution for Consultant's review.

1.7.2.2. Should mock-up have objections recorded, rework or remake until no objection are recorded. Remove rejected units from Project site.

1.7.2.3. Mock-up will be used as standard for review of subsequent work.

1.7.2.4. Mock-ups may remain as part of finished work.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements: Deliver no components to Project site until areas are ready for installation.

1.8.2. Storage and Handling Requirements:

1.8.2.1. Store components indoors prior to installation.

1.8.2.2. Handle materials to prevent damage to finished surfaces.

1.9. WARRANTY

1.9.1. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

2.1.1.1. Corian® by DuPont; www.corian.com

2.1.1.2. Formica Inc.; www.formica.com

2.1.1.3. Samsung Chemical USA; www.staron.com

2.1.1.4. Wilsonart Contract; www.wilsonartcontract.com

2.1.2. Substitution Limitations: This Specification is based on DuPont's Products. Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

2.2.1.1. Solid Polymer Based Products:

| | Property | Requirement min or max | | Test Procedure |
|---------------|--|---|--------------------|-------------------------|
| 2.2.1.1.1. | Tensile Strength | 6000 psi min | | ASTM D638 |
| 2.2.1.1.2. | Tensile Modulus | 1.5 x 10 ⁶ psi min | | ASTM D638 |
| 2.2.1.1.3. | Tensile Elongation | 0.4% min. | | ASTM D638 |
| 2.2.1.1.4. | Flexural Strength | 10000 psi min | | ASTM D790 |
| 2.2.1.1.5. | Flexural Modulus | 1.2 x 10 ⁶ psi min | | ASTM D790 |
| 2.2.1.1.6. | Hardness | >85-Rockwell "M" scale min. | | ASTM D785 |
| 2.2.1.1.7. | Thermal Expansion | 3.90 x 10 ⁻⁵ in./in./°C (2.2 x 10 ⁻⁵ in./in./°F) | | ASTM E228 |
| 2.2.1.1.8. | Fungi and Bacteria | Does not support microbial growth | | ASTM G21 |
| 2.2.1.1.9. | Microbial Resistance | Highly resistant to mould growth | | UL 2824 |
| 2.2.1.1.10. | Ball Impact | No fracture - 1/2 lb. Ball: 1/4" slab - 36" drop 1/2"* slab - 144" drop * - approximate weight per sq ft | | NEMA LD3, Method 3.8 |
| 2.2.1.1.11. | Weatherability | ΔE* ₉₄ <5 in 1,000 hrs | | ASTM G155 |
| 2.2.1.1.12. | Flammability | | | ASTM E84 & UL 723 |
| | | | All Colours | |
| | | 1/4" | 1/2" | 3/4" |
| 2.2.1.1.12.1. | Flame Spread | <25 | <25 | <25 |
| 2.2.1.1.12.2. | Smoke Developed | <25 | <25 | <25 |
| 2.2.1.1.12.3. | Class | 1 and A 1 and A | | 1 and A |
| | * NEMA results based on the NEMA LD 3 | | | |
| 2.2.2. | Solid Surfacing Material: | | | |
| 2.2.2.1. | Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria: | | | |
| 2.2.2.1.1. | Flammability: Flame Spread Index: 0 and Smoke Development Index: 5 when tested to CAN/ULC-S102. | | | |
| 2.2.2.1.2. | Food Equipment Material Compliance: Food zone to NSF/ANSI 51. | | | |
| 2.2.2.2. | Ensure material has minimum physical and performance properties specified under "Performance/Design Criteria". | | | |
| 2.2.2.3. | Ensure superficial damage to a depth of 0.25 mm (0.010") is repairable by sanding and polishing | | | |
| 2.2.3. | Adhesive for Bonding to Other Products: One component silicone to ASTM C920. | | | |
| 2.2.4. | Sealant: A standard mildew-resistant, FDA/UL® and NSF/ANSI 51 compliant in food zone area recognized silicone colour matched sealant or clear silicone sealant. | | | |

2.3. COMPONENTS

- 2.3.1. Countertops: 13 mm (1/2") thick solid surfacing material, adhesively joined with inconspicuous seams, edge details as indicated on Drawings. Refer to "Material and Finish Schedule" appended to Section 00 01 20 for colours and patterns.
- 2.3.2. Counter Perimeter Frame: Ensure 13 mm (1/2") thick, moisture resistant cores for countertops in wet areas having sinks or lavatories are 19 mm (3/4") thick exterior grade plywood with waterproof adhesive, CSA O115-M (G/SO) Fir or Poplar plywood, veneer core only. MDF core conforming to ANSI/NPA A208.2 balanced design, manufactured from recycled materials, meeting ANSI Standards for emissions, of minimum density of 770 kg/m³, (48 lb/cu ft) and surface character to match sample reviewed by Consultant. Ensure fire retardant Product contains fire-retardant chemicals injected with raw materials during manufacturing and achieves a maximum flame-spread rating of 25 with a maximum smoke development of 200 when tested to ASTM E84. Permitted Product by Uniboard Canada or The Canfibre Group Limited.
- 2.3.3. Fabrication:
- 2.3.3.1. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with reviewed Shop Drawings and solid surfacing manufacturer requirements. Form joints between components to create inconspicuous seams using manufacturer's standard joint adhesive. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
- 2.3.3.2. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
- 2.3.3.3. Ensure no blistering, whitening and cracking of components during forming.
- 2.3.3.4. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings. Backsplashes for most colours may be fabricated by traditional means discussed in K-25294 *Backsplashes*. Colours with metallic/mica particle or veined colours creating directional aesthetics (K-26833 *Directional Aesthetics*) may require the techniques in Technical Bulletin K-28235 *Thermoformed Backsplash*.
- 2.3.3.5. Form joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid polymer material under each joint.
- 2.3.3.6. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.
- 2.3.3.7. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
- 2.3.3.8. Finish: Ensure surfaces have uniform finish:
- 2.3.3.8.1. Matte, with a 60° gloss rating of 5 - 20.
- 2.3.3.9. Fabrication Tolerances:
- 2.3.3.9.1. Variation in Component Size: +/-3 mm (+/-1/8").
- 2.3.3.9.2. Location of Openings: +/-3 mm (+/-1/8") from indicated location.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
- 3.1.1.1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

- 3.1.1.2. Verify actual site dimensions and location of adjacent materials prior to commencing work.
- 3.1.1.3. Examine cabinets upon which countertops are to be installed. Verify cabinets are level to within 3 mm in 3 m (1/8" in 10' - 0").
- 3.1.1.4. Notify Consultant in writing of any conditions which would be detrimental to installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.
- 3.2.2. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.
- 3.2.3. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in colour to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- 3.2.4. Install countertops with no more than 3 mm (1/8") sag, bow or other variation from a straight line.
- 3.2.5. Adhere sinks/bowls to countertops using manufacturer recommended adhesives and colour-matched silicone sealant. Secure seam mount bowls and sinks to countertops using colour matched joint adhesive.
- 3.2.6. Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.
- 3.2.7. Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard colour-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard colour-coordinated silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard colour-coordinated joint adhesive.
- 3.2.8. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Performance of the Work.
- 3.2.9. Coordinate connections of plumbing fixtures with Division 22. Make plumbing connections to sinks in accordance with Division 22.

3.3. REPAIR

- 3.3.1. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Fabrication and Installation Manual".

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Remove excess adhesive and sealant from visible surfaces.
- 3.5.2. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

3.6. PROTECTION

- 3.6.1. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.
- 3.6.2. Protect surfaces from damage until date of Substantial Performance of the Work.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide general installations including but not limited to following:
 - 1.2.1.1. installation of hollow metal doors and frames.
 - 1.2.1.2. installation of plastic laminate wood doors.
 - 1.2.1.3. installation of door hardware.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of concrete wall: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Provision of concrete block wall: Section 04 20 00, Masonry Units.
 - 1.2.2.3. Provision of architectural woodwork: Section 06 40 00, Architectural Woodwork.
 - 1.2.2.4. Supply of hollow metal doors and frames: Section 08 11 13, Hollow Metal Doors and Frames.
 - 1.2.2.5. Supply of plastic laminate wood doors: Section 08 15 00, Plastic Laminate Wood Doors.
 - 1.2.2.6. Supply of door hardware: Section 08 71 00, Door Hardware.
 - 1.2.2.7. Installation of gypsum wall board partition steel frames and wall boards: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.8. Electrical fittings and services: Division 26, Electrical.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. DHI: Door and Hardware Institute Canada; www.dhicanada.ca.
 - 1.3.1.2. NFPA: National Fire Protection Association; www.nfpa.org.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ANSI/NAAMM/HMMA 840-17 - Guide Specification for Receipt, Storage and Installation of Hollow Metal Doors and Frames
 - 1.3.2.2. ANSI/WDMA I.S. 1A-21 - Industry Standard for Interior Architectural Flush Wood Doors
 - 1.3.2.3. NFPA 80-22 - Standard for Fire Doors and Other Opening Protectives
 - 1.3.2.4. CAN/ULC-S702.1-21 - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meeting:
 - 1.4.1.1. Prior to start of work, arrange for site meeting of parties associated with work of this Section. Presided over by Contractor, include Consultant, Subcontractor, Testing Company's Representative and manufacturer's representative.

- 1.4.1.2. Review work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of hardware, hardware to be used, installation of methods and procedures related to electrified door hardware, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of this Section. Also discuss following items:
 - 1.4.1.2.1. electrical roughing in and other preparatory work performed by other trades.
 - 1.4.1.2.2. sequence of operation of each type of electrified door hardware.
 - 1.4.1.2.3. construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 - 1.4.1.2.4. required testing, inspecting and certifying procedures.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Doors, Frames and Hardware: Refer to following Sections for Products to be installed as part of the work of this Section:
 - 2.1.1.1. Section 06 40 00, Architectural Woodwork.
 - 2.1.1.2. Section 08 11 13, Hollow Metal Doors and Frames.
 - 2.1.1.3. Section 08 15 00, Plastic Laminate Wood Doors.
 - 2.1.1.4. Section 08 71 00, Door Hardware.
- 2.1.2. Batt Insulation: Preformed mineral (glass and stone wool) fibre, conforming to CAN/ULC-S702.1. Permitted Products: "QUIETZONE® PINK NEXT GEN™ FIBERGLAS® Insulation" by Owens Corning Canada LP; www.owenscorning.ca, "ROCKWOOL™ AFB - Acoustical Fire Batt Insulation" by ROCKWOOL™ International A/S; www.rockwool.com or "Thermafiber® SAFB™ Mineral Wool Insulation" by Thermafiber, Inc. (Owens Corning Canada LP); www.thermafiber.com, of sufficient thickness and of width to suit metal framing spacing and other miscellaneous spacings.
- 2.1.3. Threshold Sealant: As recommended by installer in accordance with Section 07 92 00.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Verify frames comply with indicated requirements for type, size, location, swing characteristics and have been installed with plumb jambs and level heads. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Hollow Metal Frames:
 - 3.2.1.1. Install hollow metal frames in accordance with manufacturer's instructions and ANSI/NAAMM/HMMA 840.
 - 3.2.1.2. Set frames plumb, square, level and at correct elevation, maintaining uniform door width and height.
 - 3.2.1.3. Secure anchorages and connections to adjacent construction.

- 3.2.1.4. Remove temporary steel shipping jamb spreaders prior to setting 1-piece welded frames. Brace frames rigidly in position while being built in. Use precisely-dimensioned installation spreaders at sill and third-points of door opening height to maintain door opening width during building-in. Follow manufacturer's instructions regarding proper use of floor and jamb anchors. Remove installation spreaders only after mortar has set, where applicable.
- 3.2.1.5. Allow for deflection to prevent structural loads from being transmitted to frame.
- 3.2.1.6. Provide batt insulation to completely fill pressed steel frames of exterior doors and adjacent cavities.
- 3.2.2. Fire Labeled Doors and Frames:
 - 3.2.2.1. Install fire labeled doors and frames in accordance with manufacturer's printed instructions and NFPA 80.
 - 3.2.2.2. Verify labeled doors and frames are placed in their designated openings. Review, inspect and certify where required by authorities having jurisdiction.
- 3.2.3. Hollow Metal Doors:
 - 3.2.3.1. Install hollow metal doors in accordance with manufacturer's instructions and ANSI/NAAMM/HMMA 840.
 - 3.2.3.2. Install in accordance with following edge clearances unless otherwise indicated:
 - 3.2.3.2.1. Between doors and frames at head and jambs: 3 mm (1/8").
 - 3.2.3.2.2. At door bottom: 19 mm (3/4") maximum to unfinished floor, 16 mm (5/8") maximum to finished floor unless indicated to be undercut.
 - 3.2.3.2.3. Between meeting edges of pairs of doors: 3 mm (1/8").
- 3.2.4. Plastic Laminate Wood Doors:
 - 3.2.4.1. Install plastic laminate wood doors in accordance with manufacturer's instructions.
 - 3.2.4.2. Install lead lined plastic laminate wood doors in accordance with manufacturer's instructions.
 - 3.2.4.3. Install in accordance with following edge clearances unless otherwise indicated:
 - 3.2.4.3.1. Between doors and frames: at head and jambs: 3 mm (1/8").
 - 3.2.4.3.2. At door bottom: 19 mm (3/4") maximum to unfinished floor unless doors are indicated to be undercut.
 - 3.2.4.3.3. Between meeting edges of pairs of doors: 3 mm (1/8")
 - 3.2.4.3.4. Cut, drill and prepare doors to template to receive hardware.
- 3.2.5. Door Hardware:
 - 3.2.5.1. Install hardware to doors and frames in accordance with manufacturer's packaged installation, template and adjusting instructions.
 - 3.2.5.2. Adjust hardware to provide smooth operation of doors and ensure clearances are maintained. Provide lubricants to allow smooth function of hardware consistent with manufacturer's recommendations.
 - 3.2.5.3. Mount hardware at heights in accordance with "Recommended Locations for Builder's Hardware" by DHI Canada except as otherwise indicated on the Documents or required by authorities having jurisdiction.
 - 3.2.5.4. Install frame bumpers.
 - 3.2.5.5. Tighten fastening components snugly. Do not burr or otherwise mar the edges of surfaces of hardware components. Repair defects resulting from work of this Section in accordance with Consultant's review.

- 3.2.5.6. Set exterior door thresholds in a continuous bed of sealant to prevent water and air intrusion beneath sill.
- 3.2.5.7. Unless otherwise indicated, mounting heights for door hardware is as follows:
 - 3.2.5.7.1. Locksets - 1023 mm (40-5/16") from floor to centre line of knob.
 - 3.2.5.7.2. Deadlocks - 1100 mm (43-5/16") from floor to centre line of cylinder.
 - 3.2.5.7.3. Panic Bolts - 1023 mm (40-5/16") from floor to centre line of bar.
 - 3.2.5.7.4. Pulls - 1041 mm (41") from floor to centre line of pull.
 - 3.2.5.7.5. Push Plates - 1100 mm (43-5/16") from floor to centre line of plate.
 - 3.2.5.7.6. Guard Bars - 1066 mm (42") from floor to centre line of bar.
- 3.2.5.8. Provide locked room for storage of door hardware at the job site and a person responsible for control and distribution of door hardware.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. ADJUSTING

- 3.4.1. Adjust doors and hardware and other moving or operating parts to function smoothly and correctly.

3.5. CLEANING

- 3.5.1. Carefully wipe clean doors of dust created due to work of this Project.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide crystalline waterproofing including but not limited to following:
 - 1.2.1.1. application of crystalline waterproofing to interior of elevator pits, sumps and other pits or depressions in slabs on grade and elsewhere where indicated.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of cast-in-place concrete: Section 03 30 00, Cast-In-Place Concrete.

1.3. REFERENCES

- 1.3.1. Reference Standards:
 - 1.3.1.1. ASTM C267-20 - Standard Test Methods for Chemical Resistance of Mortars, Grouts and Monolithic Surfacing and Polymer Concretes

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Coordination: Coordinate work of this Section with items to be cast-in or grouted into surfaces to receive crystalline waterproofing to ensure compatibility and continuity of waterproofing application.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit Product data, including manufacturer's specifications and general recommendations for waterproofing applications.
- 1.5.2. Test and Evaluation Reports: Submit test reports from permitted independent testing laboratories certifying waterproofing system conforms to performance characteristics and testing requirements specified herein.
- 1.5.3. Certificates: Provide certificate signed by manufacturer's representative certifying materials installed comply with requirements of this Specification and applicator is qualified and approved to install Product in accordance with manufacturer's recommendations.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
 - 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.7. SITE CONDITIONS

- 1.7.1. Ambient Conditions: Ensure surfaces and ambient air temperature is not less than 5 deg C (41 deg F) for a minimum period of 48 hours before, during and for 48 hours after applications.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; water leakage, except as result of structural failure of concrete substrate. Cracks arising from normal shrinkage and/or expansion of concrete which are 0.3 mm (1/100") wide or less are not to be considered as structural failure. Hairline cracks which result from these causes are to be considered normal and consequently warranty will not be invalidated as a result of these minor defects.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Aquafin, Inc.; www.aquafin.net
- 2.1.1.2. Edco Technologies Inc.; www.edcotechnologies.com
- 2.1.1.3. Euclid Chemical Canada Ltd.; www.euclidchemical.com
- 2.1.1.4. Kryton International Inc.; www.kryton.com
- 2.1.1.5. Tremco Canada; www.tremcosealants.com
- 2.1.1.6. W.R. Meadows of Canada; www.wrmeadows.com
- 2.1.1.7. Xypex Chemical Corporation; www.xypex.com
- 2.1.2. Substitution Limitations: This Specification is based on Tremco Canada's "Permaquik Products". Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Cementitious crystalline waterproofing is a blend of Portland cement, fine treated silica sand active proprietary chemicals. When mixed with water and applied as cementitious coating, active chemicals cause a catalytic reaction which generates a non-soluble crystalline formation of dendritic fibers within pores and capillary tracts of concrete causing concrete to become permanently sealed against penetration of liquids from any direction.
- 2.2.1.2. Ensure chemical resistance in accordance with ASTM C267 exhibits no detrimental effects after exposure.
- 2.2.1.3. Ensure waterproofing treatment prevents passage of water under pressure and capable of spanning cracks up to 0.3 mm (1/100") without failure.
- 2.2.2. Crystalline Waterproofing: "Permaquik® Crystalline Waterproofing" by Tremco Canada, "Vandex Super/Super White" by Euclid Chemical Canada Ltd., "Krystol T1®" by Kryton International Inc. or "Cem-Kote CW Plus" by W.R. Meadows of Canada surface applied waterproofing compound, consisting of a patented formula of chemicals, cement and specially treated quartz which waterproofs by crystalline growth through cementitious voids in concrete substrate.
- 2.2.3. Slurry Coat: "Permaquik® 200" by Tremco Canada, "Vandex Super/Super White" by Euclid Chemical Canada Ltd., "Krystol T2®" by Kryton International Inc. or "Cem-Kote CW Plus" by W.R. Meadows of Canada applied in slurry consistency or powder application on concrete surfaces to prevent passage of water under pressure.

- 2.2.4. Premixed Mortar: Ensure premixed waterproofing material is "Permaquik Mortar 300" used in connection with "Permaquik® 200" by Tremco Canada, "Vandex Uni Mortar 1 ZSR" by Euclid Chemical Canada Ltd., "Krystol T1®" used in connection with "Krystol T2®" by Kryton International Inc. or "Meadow-Crete OV" by W.R. Meadows of Canada; mixed to mortar consistency for filling of form tie holes, honeycombed areas, routed out cracks and seal strips and coves at construction joints, to assure water tightness of structure.
- 2.2.5. Water: Free from matter deleterious to waterproofing materials.
- 2.2.6. Sealant: Compatible with waterproofing material, of type which will not re-emulsify and acceptable to manufacturer of waterproofing material.
- 2.2.7. Mixes:
 - 2.2.7.1. Slurry Consistency: Use separate containers for measuring by volume powdery materials. Add water to materials (not vice versa) and mix thoroughly. Ensure ratio of water to powder is as recommended by waterproofing material manufacturer. Prepare only as much slurry mixture as can be applied within 20-30 minutes. Do not add more water when mixture starts to thicken. Stir mixture frequently.
 - 2.2.7.2. Mortar Consistency: Measure "Slurry Coat" and "Premixed Mortar" material and mix powder thoroughly. Add water to powdery mixture and work with trowel until a medium stiff consistency is reached. Prepare only as much mortar as can be applied within 10-15 minutes. Ensure ratio of water and powder is as recommended by waterproofing manufacturer.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Examine concrete surfaces to be waterproofed for visible structural defects. Report unacceptable surface conditions. Report in writing, location of cracks exceeding 0.3 mm (1/100").
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Remove form scale, laitance, oil, form release agents and other foreign materials likely to affect bond, penetration and performance of waterproofing. Employ steam cleaning or sandblasting as required.
 - 3.2.1.2. Prepare smooth surfaces resulting from steel formwork and similarly smooth surfaces by light sandblasting or high pressure water blasting.
 - 3.2.1.3. Ensure prepared surfaces use an open crystalline system to assure permanent bonding of waterproofing application.
 - 3.2.1.4. Horizontal Concrete Surfaces:
 - 3.2.1.4.1. Do not treat concrete surfaces with floor hardener or curing agents prior to waterproofing application.
 - 3.2.1.4.2. Rout out to minimum 38 mm (1-1/2") wide by 19 mm (3/4") deep, construction joints and visible cracks exceeding 0.3 mm (1/100") in size. Thoroughly rinse with water all concrete slab surfaces. Remove free water a Day prior to waterproofing application. Ensure concrete surfaces are damp at time slurry coating is applied.
 - 3.2.1.5. Vertical Concrete Surfaces:
 - 3.2.1.5.1. Ensure form tie holes are left approximately 25 mm (1") back of surface.
 - 3.2.1.5.2. Ensure honeycombed pockets and faulty construction joints are routed out to sound concrete.

3.2.1.5.3. Ensure vertical and horizontal construction joints and visible cracks in concrete surfaces exceeding 0.3 mm (1/100") are routed out 38 mm (1-1/2") wide by 19 mm (3/4") deep.

3.2.1.5.4. Rinse surfaces to be waterproofed thoroughly with water a Day prior to waterproofing application. Ensure moisture is present in concrete substrate to achieve maximum initial penetration of activated waterproofing chemicals. Ensure surfaces are moist only (not wet) when waterproofing is applied.

3.3. APPLICATION

3.3.1. Waterproofing:

3.3.1.1. Apply waterproofing material to concrete surfaces, typically 7 Days after concrete pour.

3.3.1.2. Carry waterproofing up to pipes, standards and other items projecting through substrate, cut back to receive sealant.

3.3.1.3. Waterproof concrete construction joints and pipes, standards and other items projecting through substrate.

3.3.1.4. Apply slurry coatings by using a stiff masonry brush, or with suitable spray equipment.

3.3.1.5. Allow each successive coat to reach initial set before recoating.

3.3.1.6. Horizontal Concrete Surfaces:

3.3.1.6.1. Dry sprinkle and power trowel or wood float application for slabs. When concrete of structure slab starts to reach initial set, dry sprinkle Slurry Coat 1.4 kg/m² (2.5 lbs/sq yd) on concrete surfaces and power trowel or wood float surfaces until uniformity in coverage and specified finish is reached.

3.3.1.6.2. Where it is not possible or practical to float waterproofing into concrete structure and where permitted, apply slurry coating to concrete surfaces, "Slurry Coat" 1.4 kg/m² (2.5 lbs/sq yd) in slurry consistency. Apply slurry coatings uniformly in quantities specified (in 1 or 2 successive coatings). Second slurry coating of "Slurry Coat" may be applied while first coat is still green but after it has reached an initial set.

3.3.1.6.3. Ensure construction joints are treated with "Slurry Coat" 1.4 kg/m² (2.5 lbs/sq yd) in slurry consistency or powder form on pre-wetted surface immediately prior to pouring of concrete.

3.3.1.6.4. Install seal strip 19 mm x 38 mm (3/4" x 1-1/2") at construction joints and at routed out cracks. Ensure seal strips consists of 2 laminating layers of "Slurry Coat" and "Premixed Mortar" material 1:6 in mortar consistency.

3.3.1.7. Vertical Concrete Surfaces:

3.3.1.7.1. Treat horizontal construction joints where accessible with "Slurry Coat" at rate of 0.8 kg/m² (1.5 lbs/sq yd) in slurry consistency or dry sprinkled on pre-wetted surfaces immediately prior to pouring of concrete.

3.3.1.7.2. Rout out honeycombed areas, faulty construction joints and cracks, apply slurry coating of "Slurry Coat" 1.4 kg/m² (2.5 lbs/sq yd) and fill with mortar ("Slurry Coat" and "Premixed Mortar") 1:6 in laminating layers.

3.3.1.7.3. Ensure form tie holes are filled with "Slurry Coat" and "Premixed Mortar" material 1:6 in mortar consistency after slurry coat of "Slurry Coat" has been applied.

3.3.1.7.4. Install seal strip 19 mm x 38 mm (3/4" x 1-1/2") at construction joints and junction of walls and slab with "Slurry Coat" and "Premixed Mortar" material 1:6 (mortar consistency) in 2 laminating layers.

3.3.1.7.5. Apply to concrete surfaces "Slurry Coat" 1.4 kg/m² (2.5 lbs/sq yd). Ensure slurry coating is uniformly applied in quantities specified (minimum 2 coatings). Fill small pockets in concrete surfaces with "Premixed Mortar" in mortar consistency. Second slurry coating of "Slurry Coat" can be applied while first coat is still green, but after it has reached an initial set. Ensure waterproofing is continuous through recesses to receive horizontal slabs and is installed prior to slab pour.

- 3.3.2. Curing:
 - 3.3.2.1. When temperatures fall below freezing, cover waterproofed surfaces with tarpaulins, or other protection, and maintain surface temperature above 5 deg C (41 deg F) for a minimum period of 3 Days after completion of waterproofing application.
 - 3.3.2.2. Protect freshly waterproofed surfaces from rain for a minimum of 24 hours.
 - 3.3.2.3. Moist cure waterproofed surfaces for a minimum of 3 Days, starting with fine water fog spraying Day following completion of application.
 - 3.3.2.4. During extreme hot weather, apply, as required, a light water fog spray to freshly applied slurry application in order to prevent dehydration of waterproofing.
- 3.3.3. Waterbars and Sealant:
 - 3.3.3.1. Examine installed waterbars to ensure that proper waterbars are provided, correctly welded at joints and that placing of concrete does not destroy purpose of waterbars, as required to make foundation walls and slabs on grade watertight. Cooperate with and coordinate work of this Section with work of Section providing waterbars.
 - 3.3.3.2. Seal around pipes and other protrusions with sealant.
- 3.3.4. Do not backfill foundation walls for at least 36 hours after application of crystalline waterproofing.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections: Owner may engage services of an independent inspection and testing company to carry out inspection and testing of work of this Section. Cost of such inspection and testing, if required, will be paid by Owner.
- 3.4.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Clean and repair surfaces soiled or otherwise damaged in connection with work of this Section. Replace materials or finishes that cannot be satisfactorily cleaned at no cost to Owner.
- 3.5.2. Waste Management: Upon completion of work remove debris, equipment and excess material from site.

3.6. PROTECTION

- 3.6.1. Protect surfaces which are not to be waterproofed from soiling or other damage resulting from work of this Section.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide mechanical room waterproofing including but not limited to following:
 - 1.2.1.1. elastomeric mechanical room waterproofing.
 - 1.2.1.2. breathable epoxy mechanical room waterproofing for basement.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Concrete slab finishing and curing: Section 03 35 13, Concrete Floor Finishing.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. DFT: Dry film thickness.
 - 1.3.1.2. RH: Relative Humidity.
 - 1.3.1.3. WFT: Wet film thickness.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM D412-16(21) - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
 - 1.3.2.2. ASTM D2240-15(21) - Standard Test Method for Rubber Property–Durometer Hardness
 - 1.3.2.3. ASTM D4060-19 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
 - 1.3.2.4. ASTM D4541-17 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 - 1.3.2.5. ASTM F1869-22 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 1.3.2.6. ASTM F2170-19a - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.4. SUBMITTALS

- 1.4.1. Product Data:
 - 1.4.1.1. Provide cured film data based on following:
 - 1.4.1.1.1. Tensile Elongation and Strength based on ASTM D412.
 - 1.4.1.1.2. Hardness (Shore A) based on ASTM D2240.
 - 1.4.1.1.3. Tensile Adhesion to Concrete based on ASTM D4541.
 - 1.4.1.1.4. Abrasion Resistance based on ASTM D4060.

1.5. QUALIFICATIONS

1.5.1. Qualifications:

1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.

1.5.2. Mock-Ups: Construct minimum 10 m² (100 sq ft) mock-up sample at Project location designated by Consultant for review. Once reviewed with no objections recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

1.6. WARRANTY

1.6.1. Manufacturer Warranty:

1.6.1.1. Warrant work of this Section for period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

1.6.1.2. Cracks arising from normal shrinkage and/or expansion of concrete are not considered as structural failure. Hairline cracks which result from these causes are considered normal and consequently warranty will not be voided as a result of these minor defects.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

2.1.1.1. BASF; www.master-builders-solutions.basf.us

2.1.1.2. MAPEI Inc.; www.mapei.ca

2.1.1.3. R&D Technical Solutions Ltd.; www.kelmar.com

2.1.1.4. Sika Canada Inc. www.sika.ca

2.1.1.5. Tremco Canada; www.tremcosealants.com

2.2. MATERIALS

2.2.1. Performance/Design Criteria: Ensure waterproofing treatment prevents passage of water under pressure and capable of spanning cracks up to 1.5 mm (1/16") without failure.

2.2.2. Concrete Moisture Emission Reducer: Provide 1 of following:

2.2.2.1. "Planiseal™ VS" by MAPEI Inc.

2.2.2.2. "Kelmar® MVB" by R&D Technical Solutions Ltd.

2.2.2.3. "Sikafloor® 81 EpoCem^{CA}" by Sika Canada Inc.

2.2.3. Mechanical Room Waterproofing (MRW): 2 component flexible, chemical resistant, flame retardant coating capable for pedestrian traffic. Permitted systems are:

2.2.3.1. "MasterSeal® Traffic 2500" by BASF consisting of following:

2.2.3.1.1. Primer: "MasterSeal P 255".

2.2.3.1.2. Basecoat: "MasterSeal M 265" (0.635 mm (25 mils)) WFT.

2.2.3.1.3. Topcoat: "MasterSeal TC 275" (0.381 - 0.508 mm (15 - 20 mils)) WFT.

- 2.2.3.2. "Sikafloor® Resoclad MRW Type II" by Sika Canada Inc., consisting of following:
 - 2.2.3.2.1. Basecoat: "Sikalastic®-390 Membrane" (0.762 - 0.889 mm (30 - 35 mils)) DFT.
 - 2.2.3.2.2. Topcoat: "Sikafloor®-2540 W NA" (0.102 - 0.127 mm (4 - 5 mils)) DFT.
- 2.2.3.3. "Mapei Mechanical Room Waterproofing" by MAPEI Inc. consisting of following:
 - 2.2.3.3.1. Primer: "Primer SN™" (0.254 mm (10 mils)) DFT.
 - 2.2.3.3.2. Basecoat: "Mpaefloor™ PU 418" (0.635 mm (25 mils)) DFT.
 - 2.2.3.3.3. Topcoat: "Mapefloor™ Finish 54 W/S" (0.051 - 0.102 mm (2 - 3 mils)) WFT.
- 2.2.3.4. "Vulkem OC810" by Tremco Canada consisting of following:
 - 2.2.3.4.1. 2 coats of "Vulkem OC810" (0.762 - 1.016 mm (30 - 40 mils)).
- 2.2.3.5. "Kelmar® MERDEK LD" by R&D Technical Solutions Ltd. consisting of following:
 - 2.2.3.5.1. Primer: "Kelmar® Dualox Epoxy Primer/Bonding Agent".
 - 2.2.3.5.2. Basecoat: "Kelmar® MERDEK Membrane" (0.508 mm (20 mils)) DFT.
 - 2.2.3.5.3. Topcoat: "Kelmar® 1910 Interior and Exterior Coating" (0.152 - 0.178 mm (6 - 7 mils)) DFT.
- 2.2.4. Mechanical Room Waterproofing for Basement: 2 component breathable, water-based, low VOC, chemical resistant epoxy coating capable for pedestrian traffic. Permitted system is "Sikafloor®-2540 W NA" by Sika Canada Inc.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Preinstallation Testing:
 - 3.1.2.1. Perform calcium chloride test no earlier than 28 Days after concrete has been placed in accordance with requirements of ASTM F1869 and/or RH testing in accordance with ASTM F2170 immediately prior to installation of mechanical room waterproofing for moisture on concrete floors around perimeter of areas, at columns and where moisture may be anticipated. Conduct 3 tests for first 93 m² (1000 sq ft) and 1 additional test for every 93 m² (1000 sq ft) of flooring. Ensure moisture emission from concrete floor does not exceed 2.27 kg/93 m² (5 lbs/1000 sq ft) in 24 hours or has a maximum RH of 85%. Do not proceed with installation until moisture problem has been corrected. Provide results to Consultant prior to commencement of installation including diagram of area tested showing location of each moisture test.
 - 3.1.2.2. When concrete moisture emission rate is between 2.27 kg/93 m² (5 lbs/1000 sq ft) and 4.53 kg/93 m² (10 lbs/1000 sq ft) in 24 hours use either a concrete moisture emission reducer or a high moisture tolerant adhesive.
 - 3.1.2.3. When concrete moisture emission rate is between 4.53 kg/93 m² (10 lbs/1000 sq ft) and 6.79 kg/93 m² (15 lbs/1000 sq ft) and in 24 hours use a concrete moisture emission reducer.
 - 3.1.2.4. Conduct pH test no earlier than 28 Days after concrete has been placed to ensure alkali salt residue is within limitation acceptable to manufacturer and to avoid adhesive failure, discolouration, shrinkage and softening of mechanical room waterproofing. If pH results are higher than 10, report to Consultant, Contractor or Owner for investigation and remedial. Also refer to manufacturer for ways to neutralize floor prior to beginning of installation. Neutralize by sanding, vacuuming and/or by water plus mild muriatic acid application as recommended by manufacturer. Retest to assure pH has been neutralized.

- 3.1.3. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:

- 3.2.1.1. Free surfaces to receive work of this Section from dust and loose particles, grease, paint, frost, form oil and other material detrimental to bond of membrane traffic topping. Employ steam cleaning where necessary to remove form oil.
- 3.2.1.2. Sandblast, or abrade and clean using a steel shot blast machine having vacuum pick-up, whichever is deemed necessary, depending on condition of concrete.
- 3.2.1.3. Ensure substrate surfaces are free from cavities and/or shutter marks which will damage traffic topping membrane.
- 3.2.1.4. Ensure surfaces are dry at commencement of work and cured minimum of 28 Days. Remove dust and dirt with industrial type vacuum cleaner.
- 3.2.1.5. Ensure ambient and surface temperatures are at least 10 deg C (50 deg F) for a minimum period of 48 hours before, during and after membrane application.
- 3.2.1.6. Ensure substrates slope properly to drains.

3.3. APPLICATION

- 3.3.1. Ensure preparation of substrate, crack control and membrane application complies with detailed requirements recommended by membrane manufacturer.
- 3.3.2. Apply primer at coverage rate recommended by manufacturer for particular surface porosity. Do not permit primer to collect in pools. Prevent seepage through joints. Allow to dry thoroughly.
- 3.3.3. Apply 13 mm x 13 mm (1/2" x 1/2") cant to internal angles. Ensure cant is a 2 part rubber set sealant and compatible with waterproofing membrane.
- 3.3.4. Provide membrane in thicknesses specified in addition to crack treatment membrane application.
- 3.3.5. Apply top coat and minimal amount of silica aggregate for slip resistance, in accordance with reviewed mock-up.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections:

- 3.4.1.1. Inspect work of other Sections where such is associated with waterproofing membrane system including placement, finishing and curing of concrete substrate.
- 3.4.1.2. Owner may engage services of an independent inspection and testing company to carry out inspection and testing of materials and application.
- 3.4.1.3. Cost of such inspection and testing for Consultant's quality control, if required, shall be paid by Owner.
- 3.4.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
- 3.4.3. Manufacturer Services: Provide membrane manufacturer's supervision during preparation and application.

3.5. CLEANING

- 3.5.1. Clean and Make Good to Consultant's satisfaction, surfaces soiled or otherwise damaged in connection with work of this Section. Pay cost of replacing finishes or materials that cannot be satisfactorily cleaned.

3.6. PROTECTION

- 3.6.1. Protect surfaces which are not to be treated from soiling by spillage, overspray or other causes in connection with work of this Section.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide building insulation including but not limited to following:
 - 1.2.1.1. board, batt and loose insulation throughout building, except as specified under other Sections. This Section establishes insulation and accessory Products and minimum performance criteria which apply to board, batt and loose insulation types used throughout this Project. Read and become familiar with insulation requirements of all Sections.
 - 1.2.1.2. where combustible insulation or vapour barrier materials are specified herein, comply with applicable Code requirements including supply and installation of approved non-combustible backing and independently-supported, non-combustible insulation covering except where these provisions are expressly specified as work of other Sections.
 - 1.2.1.3. ensure material types (trade names), compatibility, sealing and adhesive qualities for each combination of insulation, adhesive and substrate encountered in work are reviewed for compatibility and suitability prior to commencement of installation. Include manufacturer's laboratory reports on adhesive quality and compatibility of each of these conditions.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of cavity wall insulation: Section 04 20 00, Masonry Units.
 - 1.2.2.2. Provision of foamed-in-place insulation: Section 07 21 19, Foamed-In-Place Insulation.
 - 1.2.2.3. Insulation within metal wall siding system: Section 07 46 19, Metal Siding System.
 - 1.2.2.4. Provision of roof insulation in conventional roofing system: Section 07 52 16, Modified Bituminous Membrane Roofing.
 - 1.2.2.5. Acoustic sealant: Section 07 92 00, Joint Sealants.
 - 1.2.2.6. Provision of insulation within curtain wall system: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.7. Insulation for mechanical work: Division 20, Mechanical General Requirements, Division 21, Fire Suppression, Division 22, Plumbing and Division 23, Heating, Ventilating and Air Conditioning.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. LTTR: Long Term Thermal Resistance.
 - 1.3.1.2. NRCC: National Research Council of Canada; www.nrc-cnrc.gc.ca.
 - 1.3.1.3. OBC: Ontario Building Code.
- 1.3.2. Definitions:
 - 1.3.2.1. Rain Screen Principle: A theory governing the design of a building enclosure in such a way as to prevent water penetration due to rain; in other words, a scientific approach to eliminating water leakage.

1.3.3. Reference Standards:

- | | | |
|-----------|---------------------------------|---|
| 1.3.3.1. | AAMA/WDMA/CSA 101/I.S.2/A440-11 | - NAFS 2011 – North American Fenestration Standard/ Specification for windows, doors, and skylights |
| 1.3.3.2. | ASTM C165-23 | - Standard Test Method for Measuring Compressive Properties of Thermal Insulations |
| 1.3.3.3. | ASTM C518-21 | - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |
| 1.3.3.4. | ASTM C1338-19 | - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings |
| 1.3.3.5. | CSA A440S1-17 | - Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard / Specification for windows, doors, and skylights |
| 1.3.3.6. | CAN/ULC-S102-18 | - Test Method of Surface Burning Characteristics of Building Materials and Assemblies |
| 1.3.3.7. | CAN/ULC-S114-18 | - Standard Method of Test for Determination of Non-Combustibility in Building Materials |
| 1.3.3.8. | CAN/ULC-S701-17 | - Standard for Thermal Insulation, Polystyrene Boards |
| 1.3.3.9. | CAN/ULC-S702.1-21 | - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification |
| 1.3.3.10. | CAN/ULC-S704-17 | - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced |
| 1.3.3.11. | CAN/ULC-S770-15(20) | - Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams |

1.4. QUALITY ASSURANCE

1.4.1. Qualifications:

1.4.1.1. Installers:

- 1.4.1.1.1. Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.4.1.1.2. Employ only skilled mechanics having experience in the work specified and having an understanding of the design principles of the thermal and air/vapour barriers which they are providing.

1.5. DELIVERY, STORAGE AND HANDLING

- 1.5.1. Delivery and Acceptance Requirements: Deliver materials to site in original wrappings with labels intact and store in areas directed by Consultant.
- 1.5.2. Storage and Handling Requirements:
- 1.5.2.1. Store insulation on raised platforms and protect with waterproof covers. Prevent exposure of insulation to sun.
- 1.5.2.2. Store materials inside buildings for 24 hours prior to installation.

1.6. SITE CONDITIONS

- 1.6.1. Ambient Conditions: Maintain surface and ambient temperatures during application and curing of adhesive at temperature recommended by manufacturer of type of adhesive used.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Atlas EPS; www.atlaseps.com
 - 2.1.1.2. Atlas Roofing Corporation; www.atlasroofing.com
 - 2.1.1.3. CertainTeed Corporation; www.certainteed.com
 - 2.1.1.4. DuPont de Nemours Inc.; www.dupont.com
 - 2.1.1.5. IKO Industries Ltd.; www.iko.com
 - 2.1.1.6. Johns Manville Canada Inc.; www.jm.com
 - 2.1.1.7. Owens Corning Canada LP; www.insulation.owenscorning.ca
 - 2.1.1.8. ROCKWOOL™ International A/S; www.rockwool.com
 - 2.1.1.9. Thermafiber, Inc. (Owens Corning Canada LP); www.thermafiber.com
- 2.1.2. Substitution Limitations: Comparable Products from other manufacturers not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Exterior envelope is based on "Rain Screen Principle" by NRCC. This requires construction behind cladding act as an air/vapour barrier to prevent passage of moisture laden air and diffusion of water vapour. To ensure continuity of air/vapour barrier within construction specified herein and with adjacent barrier construction is part of responsibility of this Section.
 - 2.2.1.2. Refer to Drawings for thicknesses of insulation required. Select appropriate products from list of materials on basis of their maintaining thermal value of envelope, total compatibility when incorporated into finished system while ensuring substrate conditions as well as their ability to adhere components permanently, where applicable in rigid manner and maintain flexibility where required in finished work.
 - 2.2.1.3. Ensure insulation materials and their facings do not support fungal growth when tested in accordance with ASTM C1338.
- 2.2.2. Cavity Insulation: Semi-rigid stone wool board, CAN/ULC-S702.1, Type 1, minimum RSI (R) value of 0.75 (4.3) per 25 mm (1"), "ROCKWOOL™ CAVITYROCK®" by ROCKWOOL™ International A/S, "JM CladStone™ Water & Fire Block Insulation" by Johns Manville Canada Inc., minimum RSI (R) value of 0.75 (4.3) per 25 mm (1"), thickness as indicated on Drawings.
- 2.2.3. Wall Insulation: CAN/ULC-S701, Type 3, extruded polystyrene insulation with LTTR of RSI (R) value of 0.88 (5) when determined in accordance with CAN/ULC-S770 and ASTM C518, minimum compressive strength 140 kPa (20 psi), thickness as indicated on Drawings. Supply boards with shiplapped edges at horizontal locations and butt joints elsewhere; "STYROFOAM™ Brand Cladmate™ CM20 Extruded Polystyrene Foam Insulation" by DuPont de Nemours Inc. or "FOAMULAR® NGX C-200" by Owens Corning Canada LP.

- 2.2.4. Rigid Fibrous Glass and Semi-Rigid Stone Wool Board Insulation: Fibrous glass or stone wool rigid or semi-rigid board insulation, "Fiberglas® 703" by Owens Corning Canada LP, "ROCKWOOL™ CURTAINROCK®" by ROCKWOOL™ International A/S, "MinWool® Curtainwall CW4" by Johns Manville Canada Inc. or "Thermafiber® FireSpan® 40 Mineral Wool Insulation" by Thermafiber, Inc. (Owens Corning Canada LP). Ensure insulation has a thermal resistance value of not less than RSI=0.75 (R=4.3) at a mean temperature of 24 deg C (75 deg F) and a minimum nominal density of 64 kg/m³ (4 pcf). Ensure deformation of fibrous glass rigid board does not exceed 10% when tested at 1.2 kPa (25 psf) in accordance with CAN/ULC-S702.1, Type 1 and ASTM C165. Thickness as indicated.
- 2.2.5. Batt or Roll Insulation:
- 2.2.5.1. Miscellaneous Batt or Roll Insulation: CAN/ULC-S702.1.
- 2.2.6. Rigid Polyisocyanurate Cavity Wall Insulation Boards: Square edged, closed cell polyisocyanurate foam manufactured using Zero Ozone Depleting Potential (ZeroODP) CFC -, HCFC- and HFC-free blowing agents and integrally laminated to a radiant barrier quality reflective foil facer on 1 side and non-reflective, red acrylic-coating facer on other side, meeting requirements of CAN/ULC-S704, Type 1 or 2, Class 1. Provide total thickness as shown on Drawings and following:
- 2.2.6.1. Thermal Value: Ensure insulation has minimum compressive strength of 110 kPa (16 psi) and LTTR R-value of 5.6 when determined in accordance with CAN/ULC-S770 per square edged layer.
- 2.2.6.2. Dimension Stability: 2% maximum linear change when conditioned at 70 deg C (158 deg F) and 97% relative humidity for 7 Days; curing time 24 hours minimum, plus an additional 24 hours minimum per inch (25 mm) of thickness, at a minimum of 16 deg C (60 deg F) before shipment from manufacturer.
- 2.2.6.3. Maximum board size is 1220 mm x 2743 mm, (4' x 9').
- 2.2.6.4. Ensure insulation is without limitations devoid of face-sheet delamination, edge cavitation, cupping, bowing, crushing or powdering. Provide thermal value and in multiple layers to thickness shown on Drawings. Provide "EnergyShield®" by Atlas Roofing Corporation, "AP™ Foil-Faced Foam Sheathing" Johns Manville Canada Inc., "THERMAX™ Sheathing" by DuPont de Nemours Inc. or "IKO Enerfoil™ Sheathing" by IKO Industries Ltd.
- 2.2.7. Rigid Polyisocyanurate Cavity Wall Insulation Boards: Square edged, closed cell polyisocyanurate foam manufactured using Zero Ozone Depleting Potential (ZeroODP) CFC -, HCFC- and HFC-free blowing agents and integrally laminated to non-reflective coated glass-mat facers both sides, meeting requirements of CAN/ULC-S704, Type 2, Class 3. Provide total thickness as shown on Drawings and following:
- 2.2.7.1. Thermal Value: Ensure insulation has minimum compressive strength of 110 kPa (16 psi) and LTTR R-value of 5.6 when determined in accordance with CAN/ULC-S770 per square edged layer.
- 2.2.7.2. Dimension Stability: 2% maximum linear change when conditioned at 70 deg C (158 deg F) and 97% relative humidity for 7 Days; curing time 24 hours minimum, plus an additional 24 hours minimum per inch (25 mm) of thickness, at a minimum of 16 deg C (60 deg F) before shipment from manufacturer.
- 2.2.7.3. Maximum board size is 1220 mm x 2743 mm, (4' x 9').
- 2.2.7.4. Ensure insulation is without limitations devoid of face-sheet delamination, edge cavitation, cupping, bowing, crushing or powdering. Provide thermal value and in multiple layers to thickness shown on Drawings. Provide "Rboard®" by Atlas Roofing Corporation, "R-Panel™" by Johns Manville Canada Inc. "THERMAX™ Sheathing" by DuPont de Nemours Inc.

- 2.2.8. Sound Attenuation Batts: CAN/ULC-S702.1, mineral (glass and stone wool) fibre, flame spread and smoke developed in conformance with OBC requirements and other authorities having jurisdiction in accordance with CAN/ULC-S102. Non-combustible in accordance with requirements of CAN/ULC-S114. Permitted Products: "EcoTouch™ QuietZone® PINK™ FIBERGLAS® Acoustic Insulation" by Owens Corning Canada LP, "ROCKWOOL™ AFB - Acoustical Fire Batt Insulation" by ROCKWOOL™ International A/S, "Sound-SHIELD® Formaldehyde-Free Fiber Glass Insulation" by Johns Manville Canada Inc., "NoiseReducer™ Sound Attenuation Batts" by CertainTeed Corporation or "Thermafiber® SAFB™ Mineral Wool Insulation" by Thermafiber, Inc. (Owens Corning Canada LP), of sufficient thickness to meet required STC rating for sound-rated partitions and of width to suit metal framing spacing and other miscellaneous spacings.
- 2.2.9. Adhesive Tape for Sealing Vapour Barrier Joints:
- 2.2.9.1. Polyethylene Adhesive Tape: "Scotch brand No. 483" by 3M Canada Inc.
- 2.2.9.2. Foil Vapour Barrier Tape: Pressure sensitive aluminum foil tape, 0.127 mm (2 mils) thick, 75 mm (3") wide, "Scotch brand No. 425" by 3M Canada Inc.; www.3m.com.
- 2.2.10. Adhesive: As recommended by manufacturer of insulating materials:
- 2.2.10.1. Type A: For polystyrene rigid insulation. Vapour barrier type, medium trowel consistency, or "Air-Bloc® 21" by Henry Company www.henry.com.
- 2.2.11. Mechanical Fasteners:
- 2.2.11.1. Insulation Fasteners: 60 mm (2-3/8") diameter high density polyethylene (HDPE) fastener with integrated cap. Permitted Product: "Ramset T3 InsulFast™ System" by ITW Construction Products; www.itwconstruction.ca.
- 2.2.11.2. Self-Adhered Insulation Clips: Impale type, perforated 50 mm x 50 mm (2" x 2") cold rolled steel adhesive back, spindle of length to suit insulation plus 25 mm (1") with speed washers. Permitted Products: "Self-Adhering TACTOO® Insul-Hangers" by AGM Industries, Inc.; www.agmind.com or "Self-Adhering TACTOO® Insul-Hangers" by Continental Studwelding Ltd.; www.constud.ca.
- 2.2.11.3. Glued Insulation Clips: Impale type, perforated 50 mm x 50 mm (2" x 2") cold rolled galvanized steel, spindle of length to suit insulation plus 25 mm (1") with speed washers. Permitted Products: "Perforated TACTOO® Insul-Hangers" by AGM Industries, Inc.; www.agmind.com or "Perforated TACTOO® Insul-Hangers" by Continental Studwelding Ltd.; www.constud.ca.
- 2.2.11.4. Strip Impalement Clips: 25 mm (1") wide strip of "Insul Hold Clips" by Insul Hold Canada Ltd., fabricated from galvanized sheet in rolls with punch out insulation securement arrows.
- 2.2.11.5. Staples: Galvanized wire, 13 mm (1/2") minimum.

PART 3 - EXECUTION

3.1. PREPARATION

- 3.1.1. Surface Preparation: Ensure surfaces to receive adhesive or insulation are dry, firm, straight and free from loose material, projections, ice, frost, slick, grease, oil or other matter detrimental to bond of adhesive or uniform bedding of insulation.

3.2. INSTALLATION

- 3.2.1. Install insulation when conditions meet requirements specified under "Preparation".
- 3.2.2. Install insulation to maintain continuity of thermal protection to building elements and spaces as indicated on Drawings.
- 3.2.3. Fit insulation tight to electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other projections or openings.

- 3.2.4. Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation panels free from ripped backs or chipped or broken edges. Ensure integrity and continuity of insulation at juncture with different types of materials and seal in permitted manner. Stagger joints in row.
- 3.2.5. Install materials in accordance with manufacturer's instructions.
- 3.2.6. Do not cover insulation and air/vapour barrier installed under this Section or other Sections until it has been reviewed by Consultant.
- 3.2.7. Rigid Insulation:
 - 3.2.7.1. With polystyrene insulation apply Type A adhesive to substrate material at rate of 3 l/m^2 (16 sq ft/gal) 3 mm (1/8") thick, to achieve a continuous vapour retardant film. Butter edges of board for continuous seal.
 - 3.2.7.2. Fix glass fibre insulation using either clip or fastener type fasteners on substrate, 5 per 600 mm x 1200 mm (24" x 48") board minimum. Impale insulation board on insulation clips, butting joints firmly together and secure with washers, cut off spindles 3 mm (1/8") beyond washer or apply insulation fasteners through insulation with a "Ramset T3IGT Gas Tool".
 - 3.2.7.3. Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm (6") wide 0.15 mm (6 mils) polyethylene strip over joint using compatible adhesive prior to application of insulation.
 - 3.2.7.4. Provide flexible insulation of equivalent thickness and thermal insulation to fit areas where application of rigid insulation is not possible to provide continuous coverage.
- 3.2.8. Batt or Roll Insulation:
 - 3.2.8.1. Install batt or roll insulations where indicated on Drawings.
 - 3.2.8.2. Fit batt between framing and press firmly into place. Butt tightly at joints, free of gaps.
 - 3.2.8.3. Insulate behind pipes, ducts, electric conduits and outlets or junction boxes. Cut insulation to fit around and behind obstructions and non-standard spaces.
 - 3.2.8.4. Place insulation over soffit grid system sealing around metal hangers and at wall on all sides. Carry insulation up wall and fit around steel or in masonry voids and over plaster ceiling.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide foamed-in-place insulation including but not limited to following:
 - 1.2.1.1. spray foamed-in-place insulation and air barrier.
 - 1.2.1.2. field testing of spray foamed-in-place insulation and air barrier.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of cast-in-place concrete: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Provision of concrete block masonry: Section 04 20 00, Masonry Units.
 - 1.2.2.3. Provision of structural steel studs and exterior sheathing: Section 05 41 00, Structural Metal Stud Framing System.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. LTTR: Long Term Thermal Resistance.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM E96/E96M-22ae1 - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
 - 1.3.2.2. CAN/ULC-S705.1-18 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification
 - 1.3.2.3. CAN/ULC-S705.2-20 - Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density - Application
 - 1.3.2.4. CAN/ULC-S770-15(20) - Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

1.4. QUALITY ASSURANCE

- 1.4.1. Qualifications:
 - 1.4.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience application of Products, systems and assemblies specified and with approval and training of the Product manufacturers. Provide written proof from spray foam manufacturer confirming these requirements have been met prior to installation.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. BASF Canada Inc.; www.basf.com
 - 2.1.1.2. Carlisle Spray Foam Insulation; www.carlislesfi.com
 - 2.1.1.3. Genyk Inc.; www.genyk.com
 - 2.1.1.4. Huntsman Building Solutions; www.huntsmanbuildingsolutions.com

2.2. MATERIALS

- 2.2.1. Foamed-In-Place Insulation: Provide 2 component closed cell foam-in-place polyurethane foam with following requirements:
 - 2.2.1.1. Minimum Core Density: 28 kg/m³ (1.75 lb/cu ft) in accordance with CAN/ULC-S705.1.
 - 2.2.1.2. LTTR Value: 5.2/inch minimum in accordance with CAN/ULC-S770.
 - 2.2.1.3. Water Vapour Permeance: Maximum of 57 ng/Pa•s•m² (1 US Perm) when tested in accordance with ASTM E96/E96M.
 - 2.2.1.4. Permitted Products: "Walltite® CM01" by BASF Canada Inc., "SealTite™ One" by Carlisle Spray Foam Insulation, "BOREAL ELITE" by Genyk Inc. or "HEATLOK® SOYA HFO™" by Huntsman Building Solutions.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Prepare substrate surfaces dry and free of dew, frost, voids, loose material, oil, grease, asphalt and curing compounds in accordance with CAN/ULC-S705.2.
 - 3.2.1.2. Provide masking as necessary to prevent overspray.

3.3. INSTALLATION

- 3.3.1. Provide foamed-in-place insulation in accordance with CAN/ULC-S705.2 and manufacturer's recommendations.
- 3.3.2. Provide foamed-in-place insulation to full area of surfaces indicated to be insulated and to provide a uniform and continuous thermal and airseal barrier.
- 3.3.3. Provide foamed-in-place insulation over projecting anchors and fastenings, around pipes, ducts, obstructions, openings and corners.
- 3.3.4. Provide foamed-in-place insulation free of voids and imbedded foreign materials.
- 3.3.5. Prevent overspray and remove masking materials.

3.4. SITE QUALITY CONTROL

3.4.1. Site Tests and Inspections:

3.4.1.1. Arrange and pay for cost of site reviews/tests in accordance with CAN/ULC-S705.2 by manufacturer's authorized third party testing agent. Schedule number of site reviews/tests in accordance with following schedule:

| | Coverage Area | No. of Site Reviews/Tests |
|------------|--|----------------------------------|
| 3.4.1.1.1. | 3252 - 6503 m ² (35,000 - 70,000 sq ft) | 1 |
| 3.4.1.1.2. | 6503 - 9755 m ² (70,000 - 105,000 sq ft) | 2 |
| 3.4.1.1.3. | 9755 - 13 006 m ² (105,000 - 140,000 sq ft) | 3 |
| 3.4.1.1.4. | over 13 006 m ² (over 140,000 sq ft) | 4+ |

3.4.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide sprayed insulation including but not limited to following:
 - 1.2.1.1. sprayed thermal insulation.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of structural steel: Section 05 12 00, Structural Steel.
 - 1.2.2.2. Provision of metal floor and roof decking: Section 05 31 10, Steel Deck.
 - 1.2.2.3. Provision of spray fireproofing: Section 07 81 00, Sprayed Fire-Resistive Materials.
 - 1.2.2.4. Provision of firestopping and smoke seals: Section 07 84 00, Firestopping and Smoke Seals.
 - 1.2.2.5. Provision of finish painting: Section 09 91 00, Painting.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. NRC: Noise Reduction Coefficient.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM C423-23
 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 1.3.2.2. ASTM C518-21
 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 1.3.2.3. ASTM E84-23
 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.2.4. ASTM E136-22
 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - 1.3.2.5. CAN/ULC-S102-18
 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - 1.3.2.6. CAN/ULC-S114-18
 - Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - 1.3.2.7. UL 723-18
 - Standard for Test for Surface Burning Characteristics of Building Materials

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Sequencing:
 - 1.4.1.1. Ensure sprayed thermal insulation work on a floor is completed before proceeding to next floor.
 - 1.4.1.2. Ensure Contractor cooperates in the coordination and scheduling of sprayed thermal insulation work to avoid delays.

1.5. SUBMITTALS

1.5.1. Product Data: Submit manufacturer's specifications, including certification as may be required to show material compliance with Contract Documents.

1.5.2. Test and Evaluation Reports: Submit independent laboratory test results for all specified performance criteria.

1.6. QUALITY ASSURANCE

1.6.1. Qualifications:

1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data.

1.7.2. Storage and Handling Requirements: Store materials above ground, in a dry location, protected from the weather. Remove damaged packages found unsuitable for use from site.

1.8. SITE CONDITIONS

1.8.1. Ambient Conditions:

1.8.1.1. When prevailing outdoor temperature at building is less than 4 deg C (40 deg F), maintain a minimum substrate and ambient temperature of 4 deg C (40 deg F) prior to, during and 24 hours after application of sprayed thermal insulation. If necessary for job progress, provide heated enclosures to maintain temperatures.

1.8.1.2. Provide ventilation to allow proper drying of sprayed thermal insulation during and subsequent to its application.

1.8.1.3. In enclosed areas, provide ventilation not less than 4 complete air changes per hour.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

2.1.1.1. "A/D Type 1" by AD Fire Protection Systems; www.adfire.com

2.1.1.2. "Heat-Shield" by CAFCO Industries Inc.; www.cafco.com

2.1.1.3. "Monoglass Spray-On Insulation" by Monoglass Incorporated; www.monoglass.com

2.1.2. Substitution Limitations: This Specification is based on CAFCO Industries Inc's Products. Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

2.2.1. Sprayed Thermal Insulation: Provide asbestos and cellulose free material with following test criteria:

2.2.1.1. Surface Burning Characteristics: Exhibit following surface burning characteristics when tested in accordance with ASTM E84 (UL 723, CAN/ULC-S102):

2.2.1.1.1. Flame Spread: 0.

2.2.1.1.2. Smoke Developed: 10.

2.2.1.2. Combustibility: Classified as noncombustible when tested in accordance with ASTM E136 (CAN/ULC-S114).

- 2.2.1.3. Noise Reduction Coefficients: Have following NRC ratings when tested in accordance with ASTM C423:
- | | Thickness | Substrate | NRC |
|------------|------------------|------------------|------------|
| 2.2.1.3.1. | 13 mm (1/2") | Solid Base | 0.50. |
| 2.2.1.3.2. | 25 mm (1") | Solid Base | 0.75. |
| 2.2.1.3.3. | 50 mm (2") | Solid Base | 1.05. |
- 2.2.1.4. "R" Value: When tested in accordance with ASTM C518, ensure material has a minimum "R" value of 3.85 per inch.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
- 3.2.1.1. Ensure surfaces to receive sprayed thermal insulation are free of oil, grease, loose mill scale, dirt, paints/primers (other than those tested) or other foreign materials, which would impair satisfactory bonding to the surface.
- 3.2.1.2. Ensure clips, hangers, supports, sleeves and other attachments to substrate are placed prior to application of sprayed thermal insulation materials.
- 3.2.1.3. Ensure installation of ducts, piping, conduit or other suspended equipment does not take place until application of sprayed thermal insulation is complete in an area.
- 3.2.1.4. Apply sprayed thermal insulation only to steel deck, which has been fabricated and erected in accordance with criteria set forth by Steel Deck Institute.
- 3.2.1.5. When roof traffic is anticipated, as in the case of periodic maintenance, install roofing pavers as a walkway to distribute loads.

3.3. APPLICATION

- 3.3.1. Ensure equipment, mixing and application is in accordance with manufacturer's written application instructions.
- 3.3.2. Use potable water for application of sprayed thermal insulation material.
- 3.3.3. Do not commence application of sprayed thermal insulation until certification has been received by Contractor that surfaces to receive sprayed thermal insulation have been inspected by the applicator and are acceptable to receive sprayed thermal insulation.
- 3.3.4. Unsuitable substrates must be identified and made known and corrected prior to application of sprayed thermal insulation.
- 3.3.5. Do not apply sprayed thermal insulation to steel floor decks prior to completion of concrete work on that deck.

- 3.3.6. Do not commence application of sprayed thermal insulation to underside of roof deck until roof is completely installed and tight, penthouses are complete, mechanical units have been placed and after construction roof traffic has ceased. Ensure construction roof traffic has ceased until material has fully cured.
- 3.3.7. Maintain proper temperature and ventilation as specified herein.
- 3.3.8. Provide masking, drop cloths or other suitable coverings to prevent overspray from coming in contact with surfaces not intended to receive sprayed thermal insulation.
- 3.3.9. If required, apply bonding adhesive to reviewed substrates prior to application of sprayed thermal insulation.
- 3.3.10. After spraying insulation, light board tamp insulation and apply insulation sealer in accordance with manufacturer's recommendations suitable for finish painting later.

3.4. REPAIR

- 3.4.1. Patching of and repair to sprayed thermal insulation, due to damage by other trades, is performed by this Section and paid for by trade responsible for damage.

3.5. SITE QUALITY CONTROL

- 3.5.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.6. CLEANING

- 3.6.1. After completion of work of this Section, remove equipment and clean surfaces not to be sprayed to extent previously agreed to by applicator and Contractor.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide miscellaneous air/vapour barriers including but not limited to following:
 - 1.2.1.1. air/vapour barriers required to maintain air/vapour integrity of building envelope not shown or identified on Drawings or specified under another Section.
 - 1.2.1.2. coordination of work of this Section with other trades working on building envelope.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Air/vapour barrier system in masonry cavity wall systems: Section 04 20 00, Masonry Units.
 - 1.2.2.2. Provision of exterior sheathing: Section 05 41 00, Structural Metal Stud Framing System.
 - 1.2.2.3. Thermal insulation and non-air/vapour type adhesives: Section 07 21 00, Building Insulation.
 - 1.2.2.4. Stick fasteners for rigid insulation: Section 07 21 00, Building Insulation.
 - 1.2.2.5. Provision of gypsum board work: Section 09 21 16, Gypsum Board Assemblies.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. DFT: Dry Film Thickness.
 - 1.3.1.2. ELA: Equivalent Leakage Air.
 - 1.3.1.3. NBCC: National Building Code of Canada.
 - 1.3.1.4. SAT: Self Adhesive Type.
 - 1.3.1.5. SBS: Styrene-butadiene-styrene.
 - 1.3.1.6. WFT: Wet Film Thickness.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM E96/E96M-22ae1 - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
 - 1.3.2.2. ASTM E283/E283M-19 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 1.3.2.3. ASTM E2178-21a - Standard Test Method for Determining Leakage Rate and Calculation of Air Permeance of Building Materials
 - 1.3.2.4. CAN/ULC-S741-08(20) - Standard for Air Barrier Materials - Specification

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
- 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.5.2. Mock-Ups: To identical substrate materials scheduled for use in finished building, provide on site in location as directed, mock-up panels to which each combination of materials to be used under this Section is installed, interlapped, reinforced and secured to demonstrate compatibility, adhesion and cohesion qualities, fastening systems of flats and general workmanship to be used throughout finished work. For liquid applied Products, provide both WFT and DFT required to meet specified performance values.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Storage and Handling Requirements:
- 1.6.1.1. Store materials in weathertight enclosure raised clear of ground so they are protected from sunlight, weather exposure, moisture and deterioration.
- 1.6.1.2. Comply with manufacturer's printed recommendations for handling of materials.

1.7. WARRANTY

- 1.7.1. Manufacturer Warranty: Warrant materials of this Section for period of 3 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; material remaining air and water tight.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. 3M Canada; www.3m.ca
- 2.1.1.2. BASF Wall Systems; www.enershield.basf.com
- 2.1.1.3. Corsella-Dorken Products, Inc.; www.corsella-dorken.com
- 2.1.1.4. GCP Applied Technologies, Inc.; www.gcpat.com
- 2.1.1.5. Henry Company; www.henry.com
- 2.1.1.6. IKO Industries Ltd.; www.iko.com
- 2.1.1.7. Soprema Inc.; www.soprema.ca

- 2.1.1.8. Tremco Canada; www.tremcosealants.com
- 2.1.1.9. W.R. Meadows of Canada; www.wrmeadows.com

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

- 2.2.1.1. Ensure air/vapour membrane system controls air leakage, moisture and thermal transfer while maintaining its structural integrity in accordance with NBCC. Ensure air/vapour membrane is continuous and compatible with interfacing materials in plane of air-tightness and sealed at interfaces to provide proper air barrier system in construction. Provide greater attention for air/vapour barrier continuity at physical connections of material components between window frames and wall assembly while taking into consideration construction tolerance, reduction of unnecessary interfaces in system and providing proper structural support to air/vapour barrier connections, such that wind loads, deflection and air pressure differentials do not cause connections to fail.
- 2.2.1.2. Ensure air barrier membranes have an air permeance of less than 0.02 l/s/m² (0.004 cfm/sq ft) under a pressure differential of 75 Pa (1.57 psf) when tested in accordance with ASTM E2178 or CAN/ULC-S741.
- 2.2.1.3. Ensure vapour barrier membranes have a vapour permeance of less than 57 ng/Pa•sm² (1 US perm) when tested in accordance with ASTM E96/E96M.
- 2.2.1.4. Air/vapour barrier membranes are able to withstand 2 kPa (42 psf) air pressure from either direction, with no increase in ELA.
- 2.2.1.5. When membrane forms a dual role ensure it meets requirements for air tightness and vapour diffusion control in accordance with ASTM E283/E283M and ASTM E96/E96M.
- 2.2.2. Material Compatibility: Of various materials specified herein, select combination of base materials, transition, bridging and reinforcing membranes, adhesives and accessories so when cured, they are compatible and give bonding characteristics equivalent to shear strength of selected air/vapour barrier materials used.
- 2.2.3. Air/Vapour Barrier Membrane: Supply 1 of following systems:
 - 2.2.3.1. SAT System (No Primer): Provide "LexShield SA" by Lexcor; www.lexcor.net or "3M™ Air and Vapor Barrier Membrane 3015" by 3M Canada.
 - 2.2.3.2. SAT System (Foil Faced):
 - 2.2.3.2.1. Primer: "ELASTOCOL STICK" by Soprema Inc. or "Blueskin® Adhesive", "Blueskin® LVC Adhesive" or "Aqua-Tac Primer" by Henry Company.
 - 2.2.3.2.2. SAT Membrane: SBS modified bitumen membrane, minimum 1.016 mm (40 mils) thick with aluminum foil facer on 1 side and siliconized release paper on the other, cut to suit design and lap requirements; "SOPRASOLIN HD" by Soprema Inc. or "Metal Clad® 705FR" by Henry Company.
 - 2.2.3.3. SAT System (High Temperature Resistant):
 - 2.2.3.3.1. Primer: As recommended by membrane manufacturer.
 - 2.2.3.3.2. Mastic: As recommended by membrane manufacturer.
 - 2.2.3.3.3. SAT Membrane: Self-adhering SBS modified bitumen or rubberized asphalt membrane with high softening point, minimum 1.016 mm (40 mils) thick with anti-slip coating on polyethylene or polypropylene film membrane on 1 side and siliconized release paper on the other, cut to suit design and lap requirements, "Blueskin® Roof High Temperature Underlayment - PE 200 HT" by Henry Company or "LASTOBOND SHIELD HT" by Soprema Inc.

- 2.2.3.4. Foil Vapour Retarder: A single layer of polyethylene bubbles bonded to and sandwiched between 2 radiant barrier metalized sheets creating a no tear barrier; "Metalized Foil Barrier (2200 Series)" by rFOIL™; www.rfoil.com.
- 2.2.4. Vapour Permeable Air Barriers:
 - 2.2.4.1. SAT System:
 - 2.2.4.1.1. Self-adhesive vapour permeable air barrier membrane with a tri-laminated polypropylene complex facer.
 - 2.2.4.1.2. Vapour Permeance: Greater than 570 ng/Pa•s•m² (10 US perms).
 - 2.2.4.1.3. Primer: "ELASTOCOL STICK H₂O" by Soprema Inc., "Blueskin® Adhesive" or "Aquatac Primer", "Hi-Tac™" by Henry Company or "DELTA®-LVC Primer" by Corsella-Dorken Products, Inc.
 - 2.2.4.1.4. SAT Membrane: "SOPRASEAL STICK VP" by Soprema Inc., "Blueskin® VP160" by Henry Company or "DELTA®-VENT SA" by Corsella-Dorken Products, Inc.
 - 2.2.4.2. Liquid Membrane System:
 - 2.2.4.2.1. One component liquid made from modified rubber. Minimum application temperature 4 deg C (40 deg F).
 - 2.2.4.2.2. "SOPRASEAL LM 202 VP", complete with "SOPRASEAL QUICK CORNER" and "SOPRASEAL MESH" by Soprema Inc.
 - 2.2.4.2.3. One component, synthetic permeable air barrier membrane, monolithic elastomeric liquid applied coating system; "ExoAir® 230" by Tremco Canada.
 - 2.2.4.2.4. One component elastomeric rubber, high solids trowel applied coating system; "Air-Bloc® 17MR" by Henry Company, complete with recommended primers.
 - 2.2.4.2.5. One component cold liquid applied, water based, polymer-modified, seamless, elastomeric air/vapour barrier, "Air-Shield LMP" by W. R. Meadows of Canada.
- 2.2.5. Joint Sealing Tape: Air resistant pressure sensitive adhesive tape, type recommended by air/vapour barrier manufacturer, 50 mm (2") wide for lap joints and perimeter seals, 25 mm (1") wide elsewhere.
- 2.2.6. Adhesive: As recommended by sheet manufacturers.
- 2.2.7. Air/Vapour Barrier Sealant Tape: 50 mm (2") wide polyethylene with laminated cloth backing with high-tack rubber-based adhesive in total minimum thickness of 38 µm (1-1/2 mil); "483 Tape" by 3M Canada.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Examine surface to receive membranes to assure they are smooth, dry and free from conditions that will adversely affect execution, permanence, or quality of work.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Do not install air/vapour barrier until other work which penetrates membrane has been completed.
- 3.2.2. Apply air/vapour barrier envelope to this Project with utmost care to ensure positive support and continuity.

- 3.2.3. SAT System (with Primer):
 - 3.2.3.1. Begin installation after mechanical insulation clips have been applied to substrate, have cured and are examined for bond.
 - 3.2.3.2. Priming:
 - 3.2.3.2.1. Apply fluid primer to surfaces and allow to dry tack-free. Prime only areas to be covered by membrane within same Day. Re-prime surfaces not covered within same Day.
 - 3.2.3.2.2. Apply primers at a rate recommended by membrane manufacturer.
 - 3.2.3.3. Flashing, Corner Reinforcing and Transition Membrane:
 - 3.2.3.3.1. Install membrane flashing in 900 mm (36") widths wherever possible. Where applicable, bring flashing a minimum of 150 mm (6") onto horizontal surfaces and a minimum of 200 mm (8") up walls from horizontal elevation shown.
 - 3.2.3.3.2. SAT membrane is a permitted material for transition conditions at frames and the like.
 - 3.2.3.3.3. Stagger flashing and membrane seams.
 - 3.2.3.3.4. Install flashing to protrusions, expansion joints, control joints and the like. Bring flashing a minimum of 150 mm (6") onto membrane.
 - 3.2.3.4. Installation:
 - 3.2.3.4.1. Install membrane in accordance with manufacturer's printed instructions over flashings and corner reinforcement.
 - 3.2.3.4.2. Lay membrane without buckles, fishmouths and avoid stretching membrane. Where membrane cannot extend at least 100 mm (4") onto horizontal surface, terminate in a horizontal reglet and seal.
 - 3.2.3.4.3. Lap membranes 50 mm (2") on side laps and 100 mm (4") on end laps. Stagger end laps.
 - 3.2.3.4.4. Roll membrane with a hand roller.
 - 3.2.3.5. Inspection: Inspect membrane for punctures, misaligned seams and fishmouths, apply additional layer of membrane over affected area, extending minimum of 150 mm (6") beyond damaged area in all directions.
- 3.2.4. SAT System (No Primer):
 - 3.2.4.1. Execute air/vapour barrier installation for this Project with utmost care to ensure positive support of barrier. Ensure membrane acts as both air/vapour barrier and as such requires accurate cutting and placement over supports.
 - 3.2.4.2. Ensure continuity of this envelope where Drawings indicate locations which require 2-phase installation, such as at steel beams and the like.
 - 3.2.4.3. Lap joints minimum 100 mm (4"), adhere continuously to steel framing with double-sided tape and tape joints with air/vapour-proof tape.
- 3.2.5. SAT System (High Temperature Resistant):
 - 3.2.5.1. Begin installation after mechanical insulation clips have been applied to substrate, have cured and are examined for bond. Install this SAT System under parapet flashings and other areas where high temperature can occur.
 - 3.2.5.2. Priming:
 - 3.2.5.2.1. Apply fluid primer to surfaces and allow to dry tack-free. Prime only areas to be covered by membrane within same Day. Re-prime surfaces not covered within same Day.
 - 3.2.5.2.2. Apply primers at a rate recommended by membrane manufacturer.
 - 3.2.5.3. Flashing, Corner Reinforcing and Transition Membrane:

- 3.2.5.3.1. Install membrane flashing in 900 mm (36") widths wherever possible. Where applicable, bring flashing a minimum of 150 mm (6") onto horizontal surfaces and a minimum of 200 mm (8") up walls from horizontal elevation shown.
- 3.2.5.3.2. SAT membrane is a permitted material for transition conditions at frames and the like.
- 3.2.5.3.3. Stagger flashing and membrane seams.
- 3.2.5.3.4. Install flashing to protrusions, expansion joints, control joints and the like. Bring flashing a minimum of 150 mm (6") onto membrane.
- 3.2.5.4. Installation:
 - 3.2.5.4.1. Install membrane in accordance with manufacturer's printed instructions over flashings and corner reinforcement.
 - 3.2.5.4.2. Lay membrane without buckles, fishmouths and avoid stretching membrane. Where membrane cannot extend at least 100 mm (4") onto horizontal surface, terminate in a horizontal reglet and seal.
 - 3.2.5.4.3. Lap membranes 50 mm (2") on side laps and 100 mm (4") on end laps. Stagger end laps.
 - 3.2.5.4.4. Roll membrane with a hand roller.
- 3.2.5.5. Inspection: Inspect membrane for punctures, misaligned seams and fishmouths, apply additional layer of membrane over affected area, extending minimum of 150 mm (6") beyond damaged area in all directions.
- 3.2.6. Liquid Applied System:
 - 3.2.6.1. Ensure surfaces to receive air/vapour barrier are free from laitance, loose aggregates, oil, grease, wax, mastic compounds and form release agents.
 - 3.2.6.2. Install joint reinforcements and transition membranes in accordance with requirements specified herein, bridging cracks greater than 3 mm (1/8") wide, rough openings, bends up to 120° and transitions to framing members and similar items penetrating air/vapour membrane.
 - 3.2.6.3. Apply primers as required to substrate in accordance with manufacturer's instructions.
 - 3.2.6.4. Install air/vapour barrier in accordance with manufacturer's instructions.
 - 3.2.6.5. Begin installation after mechanical insulation clips have been applied to substrate, have cured and are examined and tested for bond.
 - 3.2.6.6. Fill insulation joints with air/vapour barrier membrane. Seal voids or cracks around components, protruding anchors and the like with air/vapour membrane.
 - 3.2.6.7. Immediately after application of air/vapour barrier membrane, embed insulation into still fluid and unskinned membrane. Ensure insulation is firmly adhered to air/vapour membrane.
- 3.2.7. Flexible Membrane, Reinforcement and Accessories:
 - 3.2.7.1. Unless otherwise noted, it is responsibility of this Section to provide and maintain continuity of air seal to adjacent dissimilar materials. Fit flexible seals at locations required to provide air/vapour/water resistant and weathertight junctions. Ensure continuity of seal at end joints between lengths of material by overlapping and cementing. Seal junctions of system components to themselves and other Work with sealant to maintain effective vapour, air and water barrier.
 - 3.2.7.2. Ensure air seal membrane termination consists of a compatible flexible membrane reinforcement sheet embedded in a permanent, compatible sealant or fluid type air/vapour barrier material, lapping a minimum of 200 mm (8") on to base materials and having free edge installed to penetrating framing by combination of adhesive or fluid coating.
 - 3.2.7.3. Where deflection of structure will cause dynamic joint movement between metal framing work and dissimilar materials, provide flexible seals of sufficient width to allow formation of bellows to take up any torsional and shear stresses.

- 3.2.7.4. Where SAT membranes are used as base air/vapour barrier, same material may also be used as flexible transition material.
- 3.2.7.5. This work is considered as 2-phase work, with final attachment of reinforced bridging sheet being made at time of installation of door frames and windows under separate contract.
- 3.2.7.6. Where air/vapour barrier crosses junction between concrete block and concrete columns or beams, provide flexible membrane of 150 mm (6") minimum width to bridge possible openings at such locations.
- 3.2.8. Provide flexible sheet membrane at junctions with dissimilar materials and corners as indicated. Where attaching air seal membrane to metal frames and the like, apply sealant in addition to fluid adhesive.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
- 3.3.2. Manufacturer Services: Ensure membrane manufacturer's representative is on site at beginning of installation to provide training and supervision of Contractor's personnel in installation of air/vapour barrier. Ensure manufacturer's representative provides frequent inspection visits thereafter to assure quality and competence of membrane installation.
- 3.3.3. Air Seal Membrane Continuity: Ensure air/vapour barrier provides an impermeable membrane seal to resist infiltration and exfiltration of air and moisture. Ensure function of air/vapour membrane as indicated.

3.4. PROTECTION

- 3.4.1. Protect surrounding surfaces against damage from this work.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide aluminum modular plate system including but not limited to following:
 - 1.2.1.1. air/vapour barrier.
 - 1.2.1.2. insulation.
 - 1.2.1.3. structural steel framing members required for support of aluminum panels.
 - 1.2.1.4. thermal spacer system.
 - 1.2.1.5. preformed aluminum modular plates.
 - 1.2.1.6. related trims and extrusions.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of carbon impact design requirements: Section 01 33 30, Carbon Impact Design Requirements.
 - 1.2.2.2. Provision of cast-in-place concrete structure: Section 03 30 00, Cast-In-Place Concrete.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. EPD: Environmental Product Declaration.
 - 1.3.1.2. HPD: Health Product Declaration.
 - 1.3.1.3. NBCC: National Building Code of Canada.
 - 1.3.1.4. NRCC: National Research Council of Canada; www.nrc-cnrc.gc.ca.
 - 1.3.1.5. PVDF: Polyvinylidene Fluoride.
 - 1.3.1.6. SAT: Self Adhesive Type.
 - 1.3.1.7. SBS: Styrene Butadiene Styrene.
- 1.3.2. Definitions:
 - 1.3.2.1. Rain Screen Principle: A theory governing the design of a building enclosure in such a way as to prevent water penetration due to rain; in other words, a scientific approach to eliminating water leakage.
- 1.3.3. Reference Standards:
 - 1.3.3.1. AAMA 2605-22
 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusion and Panels (with Coil Coating Appendix)
 - 1.3.3.2. ASTM B117-19
 - Standard Practice for Operating Salt Spray (Fog) Apparatus

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| 1.3.3.3. | ASTM B244-09(21) | - Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments |
| 1.3.3.4. | ASTM D523-14(18) | - Standard Test Method for Specular Gloss |
| 1.3.3.5. | ASTM D714-02(17) | - Standard Test Method for Evaluating Degree of Blistering of Paints |
| 1.3.3.6. | ASTM D968-22 | - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive |
| 1.3.3.7. | ASTM D2244-22 | - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates |
| 1.3.3.8. | ASTM D2247-15(20) | - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity |
| 1.3.3.9. | ASTM D3363-22 | - Standard Test Method for Film Hardness by Pencil Test |
| 1.3.3.10. | ASTM D4214-07(15) | - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films |
| 1.3.3.11. | ISO 14025:2016 | - Environmental labels and declarations - Type III environmental declarations - Principles and procedures |
| 1.3.3.12. | ISO 21930:2017 | - Sustainable in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services |
| 1.3.3.13. | CAN/ULC-S702.1-21 | - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification |

1.4. SUBMITTALS

- | | |
|------------|--|
| 1.4.1. | Product Data: |
| 1.4.1.1. | EPDs: When available, submit Product-specific Type III EPD or industry-wide (generic) EPD conforming to ISO 14025, ISO 21930 or other recognized environmental Product declaration framework demonstrating carbon impact of materials using life cycle analysis methods. |
| 1.4.1.2. | HPDs: When available, submit documentation demonstrating chemical inventory of materials to at least 0.1% (1000 ppm) and conforming to 1 of following standards: |
| 1.4.1.2.1. | Health Product Declaration open Standard. |
| 1.4.1.2.2. | Cradle to Cradle v2 Basic level. |
| 1.4.1.2.3. | Cradle to Cradle v3 Bronze level. |
| 1.4.1.2.4. | Or other recognized material ingredient framework. |
| 1.4.2. | Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to minimum requirements indicate following: |
| 1.4.2.1. | size, spacing and location of structural supports. |
| 1.4.2.2. | cladding system details. |
| 1.4.2.3. | airseal closures to adjacent parts of the Work. |
| 1.4.2.4. | plate sizes, finishes and identifying marks. |
| 1.4.2.5. | provision for thermal movement. |
| 1.4.2.6. | jointing details. |

- 1.4.2.7. cut and drilled holes.
- 1.4.2.8. anchorage and securement systems including clearances.
- 1.4.2.9. interfaces with work of other Sections.
- 1.4.2.10. material identification, thicknesses and gauges.
- 1.4.2.11. flashing installation method.
- 1.4.2.12. locations and details of horizontal fire stopping.
- 1.4.2.13. sequence of erection and any special handling or bracing required.
- 1.4.2.14. indicate plate sizes and finishes in elevation, sections, materials and thicknesses arrangements of joints and bonding, metal framing and anchorage and flashing.
- 1.4.2.15. Ensure a licensed engineer specified herein is responsible for:
 - 1.4.2.15.1. production and review of Shop Drawings.
 - 1.4.2.15.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.4.3. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples:
 - 1.4.3.1. 300 mm x 300 mm (12" x 12") aluminum plate.
 - 1.4.3.2. 300 mm (12") each of extruded and formed trim.
- 1.4.4. Certificates: Submit in accordance with Section 01 30 00. Submit preformed aluminum modular plate system manufacturer's written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

1.5. CLOSEOUT SUBMITTALS

- 1.5.1. Operation and Maintenance Data:
 - 1.5.1.1. Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section.
 - 1.5.1.2. Submit instructions for touch-up, repair and removal of panels.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
 - 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 10 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.
 - 1.6.1.2. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
- 1.6.2. Mock-Ups:
 - 1.6.2.1. Conform to requirements of Section 01 40 00.
 - 1.6.2.2. Prior to installation of work of this Section construct 1 site mock-up of preformed aluminum modular plate system including components of wall system for Consultant's review.
 - 1.6.2.3. Modify site mock-up detailing if necessary in accordance with Consultant's review.
 - 1.6.2.4. Site mock-up will serve as reference for detailing and quality of construction for remaining work of this Section.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Storage and Handling Requirements: Store components and materials in accordance with panel manufacturer's recommendations.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work of this Section for a period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. "AM3000 System" by Architectural Metals North America; www.amna-corp.com
- 2.1.1.2. "Aluminum Metal Plate Wall Panels System" by Dri-Design; www.dri-design.com
- 2.1.1.3. "Aluminum Plate" by Kanalco Ltd.; www.kanalco.com
- 2.1.1.4. "Axiom" by Northern Facades Ltd.; www.northernfacades.com
- 2.1.1.5. "Alumitex" by Ontario Panelization; www.ontariopanelization.com
- 2.1.1.6. "SL-2000P Dry Joint Pressure Equalized Rainscreen (PER) System" by Sobotec Ltd.; www.sobotec.com
- 2.1.2. Substitution Limitations: Comparable Products from other manufacturers not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Carbon Impact Design: Preference will be given to those manufacturers who have provided EPDs outlining their programs for reducing their Operational and Embodied Carbon footprints as specified herein.
- 2.2.1.2. Material Ingredient Disclosure: Preference will be given to those manufacturers who have provided HPDs or similar documentation identifying their Product chemical content as specified herein.
- 2.2.1.3. Design, fabricate and erect preformed aluminum modular plate system to meet following requirements:
- 2.2.1.3.1. Rain Penetration: Prevent rain penetration through wall system.
- 2.2.1.3.2. Design system based on "Rain Screen Principle" by NRCC. Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or the formation of icicles.
- 2.2.1.3.3. Design metal framing system to support thermal insulation and plate system.
- 2.2.1.3.4. Wind Load: Design wall system to resist wind loads, positive and negative, expected in this geographical region (NBCC climatic data, 1 in 50 year probability) without causing rattling, vibration or excessive deflection of panels, over stressing of fasteners, clips and other detrimental effects on wall system.
- 2.2.1.3.5. Structural and Thermal Movement: Accommodate movement of supporting structural framing and movement caused by thermal expansion and contraction of system component parts without causing bowing, backing, delamination, oil canning, failure of joint seals, excessive stress on fasteners or any other detrimental effects.

- 2.2.1.3.6. Air/Vapour Barrier: Ensure it is continuous and sealed at joints, laps, terminations and penetrations to prevent air infiltration and exfiltration and to effectively retard moisture vapour migration through system.
- 2.2.1.4. Plate flatness tolerance applies to even rises and falls across plate. Local bumps and depressions will not be permitted. Fabricate plates not exceeding following tolerances:
 - 2.2.1.4.1. 1.5 mm (0.06") in a convex direction, measured perpendicularly to normal plane.
 - 2.2.1.4.2. 1.5 mm (0.06") in a concave direction, measured perpendicularly to normal plane.
- 2.2.1.5. Maximum deviation from vertical and horizontal alignment of erected plates: 6 mm (1/4") in 6 m (20' - 0").
- 2.2.1.6. Ensure maximum deviation from plate flatness is 3 mm (1/8") in 1500 mm (59") plate in any direction for assembled units (non-accumulative).
- 2.2.1.7. Structural Design: Employ a licensed engineer specified herein to:
 - 2.2.1.7.1. design components for work of this Section requiring structural performance.
 - 2.2.1.7.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.2.2. Air/Vapour Barrier Membrane:
 - 2.2.2.1. SAT Membrane: SBS modified bitumen or rubberized asphalt membrane, minimum 0.56 mm (22 mils) thick with polyethylene or polypropylene film membrane on 1 side and siliconized release paper on the other, cut to suit design and lap requirements, "Perm-A-Barrier Wall Membrane" by GCP Applied Technologies, Inc.; www.gcpat.com, "Blueskin SA/Blueskin SA LT" by Henry Company; www.henry.com, "Air Shield" by W. R. Meadows of Canada; www.wrmeadows.com, "ExoAir 110/110AT Self-Adhered" by Tremco Canada; www.tremcosealants.com or "SOPRASEAL STICK 1100T" by Soprema Inc.; www.soprema.ca.
 - 2.2.2.2. Primer: Recommended by membrane manufacturer.
- 2.2.3. Insulation: Semi-rigid stone wool board, CAN/ULC-S702.1, Type 1, minimum RSI=0.74 (R=4.2) per 25 mm (1") and having a minimum density of 69 kg/m³ (4.3 pcf), "ROCKWOOL™ CAVITYROCK®" by ROCKWOOL™ International A/S, "JM CladStone™ Water & Fire Block Insulation" by Johns Manville Canada Inc., thickness as indicated on Drawings.
- 2.2.4. Insulation Fasteners: Type N "Stik-Klip" fasteners and Type S neoprene adhesive, with self-locking washers by Eckel Industries of Canada Ltd., Morrisburg, "Insul-Anchors" by Continental Stud Welding Inc., or impale type, perforated 50 mm x 50 mm (2" x 2") cold rolled steel, 22 ga adhesive pack, spindle of 0.098 x 0.106" dia. annealed steel, length to suit insulation 25 mm (1") dia. washers of self-locking nylon by Fleck Bros. or 60 mm (2-3/8") diameter high density polyethylene (HDPE) fastener with integrated cap. Permitted Products: "X-IE - G 6/X-IE - GS Insulation Fastener" by Hilti (Canada) Corporation; www.hilti.ca or "Ramset T4 InsulFast™ System" by ITW Construction Products; www.itwconstruction.ca.
- 2.2.5. Preformed Aluminum Modular Plates:
 - 2.2.5.1. Plate Material: Type 3003 and/or 5052 aluminum alloy.
 - 2.2.5.2. Plate Thickness: 3 mm (1/8").
- 2.2.6. Plate, Wall and Soffit Accessories:
 - 2.2.6.1. Provide proprietary aluminum extrusions compatible with plate edges, manufacturer's standard profiles, vertical and horizontal joint closures and perimeter trim as required for a complete installation.
 - 2.2.6.2. Fasteners: As recommended by plate manufacturer, concealed and non-corrosive.

- 2.2.6.3. Extrusions and Extrusion Clips for Attaching Panels to Substructure: Purpose made aluminum. Install a separator between extrusions and sub-girts.
- 2.2.6.4. Joint Filler Strip: Same material as panels.
- 2.2.7. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.
- 2.2.8. Thermal Spacer System: 100% pultruded glass fibre and thermoset polyester resin with following characteristics:
- 2.2.8.1. Thermal Spacer Clip Thickness (Top, Base and Web): 4.8 mm (3/16") nominal.
- 2.2.8.2. Thermal Space Depth: 200 mm (8") nominal.
- 2.2.8.3. Depth Tolerance: +/-0.127 mm (0.005").
- 2.2.8.4. Spacer Fasteners: High hex head washer head with sharp twin lead threaded design of heat treated corrosion resistant coated steel.
- 2.2.8.5. Permitted Products: "Fiberglass Thermal Spacer" by Cascadia Windows Ltd.; www.cascadiawindows.com. Comparable thermal clip systems from other manufacturers not listed herein will be reviewed provided they meet requirements of this Specification.
- 2.2.9. Flashings: Panel design to include for corners, jambs and abutments. Flashings will not be permitted at these locations.
- 2.2.10. Sill flashings to be of matching gauge and finish as panels complete with reinforce back up splice plates at joints and directional changes.
- 2.2.11. Finishes: Provide 1 of following systems:
- 2.2.11.1. Superior Performance Coating Finish Process: (3 Coat Wet System (primer/colour coat/clear coat)) including thermal setting application of 70% fluoropolymer resin minimum, PVDF with added colour pigment finish exceeding or meeting AAMA 2605 requirements. Ensure fluoropolymer baked resins form a continuous physically locked finish during manufacturing process. Apply fluoropolymer finish after multistage chemical treatment cleaning providing corrosion resistance surface ready to receive primer. During baking process apply primer in accordance with manufacturer's recommendations followed by a flash process whereby evaporating solvent and then fluoropolymer finish sprayed on to aluminum; apply another flash procedure and then bake for approximately 10 minutes when aluminum surface reaches a temperature of 232 deg C (450 deg F). Permitted Products: "Duranar XL" by PPG Industries; www.ppgideascape.com or Fluoropon® Classic" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

Description

Performance Characteristics

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| 2.2.11.1.1. | Coating Thickness: | 0.0063 mm +/-0.0013 mm (0.25 +/-0.05 mils) primer 0.025 mm (1.0 mil) min barrier coat (if applicable) 0.025 mm (1.0 mil) min colour coat 0.015 mm +/-0.0005 mm (0.6 +/-0.02 mil) clear top coat |
| 2.2.11.1.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.11.1.3. | Gloss (ASTM D523 @ 60°): | Medium gloss |
| 2.2.11.1.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.2.11.1.5. | Abrasion Resistance Falling Sand (ASTM D968): | 50 l/ml |
| 2.2.11.1.6. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |

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| 2.2.11.1.7. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: 24 hours - no attack | |
| 2.2.11.1.8. | Colour Retention 10 yrs, 45° South Florida (ASTM D2244): | $\Delta E < 5.0$ |
| 2.2.11.1.9. | Humidity Resistance: ASTM D714, ASTM D2247, 4000 hrs, 100% R.H. @ 100°F: Few #8 blisters maximum | |
| 2.2.11.1.10. | Salt Spray Resistance: ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.2.11.1.11. | Chalking Resistance 10 yrs, 45° South Florida (ASTM D4214): | No more than #8 (#6 for Whites) |
| 2.2.11.1.12. | Erosion Resistance: 10 yrs, 45° South Florida (ASTM B244): | Maximum 5% |
| 2.2.11.2. | Superior Performance Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2605 with minimum 100% fluoropolymer resin. Permitted Product: "Interpon D3000 Fluoromax Powder Coating" by Akzo Nobel Coatings, Inc.; www.akzonobel.com with following characteristics: | |
| | Description | Performance Characteristics |
| 2.2.11.2.1. | Coating Thickness: | 0.060 mm to 0.115 mm (2.4 mils to 4.5 mils) with no reading less than 0.045 mm (1.8 mils) |
| 2.2.11.2.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.11.2.3. | Gloss (ASTM D523 @ 60°): | 20% - 40% |
| 2.2.11.2.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.2.11.2.5. | Abrasion Resistance Falling Sand (ASTM D968): | 40 l/ml |
| 2.2.11.2.6. | Colour Retention 10 yrs, 45° South Florida (ASTM D2244): | $\Delta E < 5.0$ |
| 2.2.11.2.7. | Humidity Resistance ASTM D714, ASTM D2247, 4000 hrs, 100% R.H. @ 100°F: Few #8 blisters maximum | |
| 2.2.11.2.8. | Salt Spray Resistance ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.2.11.3. | Colours and Sheens: Refer to "Material and Finish Schedule" appended to Section 00 01 20. | |
| 2.2.11.4. | Apply to metal exposed on interior and exterior with finishes specified herein to suit design requirements. Ensure colour and sheen are uniform with no visible variations. | |
| 2.2.11.5. | Painting: Ensure concealed surfaces of aluminum and galvanized steel which would otherwise come in direct contact with structural steel, concrete, masonry are given a heavy coating of bituminous paint. | |

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Do not install air/vapour barrier until other work which penetrates membrane has been completed.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Air/Vapour Barrier (SAT System):
 - 3.2.1.1. Priming:
 - 3.2.1.1.1. Apply fluid primer to concrete and masonry and other surfaces and allow to dry 1 hour or until tack-free. Prime only areas to be covered by membrane within 24 hours. Re-prime surfaces not covered within 24 hours.
 - 3.2.1.1.2. Apply primers at a rate recommended by SAT membrane manufacturer.
 - 3.2.1.2. Flashing, Corner Reinforcing and Transition Membrane:
 - 3.2.1.2.1. Install membrane flashing in 900 mm (36") widths. Where applicable, bring flashing a minimum of 150 mm (6") onto horizontal surfaces and a minimum of 200 mm (8") up walls from horizontal elevation shown.
 - 3.2.1.2.2. Type SAT membrane will be permitted materials for transition conditions at frames and like.
 - 3.2.1.2.3. Seal protrusions, expansion, control joints and the like in accordance with membrane manufacturer's written requirements.
 - 3.2.1.3. Installation:
 - 3.2.1.3.1. Install membrane in accordance with manufacturer's printed instructions over flashings and corner reinforcement.
 - 3.2.1.3.2. Lay membrane without buckles, fishmouths and avoid stretching membrane. Where membrane cannot extend at least 100 mm (4") onto horizontal surface, terminate in a horizontal reglet and seal.
 - 3.2.1.3.3. Lap membranes 65 mm (2-1/2") on side laps and 150 mm (6") on end laps. Stagger end laps.
 - 3.2.1.3.4. Roll membrane with 75 mm (3") wide hand roller.
- 3.2.2. Thermal Spacers: Install thermal spacers in accordance with spacer manufacturer's written recommendations and as follows:
 - 3.2.2.1. Pre-punch holes or pre-drill holes in Z-bars and tracks to accommodate fasteners.
 - 3.2.2.2. Position Z-bars directly over thermal spacer before installation of fasteners.
 - 3.2.2.3. Completely install thermal spacers and screws for first Z-bar/track. For subsequent girts:
 - 3.2.2.3.1. Fasten top thermal spacer with single screw through Z-bar and thermal spacer into substrate ensuring thermal spacer can pivot for accurate alignment.
 - 3.2.2.3.2. Install insulation in place as specified herein before completing installation of remaining screws to secure Z-bar and thermal spacers.

- 3.2.3. Insulation:
 - 3.2.3.1. Ensure surfaces to receive insulation are dry and free of matter detrimental to uniform bedding of insulation.
 - 3.2.3.2. Fix insulation clip type fasteners on substrate, 5 per 600 mm x 1200 mm (24" x 48") board minimum. Impale insulation board on insulation clips, butting joints firmly together and secure with washers, cut off spindles 3 mm (1/8") beyond washer or apply insulation fasteners through insulation with a "Ramset T4MAG Gas Tool".
 - 3.2.3.3. Install insulation to maintain continuity of thermal protection to building elements and spaces.
- 3.2.4. Wall Plate System:
 - 3.2.4.1. Erect plates and joint filler strip in accordance with system manufacturer's details and instructions and so as to meet specified design and performance requirements.
 - 3.2.4.2. Ensure finished work is securely anchored, free of distortion and surface imperfections, uniform in colour and gloss.
 - 3.2.4.3. Use concealed fastenings only, except where exposed fastenings are specifically permitted by Consultant in writing.
 - 3.2.4.4. Install plates plumb, true, level and in alignment to established lines and elevations.
 - 3.2.4.5. Where indicated on Drawings or as required to complete work of this Section, supply and install closures, caps, fascias, covers and trims with colour matching plate finish, where exposed.

3.3. REPAIR

- 3.3.1. Repair and touch-up with colour matching high grade enamel minor surface damage, only where permitted by Consultant and only where appearance after touch-up is reviewed by Consultant.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections:
 - 3.4.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
 - 3.4.1.2. Air/Vapour Barrier Inspection: Inspect membrane for punctures, misaligned seams and fishmouths, apply additional layer of membrane over affected area, extending minimum of 150 mm (6") beyond damaged area in all directions.
- 3.4.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
- 3.4.3. Manufacturer Services: Arrange for Product manufacturer's technical representative to:
 - 3.4.3.1. meet and discuss installation procedures and unique conditions at the Place of the Work.
 - 3.4.3.2. inspect substrate surfaces and recommend solutions to accommodate adverse conditions.
 - 3.4.3.3. periodically visit and inspect the installation and report unsatisfactory conditions to Contractor.
 - 3.4.3.4. attend final inspection and submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.
 - 3.4.3.5. Ensure membrane manufacturer's representative is on site at beginning of installation to provide training and supervision of Contractor's personnel in installation of air/vapour barrier. Ensure manufacturer's representative provides frequent inspection visits thereafter to assure quality and competence of membrane installation.

3.5. CLEANING

- 3.5.1. Clean exposed plate surfaces in accordance with manufacturer's instructions.

3.6. PROTECTION

- 3.6.1. Protect finish and edges using a plastic film adhered to panel in accordance with panel manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide modified bituminous membrane roofing including but not limited to following:
 - 1.2.1.1. cleaning deck surface.
 - 1.2.1.2. roof sheathing.
 - 1.2.1.3. vapour retarder.
 - 1.2.1.4. roof insulation.
 - 1.2.1.5. insulation overlay board.
 - 1.2.1.6. roof membrane and flashings (cold applied).
 - 1.2.1.7. roof accessories.
 - 1.2.1.8. roof walkways.
 - 1.2.1.9. removal and replacement and tying into existing roofing systems.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Except for areas of existing roofing requiring patching and Making Good, stripping of existing roofing membrane and insulation: Section 02 41 00, Demolition and Salvage.
 - 1.2.2.2. Cutting existing roof slabs: Section 02 41 00, Demolition and Salvage.
 - 1.2.2.3. Reglets, through wall flashings and air/vapour barrier installation: Section 04 20 00, Masonry Units.
 - 1.2.2.4. Metal deck roof substrate: Section 05 31 10, Steel Deck.
 - 1.2.2.5. Provision of wood blocking: Section 06 10 00, Rough Carpentry.
 - 1.2.2.6. Supply of miscellaneous air/vapour barriers to complete continuity of air/vapour barrier integrity: Section 07 25 00, Miscellaneous Air/Vapour Barriers.
 - 1.2.2.7. Supply of prepainted flashings: Section 07 62 00, Sheet Metal Flashing and Trim.
 - 1.2.2.8. Sealants except for sealant required for roof flashings: Section 07 92 00, Joint Sealants.
 - 1.2.2.9. Supply and installation of roof drains: Division 22, Plumbing.
 - 1.2.2.10. Vent pipes and connection of vent pipes: Division 22, Plumbing.
 - 1.2.2.11. Prefabricated curbs for mechanical equipment on roof and counter flashings for ducts passing through roof: Division 23, Heating, Ventilating and Air Conditioning.
- 1.3. REFERENCES
 - 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CRCA: Canadian Roofing Contractors' Association; www.roofingcanada.com.
 - 1.3.1.2. FM: Factory Mutual Global; www.fmglobal.com.
 - 1.3.1.3. LTTR: Long Term Thermal Resistance.

- 1.3.1.4. OBC: Ontario Building Code.
- 1.3.1.5. OIRCA: Ontario Industrial Roofing Contractors' Association; www.ontarioroofing.com.
- 1.3.1.6. PIMA: Polyisocyanurate Insulation Manufacturers Association; www.pima.org.
- 1.3.1.7. SBS: Styrene-butadiene-styrene.
- 1.3.1.8. SRI: Solar Reflectance Index.
- 1.3.1.9. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Definitions: Conform to ASTM D1079 for glossary of terms and definitions of roofing terminology.
- 1.3.3. Reference Standards:
 - 1.3.3.1. ASTM C509-06(15) - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
 - 1.3.3.2. ASTM C920-18 - Standard Specification for Elastomeric Joint Sealants
 - 1.3.3.3. ASTM C1177/C1177M-17 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - 1.3.3.4. ASTM C1278/C1278M-17 - Standard Specification for Fiber-Reinforced Gypsum Panel
 - 1.3.3.5. ASTM D1079-20 - Standard Terminology Relating to Roofing and Waterproofing
 - 1.3.3.6. ASTM D1622-20 - Standard Test Method for Apparent Density of Rigid Cellular Plastics
 - 1.3.3.7. ASTM D1623-17 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 - 1.3.3.8. ASTM D3273-16 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 1.3.3.9. ASTM D6163/D6163M-21 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using glass Fiber Reinforcements
 - 1.3.3.10. ASTM E84-23 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.3.11. ASTM E136-19a - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C
 - 1.3.3.12. CAN/CSA-A123.21-14 - Standard test method for the dynamic wind uplift resistance of membrane-roofing systems
 - 1.3.3.13. CSA A123.23-15(20) - Product specification for polymer-modified bitumen sheet, prefabricated and reinforced
 - 1.3.3.14. CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - 1.3.3.15. CAN/ULC-S107-10(16) - Methods of Fire Tests of Roof Coverings
 - 1.3.3.16. CAN/ULC-S114-18 - Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - 1.3.3.17. CAN/ULC-S126-14(19) - Standard Method of Test for Fire Spread under Roof-Deck Assemblies
 - 1.3.3.18. CAN/ULC-S704-17 - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced

- 1.3.3.19. CAN/ULC-S770-15(20) - Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams
- 1.3.3.20. UL 1256-18 - Standard for Fire Test of Roof Deck Constructions

1.4. ADMINSTRATIVE REQUIREMENTS

1.4.1. Preinstallation Meetings:

- 1.4.1.1. Arrange preinstallation meeting 1 week before commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, manufacturer's technical representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
- 1.4.1.2. Review installation procedures and coordination required with related work including roofing requirements for interfacing with roof accessories and roof mounted equipment.
- 1.4.1.3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
- 1.4.1.4. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
- 1.4.1.5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
- 1.4.1.6. Review structural loading limitations of roof deck during roofing.
- 1.4.1.7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs and condition of other construction that will affect roofing system.
- 1.4.1.8. Review temporary protection requirements for roofing system during and after installation.
- 1.4.1.9. Review roof observation and repair procedures after roofing installation.

1.4.2. Scheduling:

- 1.4.2.1. Co-operate fully with other Subcontractors on the Work and promptly proceed with this work as rapidly as job conditions permit.
- 1.4.2.2. Supply items to be built in, in ample time to be incorporated into work of other Subcontractors as it is carried up. Proceed with insulation, roofing and flashing work as soon as walls and roof decks are ready to receive same.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit Product data on membrane, bitumen and flashing materials.

1.5.2. Shop Drawings:

- 1.5.2.1. Submit Shop Drawings in accordance with Section 01 30 00 showing method of installation and layout of each layer, fastening and flashings at edges, flashing of protrusions and penetrations, connection to air barrier in wall, details of insulation, tapered insulation layouts and vapour retarder and securement details of sheathing.
- 1.5.2.2. Ensure Shop Drawings include wind (uplift) design loads, typical reactions and support movement allowances, both horizontal and vertical in accordance with CAN/CSA-A123.21.

- 1.5.2.3. Ensure Shop Drawings have been reviewed and accepted by membrane manufacturer. Provide written confirmation on membrane manufacturer's letterhead.
- 1.5.2.4. Ensure a licensed engineer specified herein is responsible for:
 - 1.5.2.4.1. production and review of Shop Drawings.
 - 1.5.2.4.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.5.3. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.5.3.1. insulation: 300 mm x 300 mm (12" x 12") square.
 - 1.5.3.2. base sheet roofing membrane: 300 mm x 300 mm (12" x 12") square.
 - 1.5.3.3. cap sheet roofing membrane: 300 mm x 300 mm (12" x 12") square.
- 1.5.4. Test and Evaluation Reports:
 - 1.5.4.1. If requested, provide Product test reports based on evaluation of comprehensive test performed by manufacturer and witnessed by a qualified independent testing agency for components of roofing system.
 - 1.5.4.2. Indicate components of roofing system comply with requirements of these Specifications including quantity, statistical and descriptive data for each Product and other data pertaining to date, time and temperature for each load of bulk asphalt.
- 1.6. CLOSEOUT SUBMITTALS**
 - 1.6.1. Operation and Maintenance Data:
 - 1.6.1.1. Supply necessary maintenance data and repair instructions for binding into maintenance manuals described in Section 01 70 00.
 - 1.6.1.2. Bind into each maintenance manual, Project name, location, dated and executed copy of manufacturer's guaranty, described herein and name, address and phone number of nearest manufacturer's representative. Include recommendations for periodic inspections, care and maintenance. Identify common causes of damage with instructions for temporary patching until permanent repair can be made.
- 1.7. QUALITY ASSURANCE**
 - 1.7.1. Qualifications:
 - 1.7.1.1. Manufacturers: Company specializing in manufacturing Products specified in this Section with minimum 10 years successful experience.
 - 1.7.1.2. Installers: Provide work of this Section executed by competent installers fully conversant with standards, methods and techniques required, with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers. Ensure roofer is qualified and approved by membrane manufacturer and is a member in good standing in CRCA.
 - 1.7.1.3. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
 - 1.7.2. Conform to CRCA's "CRCA Roofing Specifications Manual", except where indicated or specified otherwise.
 - 1.7.3. Do roofing work employing roofing Products, roof sheathing, plates and fasteners recommended by FM data for wind uplift requirements.
 - 1.7.4. More stringent requirements in Consultant's opinion governs.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver materials to a dry location, in original containers with manufacturer's wrappers and seals intact. Carefully unload to prevent damage thereto.
- 1.8.2. Storage and Handling Requirements:
- 1.8.2.1. Store materials in dry location, in original containers with manufacturer's wrappers and seals intact. Carefully place in temporary storage in a manner to prevent damage thereto.
- 1.8.2.2. Keep membrane materials dry, stored in rolls standing on end, selva edge up, elevated from contact with moisture, at temperatures not less than 5 deg C (41 deg F) or more than 49 deg C (120 deg F) and pre-conditioned before installation. Handle rolls with care to avoid crushing, puncturing or other damage. Ensure selva edge is not damaged during handling and banding strips are removed before application of membrane. Do not use wet or damp membrane.
- 1.8.2.3. Do not expose insulation and roof sheathing to wet weather. Store and handle insulation to prevent broken edges and corners, punctures, indentations or other damage. Follow PIMA Technical Bulletin #109 for storage and handling of insulation. Remove damaged insulation from site.
- 1.8.2.4. Protect sheet metal materials from bending and scratching.
- 1.8.2.5. Store adhesive, emulsion based waterproofing mastics, sealants and primers between 15 deg C and 26 deg C (59 deg F and 79 deg F) or restore to temperature ranges before use.
- 1.8.2.6. Store materials at site within temporary sheds or trailers; such facilities must be well sealed and kept at least 3 deg C (5 deg F) warmer than exterior ambient temperature to ensure materials remain dry in terms of roofing. Do not use wet, damp, frozen or damaged materials. Stack rolls of felt on end.
- 1.8.2.7. Do not store more than 1 Day's supply of materials on roof at any time. On roof, stack materials on pallets, and completely cover with incombustible waterproof tarpaulin whenever work is interrupted, or when there is precipitation of any kind. Securely tie covering to pallets in such way as to be weather tight. Plastic covers and shrinkwrap covers by manufacturers are not permitted for site storage and be removed upon delivery to roof.
- 1.8.2.8. Distribute materials stored on roof to stay within designated live load limits of roof construction. Provide ample bases under equipment and materials to distribute weight to conform to these live-load limits. Do not store materials on, or transport materials across, completed roof areas.
- 1.8.2.9. Store combustible materials away from heat and open flames. Protect and store materials in dry, ventilated area away from welding flame, spark and from elements or harmful substance.

1.9. SITE CONDITIONS

- 1.9.1. Ambient Conditions:
- 1.9.1.1. Do not apply any part of roofing system over damp materials, or during a period of damp weather.
- 1.9.1.2. Apply roofing only when air and surface temperatures are acceptable to manufacturer for application of their Product.
- 1.9.2. Existing Conditions:
- 1.9.2.1. Modifications are to take place on existing adjacent roof areas as part of work of this Section. Do not use existing roof areas as storage, except to extent required for removal, alteration and replacement work.
- 1.9.2.2. Existing roofing is covered by roofing warranty or guarantee. Obtain from Consultant all necessary information regarding such warranty or guarantee and notify guarantor, system manufacturer and guarantor roofing contractor, by letter before work is commenced on existing roofing system.
- 1.9.2.3. Execute alteration work in manner as to maintain existing warranty or guarantee.
- 1.9.2.4. Provide temporary protection as specified in Section 01 50 00, while existing construction is open.

1.10. WARRANTY

1.10.1. Manufacturer Warranty:

1.10.1.1. Warrant work of this Section using manufacturer's standard form of warranty for a period of 25 years against defects and/or deficiencies (total membrane system warranty; labour, material and workmanship) in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies resulting in water leakage within warranty period and render roofing membrane to a watertight condition to satisfaction of Consultant and at no expense to Owner.

1.10.1.2. In addition to above, provide to Owner a written warranty covering defects of workmanship for a period of 2 years commencing from date of Substantial Performance of the Work and agree to Make Good promptly any defects which occur or become apparent within warranty period in conjunction with membrane manufacturer's warranty. Ensure warranty is on either CRCA's or OIRCA's "Standard Form of Warranty".

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

2.1.1.1. Atlas Roofing Corporation; www.atlasroofing.com

2.1.1.2. CGC Inc.; www.cgcinc.com

2.1.1.3. Firestone Building Products Company; www.firestonebpco.ca

2.1.1.4. GAF Materials Corporation; www.gaf.com

2.1.1.5. Georgia-Pacific Canada LP; www.buildgpc.com

2.1.1.6. Henry Company; www.henry.com

2.1.1.7. Hunter; www.hunterpanels.com

2.1.1.8. IKO Industries Ltd.; www.iko.com

2.1.1.9. Johns Manville Roofing Systems Canada; www.jm.com

2.1.1.10. Soprema Inc.; www.soprema.ca

2.1.1.11. Unifix Inc.; www.unifix.com

2.1.2. Substitution Limitations: This Specification is based on Soprema Inc.'s, cold applied system with perimeter base sheet membrane and flashings being installed first. Comparable systems from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements:

2.2.1.1.1. Fire Hazard Classification: ULC Class C. Ensure complete roof meets ULC requirements for Class C, as applicable roof and other authorities having jurisdiction.

2.2.1.1.2. Sustainability Characteristics: Provide roofing materials with SRI of 78 or greater.

2.2.2. Performance/Design Criteria:

2.2.2.1. Roof Design: Employ a licensed engineer specified herein to:

2.2.2.1.1. design components for work of this Section requiring structural performance indicating:

2.2.2.1.1.1. design assumptions.

- 2.2.2.1.1.2. codes and standard which calculations are based upon.
- 2.2.2.1.1.3. materials proposed and their allowable shear and bending stresses.
- 2.2.2.1.1.4. maximum and minimum tolerance for proposed materials including anchors and spacing.
- 2.2.2.1.1.5. testing data to substantiate compliance with wind (uplift) design requirements.
- 2.2.2.1.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.2.2.2. Roof Type 1 (R1): Provide 2 ply SBS modified bituminous membrane roofing work over metal deck, including but not limited to following:
 - 2.2.2.2.1. metal deck (by others).
 - 2.2.2.2.2. roof sheathing.
 - 2.2.2.2.3. self-adhering vapour retarder sheet.
 - 2.2.2.2.4. insulation.
 - 2.2.2.2.5. insulation overlay board.
 - 2.2.2.2.6. perimeter base sheet membrane cold adhered.
 - 2.2.2.2.7. vented base sheet mechanically fastened.
 - 2.2.2.2.8. base sheet membrane adhered.
 - 2.2.2.2.9. cap sheet membrane cold adhered.
 - 2.2.2.2.10. self-adhesive base cap sheet flashings.
- 2.2.2.3. Roof Type 2 (R2): Provide 2 ply SBS modified bituminous membrane roofing work over concrete deck, including but not limited to following:
 - 2.2.2.3.1. concrete deck and sloped topping (by others).
 - 2.2.2.3.2. primer over concrete deck.
 - 2.2.2.3.3. self-adhering vapour retarder sheet.
 - 2.2.2.3.4. insulation.
 - 2.2.2.3.5. insulation overlay board.
 - 2.2.2.3.6. perimeter base sheet membrane self-adhered.
 - 2.2.2.3.7. vented base sheet mechanically fastened.
 - 2.2.2.3.8. base sheet membrane self-adhered.
 - 2.2.2.3.9. cap sheet membrane cold-applied.
 - 2.2.2.3.10. self-adhesive base cap sheet flashings.
- 2.2.3. General: Ensure materials are compatible and satisfactory to membrane manufacturer. Ensure sheet membrane materials are manufactured by 1 manufacturer and comply as a minimum with requirements of local jurisdictional authorities. Select appropriate type of insulation on basis of its total compatibility when incorporated into roofing system, including that of substrate, required thermal value as well as their ability to adhere components permanently and in a rigid manner in finished roofing system.

- 2.2.4. Roof Sheathing: Provide 1 of following:
- 2.2.4.1. Gypsum glass mat reinforced silicone treated board conforming to ASTM C1177/C1177M, non-combustible according to ASTM E136/CAN/ULC-S114 thermal barrier as tested to UL 1256/CAN/ULC-S126, flame spread 0, smoke developed 0 to ASTM E84/CAN/ULC-S102 and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 12.7 mm (1/2") or for fire rating requirement 16 mm (5/8") thick gypsum board 1200 mm (4') wide, maximum practical length, tapered edge as required, "DensDeck Prime Roof Board with EONIC™ Technology" by Georgia-Pacific Canada LP.
- 2.2.4.2. Gypsum-fibre roof board conforming to ASTM C1278/C1278M, non-combustible according to ASTM E136/CAN/ULC-S114 thermal barrier as tested to UL 1256/CAN/ULC-S126, flame spread 5, smoke developed 0 to ASTM E84/CAN/ULC-S102 and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 12.7 mm (1/2") or for fire rating requirement 16 mm (5/8") thick gypsum board 1200 mm (4') wide, maximum practical length, tapered edge as required, "Securock® Gypsum-Fiber Roof Board" by CGC Inc.
- 2.2.5. Parapet Sheathing: Supply moisture resistant lightweight concrete panels, 12.7 mm (1/2") thick, "PermaBase® DEK" by Unifix Inc. or "PermaBase® DEK" by Soprema Inc.
- 2.2.6. Fasteners:
- 2.2.6.1. Factory-coated steel fasteners and metal or plastic plates designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer. Ensure fasteners engage in steel deck a minimum of 19 mm (3/4").
- 2.2.6.2. "Premium No 12, UltraFast" hexagonal head fastener coated for corrosion resistance complete with locking plastic plates or galvalume metal plates, "Lexgrip Fasteners" or "Lexgrip Striker Anchors" complete with stress plate by Lexcan Ltd.
- 2.2.6.3. Screws: Zinc and dichromate plated.
- 2.2.6.4. Nails: Non-ferrous or galvanized steel, flat head, barbed roofing nails, size and type to suit application.
- 2.2.6.5. Metal Plates: 75 mm x 75 mm (3" x 3") with stiffening ribs as recommended by manufacturer.
- 2.2.6.6. Metal Discs: Flat caps of 25 mm (1") minimum diameter, 0.759 mm (22 ga) minimum sheet metal, formed to prevent dishing. No discs are required with roofing nails having 25 mm (1") diameter solid cap heads.
- 2.2.7. Joint Tape: Asphalt treated kraft paper, fibre reinforced, 100 mm to 150 mm (4" to 6") wide, self adhering.
- 2.2.8. Tape: Pressure-sensitive tape of type recommended by vapour retarder manufacturer for sealing joints and penetrations in vapour retarder.
- 2.2.9. Self-Adhering Vapour Retarder Sheet: 0.8 mm (30 mils) thick, polyethylene film laminated to layer of butyl rubber adhesive; permeance rating conforming to OBC requirements; cold-applied, with slip-resisting surface and release-paper backing. Provide primer when recommended by vapour retarder manufacturer, self-adhesive vapour retarder membrane "SOPRAVAP'R" by Soprema Inc., "Vapor-Blok® SA Self-Adhesive Vapour Barrier Membrane" by Henry Company, "IKO MVP (Modified Vapour Protector)" by IKO Industries Ltd., "JM Vapor Barrier SA" by Johns Manville Roofing Systems Canada or "V-Force™ Vapor Barrier Membrane" by Firestone Building Products Company.

- 2.2.10. Roof Insulation: Provide 1 of following:
- 2.2.10.1. Rigid Polyisocyanurate Insulation Boards: Square edged, closed cell polyisocyanurate foam manufactured using Hydrocarbon (HC), Zero Ozone Depleting Potential (ZeroODP) HCFC free blowing agents and integrally laminated to heavy, non-asphaltic, fibre reinforced, felt facers, meeting requirements of CAN/ULC-S704, Type 2, Class 2, CAN/ULC-S126 and CAN/ULC-S107. Provide total thickness as shown on Drawings and following:
- 2.2.10.1.1. Multiple Layers: Ensure maximum thickness for 1 layer of insulation is 66 mm (2.6") having compressive strength of 140 kPa (20 psi) and LTTR RSI (R) value of 2.64 (15) when determined in accordance with CAN/ULC-S770 per square edged layer.
- 2.2.10.1.2. Dimension Stability: 2% maximum linear change when conditioned at 70 deg C (158 deg F) and 97% relative humidity for 7 Days; curing time 24 hours minimum, plus an additional 24 hours minimum per inch (25 mm) of thickness, at a minimum of 16 deg C (60 deg F) before shipment from manufacturer.
- 2.2.10.1.3. Ensure maximum board size for loose laid and mechanically attached insulation boards is 1200 mm x 2400 mm, (4' x 8'), maximum board size for insulation boards adhered to substrate is 1200 mm x 1200 mm (4' x 4').
- 2.2.10.1.4. Ensure insulation is without limitations devoid of face-sheet delamination, edge cavitation, cupping, bowing, crushing or powdering. Provide thermal value and in multiple layers to thickness shown on Drawings. Provide "SOPRA-ISO" by Soprema Inc., "ACFoam®-II" by Atlas Roofing Corporation, "IKOtherm" by IKO Industries Ltd., "ENRGY® 3" by Johns Manville Roofing Systems Canada, "H-Shield Flat Polyisocyanurate Insulation" by Hunter or "Firestone ISO 95+GL" with perforated black glass reinforced mat laminated to face by Firestone Building Products Company.
- 2.2.11. Single layer insulating system combining base insulation and tapered insulation will not be permitted as substitute to multi layer insulating system.
- 2.2.12. Insulation Adhesive: As recommended by insulation manufacturer.
- 2.2.13. Insulation Overlay Board: Provide 1 of following:
- 2.2.13.1. Gypsum glass mat reinforced silicone treated board conforming to ASTM C1177/C1177M, non-combustible according to ASTM E136/CAN/ULC-S114 thermal barrier as tested to UL 1256/CAN/ULC-S126, flame spread 0, smoke developed 0 to ASTM E84/CAN/ULC-S102 and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 6 mm (1/4") thick gypsum board 1200 mm (4') wide, maximum practical length, tapered edge as required, "DensDeck Prime Roof Board with EONIC™ Technology" by Georgia-Pacific Canada LP.
- 2.2.13.2. Gypsum-fiber roof board conforming to ASTM C1278/C1278M, non-combustible according to ASTM E136/CAN/ULC-S114 thermal barrier as tested to UL 1256/CAN/ULC-S126, flame spread 5, smoke developed 0 to ASTM E84/CAN/ULC-S102 and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 6 mm (1/4") thick gypsum board 1200 mm (4') wide, maximum practical length, tapered edge as required, "Securock® Gypsum-Fiber Roof Board" by CGC Inc.
- 2.2.13.3. Semi-rigid asphaltic panel with factory-applied polyester reinforced SBS modified bituminous membrane, 7 mm (9/32") thick; "2-1 SOPRASMART BOARD" by Soprema Inc.
- 2.2.13.4. High density 690 kPa (100 psi) polyisocyanurate insulation with factory-applied polyester reinforced SBS modified bituminous membrane, 15 mm (19/32") thick; "2-1 SOPRASMART ISO HD" by Soprema Inc.
- 2.2.14. Cold Membrane Adhesive: Provide "COLPLY EF Adhesive" by Soprema Inc. or "MBA Gold® Elastomeric Modified Bituminous Adhesive" by Henry Company.
- 2.2.15. Perimeter Roofing Base Sheet Membrane:
- 2.2.15.1. ASTM D6163/D6163M, Type I, Grade S (CSA A123.23, Type A, Grade 2).

- 2.2.15.2. Heavy duty SBS modified bitumen perimeter membrane composed of a composite reinforcement (non-woven polyester and glass grid reinforcement weighing minimum 160 g/m²), lightly sanded top and underface with both edges of perimeter base membrane having a 200 mm (8") selvedge protected by a silicone-coated release film. Ensure membrane is minimum 2.2 mm (0.078") thick.
- 2.2.16. Field and Flashing Base Sheet Membrane and Gussets (Composite Reinforced):
- 2.2.16.1. ASTM D6163/D6163M, Type I, Grade S (CSA A123.23, Type A, Grade 2).
- 2.2.16.2. Heavy duty SBS modified bitumen membrane composed of a composite reinforcement (non-woven polyester and glass grid reinforcement weighting minimum 160 g/m²); top face lightly sanded, underface covered by silicone release plastic film. Ensure membrane is minimum 3.0 mm (0.125") thick.
- 2.2.17. Primer: Primer to enhance adhesion of self-adhesive membranes on porous surfaces compatible with self-adhesive under face as recommended by flashing base sheet manufacturer.
- 2.2.18. Roofing and Flashing Cap Sheet Membrane:
- 2.2.18.1. ASTM D6163/D6163M, Type I, Grade G (CSA A123.23, Type A, Grade 1).
- 2.2.18.2. Roofing and flashing cap sheet membrane having non-woven polyester and glass grid reinforcement (160 g/m²) and SBS modified bitumen. Ensure top face is self protected with coloured ceramic granules and under face is protected by silicone release plastic film. Ensure membrane is minimum 3.5 mm (138 mils) thick.
- 2.2.18.3. Ensure colour of ceramic granules on cap sheet are selected by Consultant from manufacturer's standard range.
- 2.2.19. Membrane Adhesive: Low VOC, low odour, 100% solids and solvent-free polyether-based adhesive. Permitted Products: "COLPLY EF" and "COLPLY EF FLASHING" by Soprema Inc. or "MBA Gold® Elastomeric Modified Bituminous Adhesive" by Henry Company.
- 2.2.20. Loose Granules: Matching granules of roofing cap sheet membrane for covering bitumen bleed out at same rate granular surface cap sheet 1 kg (2.2 lb) per 25 rolls.
- 2.2.21. Roof Penetration Sealing System: Roof penetrations sealing system composed of precast modular polyester curbs, polyester adhesive and 1-part moisture-cure, self-levelling, pourable sealer; "ChemCurb System" by Chem Link Inc., www.chemlinkinc.com, "SOPRAMASTIC BLOCK" by Soprema Inc. or "FillGard M" by Firestone Building Products Company.
- 2.2.22. Flexible Flashing Membrane: A 2-component polymethyl methacrylate-based (PMMA) liquid membrane combined with a fleece fabric to form a monolithic, self-flashing and self-adhering reinforced field membrane; "ALSAN RS 230 FLASH" by Soprema Inc., "Pumadeq™ Flex 31MV" by Henry Company or "Permaflash® System" by Johns Manville Roofing Systems Canada.
- 2.2.23. Joint backing: To be continuous, extruded, polyolefin foam, consisting of non-absorbing outer skin and highly resistant interior, non-gassing, cellular network of open and closed cells, sized 25% greater than joint width. Density: 2.0 lb/cu ft (ASTM D1622) Tensile strength: 25 psi (ASTM D1623) - Water absorption: 0.5% by volume (ASTM C509) - Deflection at 50% compression: 3 psi Recovery at 50%: 95% - Out-gassing: None - Temperature range: -45 deg F to 225 deg F.
- 2.2.24. Sealant: Non-sag type, 1 component polyurethane sealant conforming to ASTM C920, Type S, Grade NS, Class 25, Use NT, G, M, A and O. Supply in standard colours as selected.
- 2.2.25. Bituminous Paint: Heavy bodied, emulsion type paint which protects against electrolytic action on metals; recommended by installer and reviewed by Consultant.
- 2.2.26. Plastic Roofing Cement: As recommended by roofing membrane manufacturer.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Report any defects or irregularities in roof deck detrimental to roof application. Do not proceed until corrected.
 - 3.1.1.2. Allow poured concrete to cure for minimum 30 Days before placement of any roofing materials.
 - 3.1.1.3. Check deck is properly installed with required slopes to attain positive drainage and drains are connected.
 - 3.1.1.4. Ensure openings, walls and projections through deck are completed and affixed and reglets and nailing strips are in place prior to membrane installation. Cooperate with mechanical and/or electrical Divisions as necessary.
 - 3.1.1.5. Ensure deck substrate scheduled to receive roof system is smooth, dry, clean and free of sharp projections.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions:
 - 3.2.1.1. Protect walls where hoisting is necessary.
 - 3.2.1.2. Temporarily block drain pipes during application of roofing membrane. Remove blocking each night or when Work is not in progress and after Work of this Section is completed.
- 3.2.2. Surface Preparation:
 - 3.2.2.1. Immediately before any roofing materials are applied, clean decks of roughness, rubbish, dust, dirt, oil, grease, snow and ice perfectly clean and dry. Remove ice and snow and dry decks. Do not use salt or calcium to remove snow or ice.
 - 3.2.2.2. Do no roofing work during rain, fog, sleet or snow, or upon surfaces covered with dust, water, dew, ice, frost, snow and similar detrimental conditions.
 - 3.2.2.3. Ensure sleeves, anchors and other items to be secured to or pass through roof surfaces are installed. Verify that units and curbs are properly secured in place.

3.3. INSTALLATION

- 3.3.1. Cold Weather Application:
 - 3.3.1.1. Remove moisture from substrate before application of membrane.
 - 3.3.1.2. Follow daily weather forecasts to determine commencement of work or to anticipate possible suspension.
 - 3.3.1.3. At temperatures below 10 deg C (50 deg F), store membrane material in warm and dry storage until ready to use. Bring out to work area only enough rolls for immediate use.
- 3.3.2. Roof Sheathing on Metal Deck:
 - 3.3.2.1. Place roof sheathing with long axis of each sheet transverse to ribs, with end joints staggered and fully supported on ribs. Butt boards together to moderate contact. Adjust spacing so screws are centred on ribs.
 - 3.3.2.2. Hold roof sheathing in-place as required by site conditions until covered by complete roof system.

- 3.3.2.3. Mechanically fasten roof sheathing within a 1200 mm (4') margin around perimeter of roof deck. Use approved mechanical fasteners and plates at rate and pattern recommended by manufacturers. Provide minimum 1 screw per 0.372 m² (4 sq ft).
- 3.3.2.4. Tape joints in roof sheathing.
- 3.3.2.5. Temporarily cover roof sheathing not covered by membrane at the end of each Day's Work with polyethylene film.
- 3.3.3. Vapour Retarder Over Roof Sheathing:
 - 3.3.3.1. Self-Adhering Sheet Vapour Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapour retarder over area to receive vapour retarder, side and end lapping each sheet a minimum of 89 mm (3-1/2") and 150 mm (6") respectively. Seal laps by rolling.
 - 3.3.3.2. Install vapour retarder so it provides continuous barrier. Overlap and seal to adjacent air/vapour barrier at top of parapets and curbs to ensure air/vapour barrier continuity of building envelope. Repair punctures of vapour retarder caused by subsequent work.
- 3.3.4. Insulation:
 - 3.3.4.1. Before laying any insulation, inspect vapour retarder and repair damage, if any. Ensure surface is free of wrinkles, air pockets, fishmouths or tears.
 - 3.3.4.2. Lay roof insulation except boards with ship lapped edges, in 2 layers, top side up in parallel courses and stagger end joints in adjacent courses and stagger joints in adjacent layers. Bring each board into moderate contact with adjacent boards and do not force into place.
 - 3.3.4.3. Cover entire area of base insulation with tapered insulation. Lay in accordance with manufacturer of tapered insulation's Shop Drawings, with joints staggered from insulation joints. Lay each layer with adhesive. Tape joints in top layer of insulation.
 - 3.3.4.4. Cover entire area of tapered insulation with insulation overlay board. Lay with adhesive. Tape joints to prevent adhesive seepage.
 - 3.3.4.5. Secure overall insulation assembly including insulation overlay board through vapour retarder into steel roof deck with screw and plate type fasteners as specified. Install 6 fasteners per 1200 mm x 2400 mm (4' x 8') top layer insulation board, 4 fasteners per 1/2 board and a minimum of 2 fasteners per partial piece.
 - 3.3.4.6. Where insulation and insulation overlay board abuts an irregular surface, scribe to profile thereof, elsewhere cut insulation square and neatly to provide plain butt joints at perimeter of insulation, at curbs and other vertical objects and surfaces.
 - 3.3.4.7. Lay only as much roof insulation and insulation board overlay that can be covered on same Day with roofing membrane. At conclusion of Day's work, seal exposed edges. Upon resumption of work, cut and remove sealed edges, square, neat and straight.
 - 3.3.4.8. Reduce thickness of insulation at drains by 13 mm (1/2") for 1200 mm (48") square centred on each drain to ensure free flow to drain.
 - 3.3.4.9. Keep insulation, tapered insulation and insulation board overlay dry at all times.
- 3.3.5. Membrane:
 - 3.3.5.1. Unroll membrane and allow roll to relax in sunlight for 30 to 45 minutes before application. Reroll from both ends and apply in both directions.
 - 3.3.5.2. Use only roofing equipment approved by manufacturer of roofing membrane system. Install roofing membrane and membrane flashings in accordance with manufacturer's printed directions.
 - 3.3.5.3. Apply roofing as soon as possible after roof deck is finished and to meet Project construction schedule.
 - 3.3.5.4. Adjustments to specified roofing procedures caused by weather and site conditions are subject to Consultant's review.

- 3.3.5.5. Maintain equipment in good working order to ensure control of roofing operations and protection of work.
- 3.3.5.6. Ensure each part of roofing system is completely bonded to other unless otherwise specified.
- 3.3.5.7. Anchor roofing to meet requirements of Underwriter and jurisdictional authorities, minimum 1200 mm (4") around perimeter.
- 3.3.5.8. Lay roofing plies free from wrinkles, air pockets, fishmouths, tears and prominent lap joints. Embed them in a uniformly spread layer of bitumen.
- 3.3.5.9. Extend roofing sheets to outer edges of roof and up vertical surfaces.
- 3.3.6. Perimeter Roofing Base Sheet Membrane:
 - 3.3.6.1. Where recommended by manufacturer install perimeter roofing base sheet specified herein or install base sheet membrane field application as specified herein, immediately followed by installation of adhesive and/or mechanically fastened sheet flashing system specified herein.
 - 3.3.6.2. Ensure membrane substrate is rigid, dry, smooth, compatible, free of fins and sharp edges and clean of debris and foreign matter and no moisture is present on substrate at time of application of membrane.
 - 3.3.6.3. Install perimeter roofing base sheet membrane before field base sheet membrane. Position this membrane parallel to upstands and mop in-place using specified procedures. Position and unroll perimeter base sheet membrane to achieve correct overlap and alignment with roof line.
 - 3.3.6.4. Lay perimeter base sheet with 75 mm (3") side laps and 150 mm (6") end laps. Seal overlaps using heat gun and trowel adjacent to upstands and elsewhere before end of Working Day. Do not push roll, always unroll evenly. After installation of base sheet, bitumen must be cooled before walking on membrane.
 - 3.3.6.5. Ensure modified bitumen surface protected by silicone-coated release film is ready to receive flashing base membrane.
 - 3.3.6.6. Ensure flow out bead is present at all locations along lap edges. Avoid excessive asphalt seepage. Maximum seepage allowed is 6 mm (1/4").
- 3.3.7. Self-Adhesive Sheet Flashing System:
 - 3.3.7.1. Apply primer at a rate recommended by base sheet flashing membrane manufacturer over substrate free of rust, dust or any residue that may hinder adherence. Apply base sheet flashing membrane over dried and cured primer coat.
 - 3.3.7.2. Starting at slope bottom, unroll each roll dry. Do not immediately remove protective film of paper. Let stand for a few minutes before re-rolling. Once aligned, re-roll 1 end towards centre.
 - 3.3.7.3. Using sharp blade, cut through surface of protective film without cutting membrane. Remove small length of protective film and unroll exposed membrane for initial adherence. Continue removing protective film and advance roll. Ensure surface remains smooth. Avoid wrinkling or warping.
 - 3.3.7.4. Align roll properly. If roll is not properly aligned, do not push to 1 side or another. Instead, cut roll and realign properly. Overlap adjacent rolls 50 mm (2") by removing protective film from top face of side laps.
 - 3.3.7.5. Do not remove protective paper film before installation to avoid accumulation of any debris on exposed roll.
 - 3.3.7.6. Overlap end joints 50 mm (2"). Stagger end laps at least 300 mm (12").
 - 3.3.7.7. Provide gusset reinforcing at stress points of roof, inside and outside corners, vents and mechanical units. Apply self-adhesive gusset at every inside and outside corners before installing base sheet flashing membrane. Install in accordance with manufacturer's recommendations.

- 3.3.8. Field Base Sheet Membrane:
- 3.3.8.1. Ensure membrane substrate is rigid, dry, smooth, compatible, free of fins and sharp edges, and clean of debris and foreign matter and no moisture is present on substrate at time of application of membrane.
- 3.3.8.2. Start roofing application at lowest point of roof (edge or drain) to ensure water flows over laps of membrane. Proceed up slope at right angles to direction of flow.
- 3.3.8.3. Position and unroll membrane to achieve correct overlap and alignment with roof line. Re-roll 1 end minimum 3 m (10') and adhere to substrate. Complete application of remainder of sheet.
- 3.3.8.4. Install base sheet membrane on a surface coated with an adhesive applied at a rate of 6 to 8 L per 10 m² (2 to 2.10 U.S. gallons per 107 sq ft). Use a neoprene squeegee with 5 mm (3/16") notches.
- 3.3.8.5. Each seldedge will overlaps previous one by 100 mm (4") laterally along line provided for this purpose and by 150 mm (6") at the ends. Space end laps a minimum of 300 mm (12").
- 3.3.8.6. Apply adhesive for first 125 mm (5") of end laps with a steel trowel with 5 mm (3/16") notches. Complete application by welding last 25 mm (1") of end lap using an electrical hot-air welder and a membrane roller.
- 3.3.8.7. After placing base sheet on adhesive, apply pressure on whole surface with a membrane roller to ensure complete and uniform adherence.
- 3.3.8.8. At walls and vertical surfaces, extend membrane minimum 50 mm (2") on vertical surface and nailed at 300 mm (12") oc.
- 3.3.9. Field and Flashing Cap Sheet Membrane:
- 3.3.9.1. Do not apply cap sheet until base sheet and flashing have been applied and show no sign of defects.
- 3.3.9.2. Plan cap sheet application so side and end laps are offset from those of base sheet minimum 300 mm (12") for side and 450 mm (18") for end laps. Mark chalk line, centred on base sheets, where first course is to start. Unroll 2 m - 3 m (6' - 9') of membrane and line it up to chalk lines or to selvage edge. If roll goes out of line by more than 13 mm (1/2"), cut and re-align. Re-roll from both ends and apply in both directions.
- 3.3.9.3. Each seldedge will overlap previous one along lines provided for this purpose and will overlap by 150 mm (6") at the ends. Space end laps a minimum of 300 mm (12").
- 3.3.9.4. Adhere first 50 mm (2") of side laps with adhesive, then heat-weld last 50 mm (2") using an electrical hot-air welder and a membrane roller.
- 3.3.9.5. Install the cap sheet on a surface covered with adhesive applied at the rate of 6 to 8 L per 10 m² (2 to 2.10 U.S. gal per 107 sq ft) using a neoprene squeegee with 5 mm (3/16") notches. Apply adhesive for first 125 mm (5") of end laps with a steel trowel with 5 mm (3/16") notches. Complete application by welding last 25 mm (1") of end lap using an electrical hot-air welder and a membrane roller.
- 3.3.9.6. Immediately after placing cap sheet membrane on adhesive, apply pressure on whole surface with a membrane roller to ensure complete and uniform adherence.
- 3.3.9.7. Once cap sheet is installed, carefully inspect joints and surfaces. Take great care to ensure asphalt does not spread out over exposed part of cap sheet.
- 3.3.9.8. Cut out drain opening after drain clamps have been installed.
- 3.3.10. Mechanical Equipment and Supports:
- 3.3.10.1. Provide prefabricated mechanical supports on steel roof deck in locations indicated on Drawings and to requirements of Division 21, 22 and 23.
- 3.3.10.2. Install equipment supports in accordance with manufacturer's instructions.

3.3.11. Area Dividers: Construct area dividers within roof construction in locations indicated on Drawings.

3.4. REPAIR

3.4.1. Repairs to Existing Roofing:

3.4.1.1. Install new roofing system where existing roofing has been removed or damaged due to work of this Contract. Cut openings in existing roof system (except deck) required for Work. Protect and seal adjacent roofing from water and damage due to elements. Make Good roofing system to match existing as promptly as possible.

3.4.1.2. At junction of new roofing with existing, remove existing flashing, fascia and cant.

3.4.1.3. Trim edges of existing roofing to even, straight line.

3.4.1.4. In event of unexpected discovery of damaged and/or wet insulation in area of work, immediately notify Consultant. Consultant may authorize remedial work, if any, in writing. Do such remedial work, as addition to Contract.

3.4.1.5. Remove debris and waste material, clean deck and provide new vapour retarder, insulation, tapered insulation and roof membrane at disturbed area.

3.4.1.6. Install modified bituminous roofing system lapping onto existing membrane 200 mm and 300 mm (8" and 12"). Ensure watertight junction between existing and new roofing.

3.4.1.7. Make junctures at new equipment and altered or added vertical surfaces using modified bituminous flashing as specified, required or indicated.

3.4.1.8. Replace or repair metal flashings to match existing.

3.5. SITE QUALITY CONTROL

3.5.1. Site Tests and Inspections:

3.5.1.1. Owner may appoint an independent roofing inspection company.

3.5.1.2. If required by inspection company or by Consultant, make any cut tests. This Subcontractor will pay costs of such tests and Making Good afterwards to roofing.

3.5.1.3. Owner may engage independent inspection company to inspect work of this Section. Give at least 2 weeks' notice of starting work and allow inspector free access. Inspection may include thermographic survey of completed roof.

3.5.1.4. Inspection - Roof Levels:

3.5.1.4.1. Before roofing is commenced, inspect and check roof surfaces for levels.

3.5.1.4.2. Undertake a series of spot level checks to determine if there is any unevenness in roof decks which may result in pools of water being left on completed roofing in excess of 13 mm (1/2") depth.

3.5.1.4.3. Ensure deck has been inspected prior to start of roofing work.

3.5.2. Manufacturer Services: Ensure to arrange for membrane manufacturer representative's site visit on Day roofing is commenced and periodically thereafter, to ensure work is properly performed. Upon completion of work of this Section, ensure manufacturer's representative inspects roof and verifies quality of work to yield weathertight waterproofing roofing system and issue manufacturer's warranty. Ensure Manufacturer's representative informs Consultant, Contractor and Subcontractor executing work of this Section promptly in writing when inspection is complete and provide detailed report.

3.6. CLEANING

3.6.1. Waste Management: Discard and legally dispose components that cannot be applied within its stated shelf life to requirements of authorities having jurisdiction.

3.7. PROTECTION

- 3.7.1. Protect work of this Section from damage. Replace damaged work which cannot be satisfactorily repaired, restored or cleaned at no cost to Owner.
- 3.7.2. Provide protection covering out of 13 mm (1/2") thick plywood underlaid with 25 mm (1") thick polystyrene insulation board adhered to it, over roofed areas when working from, or over, such roof surfaces. Provide such protection below hoist rigs, ladders, pallets of material and in other circumstances where the roofing membrane is exposed to potential damage. Secure protection boards mechanically against windstorm loss.
- 3.7.3. Protect finished wall and roof surfaces against damage of any kind. Protect finished sheet metal work and membrane flashing against punctures and damage of any kind. Be responsible for damage sustained by work of this trade. Do not use equipment over the roofing materials which would cause damage to the materials in any way.
- 3.7.4. Protect surrounding work, and adjacent building and other property from damage during roofing operations.
- 3.7.5. Use protection covering specified in work areas and along work routes as required to prevent damage to steel deck or sheathing and roofing.
- 3.7.6. Protect existing and completed portions of roof from damage.
- 3.7.7. At conclusion of each Day's work, seal exposed edges of roof insulation. Remove when resuming work.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide sheet metal flashing and trim including but not limited to following:
 - 1.2.1.1. pre-painted metal coping flashings.
 - 1.2.1.2. miscellaneous metal flashings on roof.
 - 1.2.1.3. flashings at roof openings.
 - 1.2.1.4. scupper drains.
 - 1.2.1.5. caulking.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Metal cants and curb bodies: Section 05 31 10, Steel Deck.
 - 1.2.2.2. Wood copings, cants and curbs: Section 06 10 00, Rough Carpentry.
 - 1.2.2.3. Provision of high temperature resistant air/vapour barriers: Section 07 25 00, Miscellaneous Air/Vapour Barriers.
 - 1.2.2.4. Modified bituminous membrane roofing system: Section 07 52 16, Modified Bituminous Membrane Roofing.
 - 1.2.2.5. Sealing and caulking: Section 07 92 00, Joint Sealants.
 - 1.2.2.6. Flashing at curtain wall: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.7. Prefabricated curbs for mechanical equipment on roof and counterflashing for ducts penetrating roof: Division 23, Heating, Ventilating and Air Conditioning.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CRCA: Canadian Roofing Contractors' Association; www.roofingcanada.com.
 - 1.3.1.2. EPDM: Ethylene Propylene Diene Monomer.
 - 1.3.1.3. OIRCA: Ontario Industrial Roofing Contractors' Association; www.ontarioroofing.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM A653/A653M-23 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.2.2. ASTM C920-18 - Standard Specification for Elastomeric Joint Sealants

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Prior to commencing work for this Section, arrange for Contractor, installer and manufacturer's representative to meet on site and review conditions under which work is to be performed, installation procedures and inspect surfaces to receive this work.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Submit fully detailed Shop Drawings showing proposed method of shaping, forming, jointing, fastening and application of sheet metal work, in accordance with the Contract Documents. Submit lists of materials to be used to Consultant.
- 1.5.2. Samples: Submit a representative sample section of pre-painted metal flashing illustrating "S" lock jointing, minimum 600 mm (24") long, method to accommodate thermal movement, cleats and fasteners. Submit sample well in advance of material fabrication.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
 - 1.6.1.1. Installers:
 - 1.6.1.1.1. Ensure work of this Section is installed by a company specializing in sheet metal flashing work with 5 years documented experience and a member in good standing of CRCA.
 - 1.6.1.1.2. Conform to requirements contained in CRCA manual.

1.7. WARRANTY

- 1.7.1. Manufacturer Warranty: Warrant work of this Section for period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are limited to actual leakage, loosening and splitting of seams of flashings. Ensure warranty is on either CRCA's or OIRCA's "Standard Form of Warranty".

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Sheet Steel Concealed from View: Commercial quality galvanized sheet to ASTM A653/A653M, 0.607 mm (24 ga) thick minimum, Z275 (G90) zinc coated by hot-dip process.
- 2.1.2. Pre-painted Sheet Steel Exposed to View: Supply 0.607 mm (24 ga) minimum thickness, commercial quality, Type A to ASTM A653/A653M with Z275 (G90) zinc coating designation, pre-painted with "Perspectra Plus Series™" by Baycoat; www.baycoat.com or "WeatherXL™" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com, in colour(s) selected by Consultant.
- 2.1.3. Aluminum Flashings, Closures and Trim: AA 1100, H14 temper aluminum alloy, 1.0 mm aluminum sheet, finish to match curtain wall extrusion finish.
- 2.1.4. Slip Sheet: Rosin sized building paper; 1.2 mm thick EPDM strips or modified bituminous sheet "Bituthene® 3000" by GCP Applied Technologies, Inc.; www.gcpat.com, "Blueskin® WP200" by Henry Company; www.henry.com or "MEL-ROL® Rolled, Self-Adhering Waterproofing Membrane" by W.R. Meadows of Canada; www.wrmeadows.com.
- 2.1.5. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.
- 2.1.6. Bedding Compound: Rubber-asphalt type.
- 2.1.7. Plastic Cement: As recommended by installer and reviewed by Consultant.
- 2.1.8. Sealant: Supply 1 part polysulfide sealant conforming to ASTM C920, Type S, Grade NS.
- 2.1.9. Starter Strips: Of same material as flashing used, 1.214 mm (18 ga), minimum 38 mm (1-1/2") wide, interlocked with metal flashing.
- 2.1.10. Flashing Cleats, Starter Strips, Skirts, Clips and Backup Plates: Same as specified sheet metal, unless indicated otherwise, make cleats at best 50 mm (2") wide and interlocked with metal flashing.

- 2.1.11. Flashing Fasteners: Nails, screws, bolts and other fastening devices and fasteners finished to match metal being fastened where exposed to view. Size and type to suit applicable conditions. Use stainless steel where connecting directly to concrete.
- 2.1.12. Fabrication:
 - 2.1.12.1. Fabricate copings, parapet vertical flashings, flashings, curb counter flashing starter clips, strips and miscellaneous flashings in accordance with CRCA recommendations and to detail indicated.
 - 2.1.12.2. Form sections true to shape, accurate in size, square, and free from distortion or defects. Equally space joints in any 1 run of flashing to suit building module or window spacing and in all cases locate in consultation with Consultant before installation commences. Make dedicated flashings meeting the Project requirements for roof mounted equipment to details shown.
 - 2.1.12.3. Fabricate cleats and starter strips of same material as sheet, minimum 50 mm (2") wide, interlockable with sheet.
 - 2.1.12.4. Form pieces in longest practical lengths. Make joints to permit thermal movement. Make flashing surfaces free from building, warp, wave, dents, oil canning or other defects.
 - 2.1.12.5. Hem exposed edges on underside 13 mm (1/2"); mitre and seam corners.
 - 2.1.12.6. Form material with standing seam.
 - 2.1.12.7. Fabricate corners from 1 piece with minimum 450 mm (18") long legs; seam for rigidity, seal with sealant. Make corners square and surfaces straight and in true planes.
 - 2.1.12.8. Fabricate vertical faces with bottom edge formed outward 6 mm (1/4") and hemmed to form drip.
 - 2.1.12.9. Fabricate flashings to allow toe to extend 50 mm (2") over roofing gravel and paver. Return and brake edges. Form sheet metal pans 150 mm (6") nominal size, with 75 mm (3") upstand and 100 mm (4") flanges. Fill pans watertight with plastic cement.
- 2.1.13. Finishes:
 - 2.1.13.1. Shop prepare and prime exposed ferrous metal surfaces.
 - 2.1.13.2. Concealed metal surfaces to receive 1 coat of bituminous paint, 0.4 mm (1/64") thickness.
 - 2.1.13.3. Metal finishes designated on Drawings.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.
 - 3.1.1.3. Verify membrane termination and base flashings are in place, sealed and secure.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Field measure site conditions prior to fabricating work.

3.3. INSTALLATION

- 3.3.1. Conform to drawing details included in CRCA manuals.
- 3.3.2. Install copings, curb coverings, starter strips, (back-up plates), pipe collars and other flashings to details shown on Drawings.

- 3.3.3. Exposed fastenings will not be permitted in the Work.
- 3.3.4. Install starter strips where indicated or required to present a true, non-waving, leading edge. Anchor to back-up to provide rigid, secure installation.
- 3.3.5. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- 3.3.6. Insert flashings into reglets to form tight fit. Secure in place with plastic wedges. Seal flashings into reglets with sealant.
- 3.3.7. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations directed by Consultant.
- 3.3.8. Apply plastic cement compound between metal flashings and felt flashings.
- 3.3.9. Fit flashings tight in place. Make corners square, surfaces true and straight in planes and lines accurate to profiles.
- 3.3.10. Provide and maintain continuity of high temperature resistant air/vapour barrier to adjacent dissimilar materials. Seal to form weathertight seal between flashing and adjoining surfaces and between flashing and other work.
- 3.3.11. Sheet Steel Flashings: Ensure end joints where adjacent lengths of metal flashing meet are made using an "S-lock" joint as detailed on Drawings. Execute by inserting the end of 1 coping length in a 25 mm (1") deep "S" lock formed in the end of the adjacent length. Extend concealed portion of the "S" lock 25 mm (1") outwards and nail to substrate. Face nailing of joints will not be permitted.
- 3.3.12. Aluminum Flashings: Make end joints where adjacent lengths of metal flashing meet, using a 300 mm (12") long back-up flashing secured in place before installing flashing. Apply beads of caulking compound on face of back-up plate to seal ends of metal flashing. Leave 13 mm (1/2") wide space between ends of adjacent lengths of metal flashing. Fabricate back-up plates of same material and finish as metal flashing with which it is being used. Make back-up plate profile of flashing allowing for metal thickness.
- 3.3.13. Caulking: Caulk where required to form weathertight seal between flashing and adjoining surfaces and between flashing and other work of this Section. Caulking work consists of bedding between members where possible and with neatly formed caulking bead where exposed.

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. PROTECTION

- 3.5.1. Protect work of this Section from damage.
- 3.5.2. Protect reglets from ice formation during freezing weather.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide sprayed fire-resistive materials including but not limited to following:
 - 1.2.1.1. spray applied fire-resistive materials.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of structural steel: Section 05 12 00, Structural Steel.
 - 1.2.2.2. Provision of steel deck: Section 05 31 10, Steel Deck.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AWCI: The Association of the Wall and Ceiling Industries – International; www.awci.org.
 - 1.3.1.2. NIOSH: The National Institute for Occupational Safety and Health; www.cdc.gov/niosh.
 - 1.3.1.3. OBC: Ontario Building Code.
 - 1.3.1.4. SDS: Safety Data Sheets.
 - 1.3.1.5. SFRM: Sprayed Fire-Resistive Materials.
 - 1.3.1.6. TLV: Threshold Limit Value.
 - 1.3.1.7. UL: Underwriters Laboratories Inc.; www.ul.com.
 - 1.3.1.8. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ANSI/UL 263-14 - Fire Tests of Building Construction and Materials
 - 1.3.2.2. ASTM E84-23 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.2.3. ASTM E119-20 - Standard Test Methods for Fire Tests of Building Construction and Materials
 - 1.3.2.4. ASTM E605/E605M-19 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
 - 1.3.2.5. ASTM E736/E736M-19 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - 1.3.2.6. ASTM E759/E759M-92(20) - Standard Test Method for Effect of Deflection of Sprayed Fire-Resistive Material Applied to Structural Members
 - 1.3.2.7. ASTM E760/E760M-92(20) - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members

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| 1.3.2.8. | ASTM E761/E761M-92(20) | - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members |
| 1.3.2.9. | ASTM E859/E859M-93(20) | - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members |
| 1.3.2.10. | ASTM E937/E937M-93(20) | - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members |
| 1.3.2.11. | CAN/ULC-S101-14 | - Standard Methods of Fire Endurance Tests of Building Construction and Materials |
| 1.3.2.12. | CAN/ULC-S102-18 | - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |

1.4. SUBMITTALS

- 1.4.1. Product Data: Submit brand names and descriptive catalogue data of proposed Products as follows:
 - 1.4.1.1. Include complete test report in cases where references are not published by testing laboratories and where authority having jurisdiction has approved significant changes from tested assembly on basis of an engineering study; ensure study calculations accompany report.
 - 1.4.1.2. Where SFRM are scheduled to be applied directly over existing primed surfaces, or where contact is made with primed surfaces, submit letter from manufacturer of fireproofing signifying compatibility between all contact materials.
- 1.4.2. Certificates:
 - 1.4.2.1. Submit applicator's certification that SFRM have been applied in accordance with ULC or cUL Designs specified.
 - 1.4.2.2. Submit test results in accordance with CAN/ULC-S101 or ANSI/UL 263 for fire endurance and CAN/ULC-S102 or ASTM E84 for surface burning characteristics.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
 - 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Delivery and Acceptance Requirements: Deliver SFRM in original unopened containers bearing manufacturer's name, brand of Product, certification labels for fire hazard and fire resistance classifications (ULC or cUL labels).
- 1.6.2. Storage and Handling Requirements:
 - 1.6.2.1. Refer to Product SDS for precautionary measures during storage and handling.
 - 1.6.2.2. Store materials in dry, protected area, off ground in original undamaged, sealed containers. Discard any bags or containers that have been exposed to water before use.

1.7. SITE CONDITIONS

- 1.7.1. Ambient Conditions:
 - 1.7.1.1. Maintain air and substrate temperature of 5 deg C (40 deg F) for 24 hours prior to installation, during and for a minimum of 24 hours after application of materials. Provide heated enclosures to maintain temperatures.

- 1.7.1.2. Provide adequate air circulation and exhaust to outdoors to achieve total air exchange rate of 4 times per hour until material is completely dry.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; flaking, delamination, fibre loss, crazing and cracking or evidence of other defects of finish.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. A/D Fire Protection Systems Inc.; www.adfire.com
- 2.1.1.2. CAFCO Industries Inc.; www.cafco.com
- 2.1.1.3. GCP Applied Technologies, Inc.; www.gcpat.com
- 2.1.2. Substitution Limitations: Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification. No further substitutions will be permitted.

2.2. MATERIALS

- 2.2.1. Description:
- 2.2.1.1. Regulatory Requirements:
- 2.2.1.1.1. Ensure materials and applied systems have full acceptance by authorities having jurisdiction. Ensure minimum standards SFRM conform to OBC, Division B, Part 3, Subsection 3.1.7 "Fire-Resistance Ratings" and CAN/ULC-S101, ANSI/UL 263, ASTM E84 and ASTM E119.
- 2.2.1.1.2. Minimum physical performance standards are those stated herein. Materials having higher performance standards are not precluded from submission or review.
- 2.2.1.1.3. Conform to ULC or cUL providing restrained or unrestrained fire rating as scheduled to suit design requirements.
- 2.2.2. Performance/Design Criteria:
- 2.2.2.1. Fire-Resistive Materials: Inorganic mineral wool fibres; containing factory added mould inhibitors to prevent growth of organisms and fungi; listed in specified ULC or cUL design, providing fire rating specified and meeting physical performance characteristics as specified.
- 2.2.2.2. Steel members in floor and roof construction will be selected from designs in which loads are calculated using "Limit States Design" method. Beam or joist designs bearing language "Load Restricted - Assembly evaluated in accordance with Working Stress Design" method or similar Load Restricted language will not be permitted.
- 2.2.2.3. Provide materials certified as fire resistant by ULC or cUL in accordance with CAN/ULC-S101, ANSI/UL 263 or ASTM E119 and are asbestos free.
- 2.2.2.4. Ensure materials do not induce deterioration of members to which they are applied.
- 2.2.2.5. Ensure bonding agents, binders, accessories, cleaning solvents, aggregates and sealers are in accordance with base material manufacturer's recommendation.
- 2.2.2.6. Ensure mixing water is potable, clear and free from injurious amounts of oil, acid, alkali, organic matter, sediment or any other deleterious or stain-producing substances.

- 2.2.3. Fiberglass Mesh: Symmetrical, interlaced glass fibre made from twisted multi-end strands with alkaline resistant coating of 32.21 - 36.28 g/m² (0.95 - 1.07 oz/sq yd), for compatibility with system materials. Ensure mesh is shift-proof, with trimmed roll edges to minimize building on overlapped seams. Ensure nominal Greige weight of mesh is 130.54 g/m² (3.85 oz/sq yd). Ensure reinforcing mesh adhesive is water resistive type glue with permitted characteristics and manufacturer, suitable for use intended.
- 2.2.4. Expanded Metal Lath: In sheet sizes of 685 mm x 2438 mm (27" x 96") from galvanized, copper alloy steel sheets. Use 9 mm (3/8") rib lath at 7.05 kg/m² (3.4 lbs/sq yd).
- 2.2.5. Fibrous: "CAFCO® Blaze-Shield® II" by CAFCO Industries Inc., (of type listed by ULC for appropriate application) or similar type meeting performance criteria.
- 2.2.6. Sealer: Type recommended by SFRM manufacturer, qualified for use in ULC or cUL Design specified or indicated.
- 2.2.7. Physical Performance Characteristics:
- 2.2.7.1. Fibrous: Sprayed mineral fibre consisting primarily of inorganic virgin mineral wool fibres blended with property binders.

| | Characteristics | ASTM Tests References | Required Results |
|------------|------------------------|------------------------------|--|
| 2.2.7.1.1. | Corrosion | E937/E937M | Pass |
| 2.2.7.1.2. | Density | E605/E605M | 240 kg/m ³ (15 pcf) |
| 2.2.7.1.3. | Compressive Strength | E761/E761M | 35.9 kPa (750 psf) |
| 2.2.7.1.4. | Air Erosion Resistance | E859/E859M | < 0.27 g/m ² (< 0.025 g/sf) |
| 2.2.7.1.5. | Cohesion/Adhesion | E736/E736M | 7.2 kPa (150 psf) |
| 2.2.7.1.6. | Bond Impact | E760/E760M | No Cracks |

- 2.2.8. Mixes:
- 2.2.8.1. Mix SFRM with water at Project site to form a slurry or mortar before conveyance and application and as recommended by manufacturer.
- 2.2.8.2. Do not use partially set, frozen, caked or lumpy materials. Mix each batch separately in mechanical mixer and clean mixer free of particles before mixing new batch.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Examine surfaces to receive SFRM and report to Consultant any defects. Commencement of work implies acceptance of surfaces and conditions.
- 3.1.2. Ensure ducts, pipe, conduit and other items which would interfere with application of SFRM, have not been installed until SFRM work is completed.
- 3.1.3. Do not apply SFRM until clips, hangers, inserts, sleeves and similar items have been installed in areas to receive SFRM.
- 3.1.4. Verify application of high-performance corrosion protection primer on non-galvanized steel members and galvanized primer for galvanized perimeter steel and structural steel members to receive SFRM. Ensure primed surfaces to receive SFRM are compatible with SFRM and bond requirements.
- 3.1.5. Do not commence application of SFRM prior to completion of concrete work on steel decking.
- 3.1.6. Do not commence application of SFRM prior to completion of roofing application and roof traffic has ceased.

- 3.1.7. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions:
- 3.2.1.1. Provide temporary enclosures and masking to prevent spray from contaminating adjacent areas and surfaces.
- 3.2.1.2. Protect adjacent surfaces and equipment from damage by overspray, fall-out and dusting of SFRM.
- 3.2.2. Surface Preparation: Clean surfaces free of dust, dirt, oil, grease, loose paint, mill scale and other foreign matter which would interfere with bond of SFRM. Ensure surfaces to be sprayed are dry and reviewed by Consultant before spraying.

3.3. APPLICATION

- 3.3.1. Safety Precautions:
- 3.3.1.1. Respiratory Protection from Dust: Use NIOSH approved N95 dust mask for cementitious fireproofing application and NIOSH approved N95 respirators for mineral fibre fireproofing application.
- 3.3.1.2. Ventilation: Provide sufficient air supply to maintain dust levels below TLV.
- 3.3.1.3. Eye Protection: Wear dust goggles.
- 3.3.1.4. Protective Equipment: Wear loose fitting long sleeve shirt and pants when handling fireproofing materials.
- 3.3.2. Apply SFRM according to manufacturer's printed instruction, required ULC or cUL Design numbers and using spray equipment approved by manufacturer of fireproofing.
- 3.3.3. Apply SFRM to required total thickness and density.
- 3.3.4. Apply SFRM in accordance with manufacturer's recommendation and to ULC or cUL Designs requirements to suit design requirements for restrained and unrestrained conditions and as indicated on Drawings to achieve required ratings.
- 3.3.5. Water tamp fibrous SFRM after application to provide dense, medium smooth surfaces.
- 3.3.6. Board tamp fibrous SFRM when use in high velocity plenum and in vertical contact areas (i.e. columns in Mechanical Room) to provide additional surface protection.
- 3.3.7. Apply sealer or curing compound to surface of fibrous SFRM, as required by manufacturer.
- 3.3.8. Do cutting, patching and repairing of damage caused by work of this Section or of unsatisfactory fireproofing as directed. Repair areas cut out or damaged as result of testing.
- 3.3.9. Except as provided above, repair damaged SFRM at expense of those causing damage. Do repairs before SFRM are concealed, or if exposed, before final inspection.
- 3.3.10. After application clean off any overspray and broom clean floor.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections:
- 3.4.1.1. Carry out tests required by authorities having jurisdiction.
- 3.4.1.2. Owner may appoint independent inspection and testing company as specified in Section 01 40 00.
- 3.4.1.3. Inspector may perform tests in accordance with AWCI's "Technical Manual 12-A – Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials; an Annotated Guide".

- 3.4.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Waste Management:

- 3.5.1.1. Sweep up and place in disposal containers if material is accidentally released or spilled. Avoid inhalation of dust.

- 3.5.1.2. Use permitted landfill site for waste disposal.

3.6. PROTECTION

- 3.6.1. Protect during installation any adjacent finished surfaces from contamination and damage due to work under this Section.

- 3.6.2. Protect completed work, vulnerable corners, edges and surfaces liable to be damaged due to construction activities. Provide wood cover strips and sheet material as required to prevent damage.

- 3.6.3. Method and materials to effect protection are subject to review by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide intumescent fire resistive coatings including but not limited to following:
 - 1.2.1.1. preparation of substrate materials for application of intumescent fire resistive coatings.
 - 1.2.1.2. inspection of substrate materials for application of intumescent fire resistive coatings.
 - 1.2.1.3. water-based intumescent fire resistive coating system:
 - 1.2.1.3.1. primer coat for adhesion.
 - 1.2.1.3.2. intumescent base coat.
 - 1.2.1.4. inspection of intumescent fire resistive coating system thickness.
 - 1.2.1.5. protection of adjacent surfaces.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of structural steel: Section 05 12 00, Structural Steel.
 - 1.2.2.2. Provision of steel deck: Section 05 31 10, Steel Deck.
 - 1.2.2.3. Provision of applied fireproofing not covered in this Section: Section 07 81 00, Sprayed Fire-Resistive Materials.
 - 1.2.2.4. Provision of firestopping and smoke seals: Section 07 84 00, Firestopping and Smoke Seals.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AWCI: Association of Wall and Ceiling Industries – International; www.awci.org.
 - 1.3.1.2. DFT: Dry Film Thickness.
 - 1.3.1.3. HVAC: Heating, Ventilating and Air Conditioning.
 - 1.3.1.4. UL: Underwriters Laboratories Inc.; www.ul.com.
 - 1.3.1.5. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
 - 1.3.1.6. WHI: Warnock Hersey (Intertek); www.intertek.com.
- 1.3.2. Definitions:
 - 1.3.2.1. Intumescent: Foaming and swelling of a plastic or other material when exposed to high surface temperatures or flames, causing material to increase in volume and decrease in density as in an endothermic reaction. Usually containing chemically bound water which is used to elongate time before item being protected from heat or flame is affected.
 - 1.3.2.2. Intumescent Coatings: A family of Products, which when properly applied, offer protection to a substrate from flame spread or smoke generation, or (in the case of structural steel) protection from structural failure during a fire. This family of Products includes both intumescent fireproofing and intumescent paint Products. These may be inorganic or organic.

- 1.3.2.3. Intumescent Fireproofing: These Products are divided into 2 sub-categories: Intumescent thin-film coatings and intumescent mastic coatings.
- 1.3.2.4. Intumescent Mastic Fireproofing: An industry slang referring to intumescent mastic coatings.
- 1.3.2.5. Intumescent Mastic Coating: Mastics are a thicker application of intumescent thin-film coatings. They generally refer to solvent based intumescent. They are typically designed to be much more durable than thin-film intumescent coatings and do not offer a finish as aesthetically pleasing as thin-film intumescent coatings. These coatings may have additives such as fibres and other binder materials. Mastic coatings can be either single or multi-layered having a total thickness generally greater than 5.0 mm (197 mils). Mastic coatings may also be classified with respect to vapour hazard due to percent of solvent or other volatiles.
- 1.3.2.6. Intumescent Thin-Film Coatings: These factory mixed Products are intended to protect structural steel columns and beams from failure during a fire. They are typically designed to not only meet the fireproofing requirements but also to offer a more aesthetically pleasing, thin-film appearance more closely resembling a “paint-like” finish. Coatings are either single or multi-layered having a total thickness generally within the range of 0.5 mm (20 mils) to 5.0 mm (197 mils).
- 1.3.2.7. Surface Preparation: Cleaning or treating of substrate to be coated to ensure best possible bond between substrate and coating to be applied; remove surface contaminants that will affect performance of coating, without limitations such as oil, grease, salts, dust, dirt, rust scale, mill scale and old coatings where applicable. Remove surface imperfections without limitations such as weld spatter, sharp edges, burrs, slivers, laminations, pits, porosities and crevices. Prepare surfaces to provide anchor profile or surface profile which improve mechanical bonding of coating to prepared surface by increasing surface area.
- 1.3.3. Reference Standards:
- 1.3.3.1. ASTM D2240-15(21) - Standard Test Method for Rubber Property - Durometer Hardness
- 1.3.3.2. ASTM D2794-93(19) - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- 1.3.3.3. ASTM D4060-19 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- 1.3.3.4. ASTM D4541-22 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- 1.3.3.5. ASTM E84-23 - Standard Test Method for Surface Burning Characteristics of Building Materials
- 1.3.3.6. ASTM E119-22 - Standard Test Method for Fire Tests of Building Construction and Materials
- 1.3.3.7. ASTM E736/E736M-19(23) - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
- 1.3.3.8. ASTM E759/E759M-92(23) - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Materials Applied to Structural Members
- 1.3.3.9. ASTM E760/E760M-92(23) - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
- 1.3.3.10. AWCI - 12-B - Technical Manual 12-B, “Standard Practice for the Inspection of Field Applied Thin Film Intumescent Fire Resistive Material; an Annotated Guide
- 1.3.3.11. ISO 9001:2001 - Quality management systems - Requirements

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| 1.3.3.12. | SSPC-PA 2 | - Steel Structures Painting Council: Paint Application Specification No. 2 - Measurement of Dry Paint Thickness with Magnetic Gages |
| 1.3.3.13. | SSPC-SP 1 | - Steel Structures Painting Council (SSPC) Surface Preparation Standards - Solvent Cleaning |
| 1.3.3.14. | SSPC-SP 2 | - Steel Structures Painting Council (SSPC) Surface Preparation Standards - Hand Tool Cleaning |
| 1.3.3.15. | SSPC-SP 3 | - Steel Structures Painting Council (SSPC) Surface Preparation Standards - Power Tool Cleaning |
| 1.3.3.16. | SSPC-SP 6/NACE 3 | - Steel Structures Painting Council (SSPC) Surface Preparation Standards - Commercial Blast Cleaning |
| 1.3.3.17. | CAN/ULC-S102-18 | - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Coordination: Where access will be limited, coordinate installation of piping, ducts, conduit or other suspended equipment until application of intumescent fire resistive coatings is complete in that area.
- 1.4.2. Sequencing:
- 1.4.2.1. Coordinate sequence of work with other installers of work that need to penetrate intumescent fire resistive coatings, to avoid unnecessary damage and patching.
- 1.4.2.2. Coordinate sequence of work with other installers of work that would obstruct access to surfaces to be fireproofed.
- 1.4.3. Scheduling: Cooperate in coordination and scheduling of intumescent fire resistive coatings work to avoid delays in Work Schedule.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit in accordance with Section 01 30 00. Submit Product data indicating:
- 1.5.1.1. Product characteristics.
- 1.5.1.2. storage and handling requirements and recommendations.
- 1.5.1.3. performance and limitation criteria.
- 1.5.1.4. preparation instructions and recommendations.
- 1.5.1.5. application instructions, field application manual, methods and performance.
- 1.5.1.6. ULC Design Listings for specific applications required.
- 1.5.2. Certificates:
- 1.5.2.1. Submit certification of acceptability of intumescent fire resistive coating materials to authorities having jurisdiction.
- 1.5.2.2. Provide a schedule indicating surfaces, ratings and thicknesses required for Project.
- 1.5.3. Test and Evaluation Reports:
- 1.5.3.1. Submit test reports and certificates as requested showing conformance with ULC or cUL approved designs, acceptable to authorities having jurisdiction. Verify hourly rating, influence of coating's expansion and ability to retain insulating char layer on structural steel with manufacturer's test data.

- 1.5.3.2. In cases where such test reports are not available and/or where changes to such test reports are required, arrange, pay for and submit test reports on basis of engineering studies and tests from an accredited testing company acceptable to authorities having jurisdiction.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
- 1.6.1.1. Manufacturers:
- 1.6.1.1.1. Ensure manufacturer is a company specializing in manufacturing Products for a minimum of 10 years.
- 1.6.1.1.2. Ensure manufacturer's quality management system has been assessed and registered by an independent registrar in accordance with requirements of ISO 9001.
- 1.6.1.2. Installers:
- 1.6.1.2.1. Provide work of this Section executed by competent applicator with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.6.1.2.2. Ensure applicator is approved and licensed for this type of work by manufacturer of materials. Use equipment approved by intumescent fire resistive coating material manufacturer.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's unopened, undamaged containers, fully identified as to trade name, type and other identifying data. Ensure packages bear ULC or cUL labels and seals for fire resistance ratings.
- 1.7.2. Storage and Handling Requirements:
- 1.7.2.1. Store Products in dry, protected area off ground in original, undamaged sealed containers bearing manufacturer's labels, application instructions and certification labels for fire hazard and fire resistance classifications. Ship and store materials [between 10 deg C (50 deg F) and 38 deg C (100 deg F)] [at temperatures recommended by material manufacturer]. Do not freeze. Check freeze-watch indicators before allowing delivery of water-based Products unless they are immediately stored in temperature controlled spaces.
- 1.7.2.2. Remove damaged packages found unsuitable for use and any materials which have come into contact with contaminants prior to use.
- 1.7.2.3. Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions. Do not store in direct sunlight. In enclosed areas, ensure ventilation is not less than 4 complete air exchanges per hour.
- 1.7.2.4. Store and dispose of solvent-based materials and materials used with solvent-based fire resistive coating materials in accordance with requirements of local authorities having jurisdiction.

1.8. SITE CONDITIONS

- 1.8.1. Ambient Conditions:
- 1.8.1.1. Comply with manufacturer's recommended requirements for ambient and substrate temperature, relative humidity and substrate moisture content during application and curing of materials.
- 1.8.1.2. Temperature and Humidity Requirements for Water-Based Intumescent Fire Resistive Coatings: Maintain air temperature and relative humidity conditions as recommended by manufacturer in spaces where Products will be installed throughout entire application and drying period until coatings are fully dried[, including any interim period prior to application of topcoat].
- 1.8.1.3. Ensure heat is uniformly distributed and adequate ventilation and dehumidification equipment (as required) is provided during application and minimum 24 hours after application of final coat of intumescent fire resistive coating is applied.

- 1.8.1.4. Provide temporary enclosures as necessary to control conditions.
- 1.8.1.5. When ambient temperatures are less than 10 deg C (50 deg F), follow manufacturer's instructions for cold weather installation.
- 1.8.1.6. Relative Humidity: Water-based - 40% to 60% in work area. Not to exceed following:
 - 1.8.1.6.1. Maximum of 75% relative humidity during application and drying of intumescent coating.
- 1.8.1.7. Provide dehumidification as required to maintain humidity range and facilitate drying.
- 1.8.1.8. Maintain ventilation after application of intumescent fire resistive coatings in accordance with manufacturer's recommendations.

1.9. WARRANTY

- 1.9.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; cracks, chalking, spalling, separation and blistering.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. A/D Fire Protection Systems Inc.; www.adfire.com
 - 2.1.1.2. CAFCO Industries Inc. by Isolatek International; www.cafco.com
 - 2.1.1.3. Carboline Protective Coatings and Linings; www.carboline.com
 - 2.1.1.4. Hilti (Canada) Corporation; www.hilti.ca

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
 - 2.2.1.1. Fireproofing: Provide thin-film intumescent fire resistive coating system, tested by independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction:
 - 2.2.1.1.1. Listed by ULC, WHI, or FM Global and bearing their label.
 - 2.2.1.2. Apply intumescent fire resistive coating materials to required thickness to provide required ULC fire resistive ratings.
 - 2.2.1.3. Be responsible for and ensure intumescent fire resistive coating materials and application, on their own and in combination with structural components and building assemblies provide specified fire resistance classification to approval of authorities having jurisdiction.
 - 2.2.1.4. Conform to fire rating requirements indicated on Drawings.
- 2.2.2. Intumescent Fire Resistive Coating Systems: Ensure intumescent fire resistive coating system is listed by ULC and bearing ULC or cUL label on each container.
- 2.2.3. Primer Coat: Corrosion inhibiting type primer for ferrous metal surfaces, hi-build type primer for irregular ferrous metal surfaces and permitted primer for galvanized surfaces as recommended by intumescent fire resistive coating material manufacturer for use with their Product to suit site conditions. As required by intumescent fire resistive coating manufacturer.

- 2.2.4. Base Coat: Provide base coat such as “A/D Basecoat” by A/D Fireproofing Systems Inc. as required by tested ULC fireproofing design with following characteristics:
 - 2.2.4.1. Deflection Resistance: Pass without spalling, cracking or delaminating, when tested in accordance with ASTM E759/E759M.
 - 2.2.4.2. Impact Resistance: Pass when tested in accordance with ASTM E760/E760M.
 - 2.2.4.3. Cohesion and Adhesion, Bond or Tensile: 24 kPa (502 psf) at 3 mm (120 mils) DFT, when tested in accordance with ASTM E736/E736M.
- 2.2.5. Glass Cloth: Self-adhesive, alkali resistant, 152 g/m² (4.5 oz/sq yd) glass mesh cloth for use as reinforcement when required by tested fire resistive design.
- 2.2.6. Water-Based Intumescent Fire Resistive Coating(s): Provide water-based intumescent thin-film and mastic fire resistive coat as follows:
 - 2.2.6.1. Permitted Products:
 - 2.2.6.1.1. “CAFCO® SprayFilm® WB 5” by Cafco Industries Inc.
 - 2.2.6.1.2. “A/D Firefilm III” by A/D Fire Protection Systems part of the Carboline Group of Companies (an RPM Company).
 - 2.2.6.1.3. “FIRE FINISH CFP-SP WB” by Hilti (Canada) Corporation.
 - 2.2.6.2. Characteristics:
 - 2.2.6.2.1. Thickness: As required by ULC, FM Global and/or WHI system.
 - 2.2.6.2.2. Surface Burning Characteristics:
 - 2.2.6.2.2.1. Flame Spread: Less than 5 when tested in accordance with ASTM E84 (Class A) and CAN/ULC-S102.
 - 2.2.6.2.2.2. Smoke Developed: Less than 35 when tested in accordance with ASTM E84 (Class A) and CAN/ULC-S102.
 - 2.2.6.2.3. Hardness: Minimum 63 when tested in accordance with ASTM D2240, using Durometer Hardness: Shore D.
 - 2.2.6.2.4. Bond Strength: Minimum 2344.2 kPa (340 psi) when tested in accordance with ASTM D4541.
 - 2.2.6.2.5. Impact Resistance: Intrusion minimum: 65 inch•lb) at 2 mm when tested in accordance with ASTM D2794.
 - 2.2.6.2.6. Abrasion Resistance: Maximum 0.14 g (0.005 oz) loss when tested in accordance with ASTM D4060 for 1,000 cycles.
- 2.2.7. Cleaning Solvents: In accordance with fireproofing manufacturer's recommendations.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Ensure ducts, pipe, conduit and other items which would interfere with application of intumescent fire resistive coatings have not been installed until intumescent fire resistive coating work is completed. Sequence work in conjunction with installation of ceiling hanger tabs, sprinkler pipes, HVAC systems, other mechanical systems and electrical equipment to avoid conflicts and damage to intumescent fire resistive coatings.
 - 3.1.1.2. Do not begin installation until substrates have been properly prepared to receive primers, basecoats or intumescent fire resistive coatings.

- 3.1.1.3. Do not apply intumescent fire resistive coatings until clips, hangers, supports, inserts, sleeves and similar devices have been installed in areas to receive intumescent fire resistive coating system application.
- 3.1.1.4. Identification marking of steel components must be by wax crayon to facilitate ease of removal prior to application of these intumescent fire resistive coatings.
- 3.1.1.5. Do not apply intumescent fire resistive coatings to underside of roof decks (if any) until roofing application is complete or concrete topping has been installed.
- 3.1.1.6. Start application only when surface, weather and local environmental conditions are satisfactory.
- 3.1.1.7. If substrate preparation is the responsibility of another trade, notify Consultant of unsatisfactory preparation before proceeding. Verify substrates are ready to receive intumescent fire resistive coatings.
- 3.1.1.8. Verify other work that would obstruct access to surfaces to receive intumescent fire resistive coatings has not yet been installed.
- 3.1.1.9. Verify sufficient clear working space is available. Make arrangements to install intumescent fire resistive coatings on inaccessible surfaces (less than 1 m (3') clear working access) prior to erection of steel members, either at point of fabrication or on-site.
- 3.1.1.10. Existing Condition: Verify substrate and workspace temperature and humidity conditions are in accordance with manufacturer's recommendations.
- 3.1.1.11. Ensure primers applied beneath intumescent fire resistive coatings are compatible with applied intumescent fire resistive coatings.
- 3.1.1.12. Where intumescent fire resistive coatings are to be exposed to view as a finished surface, verify surfaces are smooth, without voids, cracks or projections.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions: Mask or otherwise protect surrounding surfaces and areas. Install durable protective coverings on floors and adjacent walls and ceilings, to protect from overspray, fall-out and dusting.
- 3.2.2. Surface Preparation:
 - 3.2.2.1. Before application, permit materials to reach same temperature as surface temperature of steel by storing unopened containers in room or area where it will be applied.
 - 3.2.2.2. Remove identification markings on steel components and grind weld flashes smooth prior to commencement of application.
 - 3.2.2.3. Clean surfaces of dirt, dust, grease, oil, loose paint, rust, mill scale and other foreign matter which would interfere with bond of applied intumescent fire resistive coatings in accordance with SSPC-SP 1, SSPC-SP 2, SSPC-SP 3 or SSPC-SP 6/NACE No. 6 as recommended by intumescent fire resistive coating manufacturer. Ensure work to be protected is dry and has been reviewed before application of material.
 - 3.2.2.4. Seal penetrations and open ended intumescent fire resistive coating terminations as required by manufacturer.
 - 3.2.2.5. Prime galvanized and ferrous metal substrate surfaces in accordance with manufacturer's instructions. Ensure surfaces are completely covered. Allow to dry. Prepare surfaces using methods recommended by manufacturer for achieving best result for the substrate under Project conditions.
 - 3.2.2.6. Coordinate scheduling and sequencing of work with work specified in other Sections.

3.3. APPLICATION

- 3.3.1. Prime required surfaces unless existing primer is suitable and undamaged and compatible with intumescent fire resistive coating. Allow to dry.
- 3.3.2. Install base coat and reinforcing if required by intumescent fire resistive coating system design. Allow to dry. Re-coat where required. Repeat until required thickness is achieved.
- 3.3.3. Mix and apply intumescent fire resistive coatings in accordance with manufacturer's instructions and using equipment approved by manufacturer.
- 3.3.4. Apply intumescent fire resistive coating and topcoat by spray, brush or trowel applied as recommended by manufacturer to achieve fire rating requirements.
- 3.3.5. Apply intumescent fire resistive coating in number of coats required to achieve smooth uniform texture and total thickness necessary to provide required fire ratings. Allow to dry between coats as per manufacturer's required drying time. Apply subsequent coats only after previous coat has thoroughly dried.
- 3.3.6. Do not exceed wet film thickness per coat recommended by material manufacturer as detailed in manufacturer's drying guidelines (based upon temperature, relative humidity and air movement/ventilation). Use as many passes as necessary to cover with a monolithic coating of uniform hardness, density and texture.
- 3.3.7. Comply with specified fire resistive designs or use intumescent fire resistive coating thickness selection tables to determine DFT of intumescent fire resistive coating and basecoat if required, for sizes of steel elements being protected and for required fire resistance rating.
- 3.3.8. At ducts, pipes and similar items passing through fire protected structural members, extend intumescent fire resistive coating material 150 mm (6") on either side along penetrating item.
- 3.3.9. Measure final thickness with a calibrated DFT gauge in accordance with AWCI Technical Manual 12-B. Do not apply topcoat until it has been determined that required DFT of intumescent fire resistive coating has been provided. Determine DFT by field sample.
- 3.3.10. Conform to SSPC-PA 2 for method of thickness determination and in accordance with AWCI Technical Manual 12-B.
- 3.3.11. Allow minimum of 5 to 15 Days between application of final coat of intumescent fire resistive coating material and application of topcoat, as recommended by Product manufacturer.
- 3.3.12. Do cutting, patching and repairing of damages caused by work of this Section or of unsatisfactory intumescent fire resistive coating, as directed. Repair areas cut out or damaged as result of testing.
- 3.3.13. Where intumescent fire resistive coating is subsequently cut away to facilitate installation of other work, patch intumescent fire resistive coating to same thickness and texture after installation of other work at no cost to Owner.

3.4. REPAIR

- 3.4.1. Repair damaged work caused by other trades at expense of those causing damages.
- 3.4.2. Remove intumescent fire resistive coating system from surfaces not specifically required to be fireproofed.
- 3.4.3. Touch-up, repair or replace damaged Products before Substantial Performance.

3.5. SITE QUALITY CONTROL

- 3.5.1. Site Tests and Inspections:
 - 3.5.1.1. Perform tests required by authorities having jurisdiction as part of work of this Section.

- 3.5.1.2. Owner may engage services of an independent inspection and testing company to carry out inspection and testing of materials and application for Owner's quality control. Cost of such inspection and testing, if required, will be paid by Owner.
- 3.5.1.3. Conform to requirements of AWCI Technical Manual 12-B for testing and inspection of field applied intumescent fire resistive coating materials. Testing will occur immediately following complete drying of final thickness of intumescent fire resistive coat and before application of topcoat. Notify Consultant at least 7 Days in advance to allow prompt scheduling of testing.
- 3.5.1.4. Maintain complete record of environmental conditions such as continuous monitoring of air temperature, surface temperature, dew point temperature and percent relative humidity during and after application of intumescent fire resistive coatings. Deduct dew point temperature from surface temperature to determine probability of condensation. Accurately and non-destructively measure total DFT of intumescent fire resistive coating to determine if adequate coverage has been applied to protect structure for fire rating time required by authorities having jurisdiction during crisis situations. Make inspection report available to Consultant.
- 3.5.1.5. Do not proceed with topcoating and/or painting until testing has been completed.
- 3.5.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
- 3.5.3. Manufacturer Services:
 - 3.5.3.1. Before commencing work of this Section, have material manufacturer's representative examine surface conditions and verify substrate surfaces are ready to receive work. Arrange for periodic visits by manufacturer's representative while work is in progress to verify proper materials, methods and procedures are being followed.
 - 3.5.3.2. Verify cured intumescent fire resistive coating thickness at random locations chosen by and in presence of Consultant and manufacturer's representative.

3.6. CLEANING

- 3.6.1. Clean adjoining walls, floors, equipment, ducts, pipes and other surfaces coated as a result of work of this Section. Remove excess material, over spray, droppings and debris. Do cleaning in a permitted manner to prevent damage to finish work.
- 3.6.2. Clean intumescent fire resistive coating surfaces as recommended by manufacturer.

3.7. PROTECTION

- 3.7.1. Protect work area from inclement weather and moisture during application and curing of materials. Protect work area from windblown dust.
- 3.7.2. Protect installed Products and finish surfaces until completion of Project.
- 3.7.3. Touch-up, patch, repair or replace damaged Products before Substantial Performance, in accordance with material manufacturer's recommendations.
- 3.7.4. Remove temporary coverings and protection of adjacent work areas. Clean installed Products in accordance with manufacturer's instructions. Remove and legally dispose of construction debris.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide firestopping and smoke seals including but not limited to following:
 - 1.2.1.1. firestopping and smoke seals in accordance with Code requirements, at openings and around penetrations, at un-penetrated openings, at projecting and recessed items and at openings and joints within fire separations and assemblies having fire resistance rating, excluding those inside sealed mechanical and electrical assemblies (e.g. inside ducts, dampers, bus ducts, etc.).
 - 1.2.1.2. firestopping and smoke seals in accordance with Code requirements, at openings and spaces at perimeter edge conditions, excluding those inside sealed mechanical and electrical assemblies (e.g. inside ducts, dampers, bus ducts, etc.).
 - 1.2.1.3. firestopping and smoke seals between back of curtain wall and edge of slab.
 - 1.2.1.4. seals to form draft tight barriers to retard passage of flame and smoke and where specifically designated, passage of liquids while passing hose stream test.
 - 1.2.1.5. ensure seal provides and maintains a fire-resistance rating as determined by OBC for adjacent floor, wall or other fire separation assembly to requirements of and as acceptable to authorities having jurisdiction and to Consultant.
 - 1.2.1.6. firestopping and smoke seals in and around fire separations, including spaces around mechanical and electrical penetrations, at tops of fire walls, between slab edges and other gaps and penetrations at fire assemblies.
 - 1.2.1.7. ensure Divisions 20, 21, 22, 23, 26, 27 and 28 respectively are responsible for firestopping and smoke seals within mechanical (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside electrical bus ducts). Ensure firestopping and smoke seals around outside of such mechanical and electrical assemblies where they penetrate fire-rated separations are part of work of this Section.
 - 1.2.1.8. systems and specified Products are only a guide and may not address all firestopping conditions pertaining to situations which may be present in the Work. Provide firestopping and smoke seal required for the Work. These Products and systems are not presented to restrict other tested and approved listed assemblies of other manufacturers designing assemblies conforming to Code and resolving firestopping required for the Work.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Cutting and patching: Section 01 70 00, Execution and Closeout Requirements.
 - 1.2.2.2. Demolition: Section 02 41 00, Demolition and Salvage.
 - 1.2.2.3. Poured concrete slabs and walls: Section 03 30 00, Cast-in-Place Concrete.
 - 1.2.2.4. Masonry partitions including mortaring in of fire dampers: Section 04 20 00, Masonry Units.
 - 1.2.2.5. Provision of metal decking: Section 05 31 10, Steel Deck.
 - 1.2.2.6. Temporary sheet steel covers: Section 05 50 00, Metal Fabrications.
 - 1.2.2.7. Sealants and caulking: Section 07 92 00, Joint Sealants.
 - 1.2.2.8. Coordination with curtain wall system: Section 08 44 13, Glazed Aluminum Curtain Wall.

- 1.2.2.9. Gypsum board partitions: Section 09 21 16, Gypsum Board Assemblies.
- 1.2.2.10. Firestopping and smoke seals inside mechanical assemblies: Division 21, Fire Suppression, Division 22, Plumbing and Division 23, Heating Ventilating and Air Conditioning.
- 1.2.2.11. Firestopping and smoke seals inside electrical assemblies: Division 26, Electrical, Division 27, Communications and Division 28, Electronic Safety and Security.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:

- 1.3.1.1. IFC: International Firestop Council; www.firestop.org.
- 1.3.1.2. OBC: Ontario Building Code.
- 1.3.1.3. UL: Underwriters Laboratories Inc.; www.ul.com.
- 1.3.1.4. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.

- 1.3.2. Definitions:

- 1.3.2.1. Firestop System Types:

- 1.3.2.1.1. Head of Wall Joint Firestop Systems (HW): Systems intended for installation in vertical separations between wall and floor or roof structures. Ensure these systems do not incorporate penetrating items such as pipes or cables.

- 1.3.2.1.2. Joint Firestop Systems (JF): Systems intended for installation in openings such as construction joints, gaps and spaces in floors or walls or at floor and wall intersections in accordance with approved systems. Ensure these systems do not incorporate penetrating items such as pipes or cables.

- 1.3.2.1.3. Perimeter Joint Firestop Systems (PJ): Perimeter joint firestop system rating are governed by lowest of fire resistance ratings of individual components (i.e. wall, floor or joint system). These systems consist of floor with fire endurance rating, exterior wall with or without fire endurance rating and perimeter joint system. Ensure these perimeter joint firestop systems do not incorporate penetrating items such as pipes or cables.

- 1.3.2.1.4. Service Penetration Firestop Systems (SP): Systems intended for installation in openings of limited dimensions and shape in floor or wall assemblies in accordance with approved systems. Ensure penetrating pipes, cable trays and similar items are in exact accordance with approved systems.

- 1.3.2.1.5. Service Penetration for Combustible Systems (SPC): Systems intended for installation in openings of limited dimensions and shape in floor or wall assemblies in accordance with approved systems. Ensure penetrating pipes are in exact accordance with approved systems. These systems are tested with a minimum differential pressure of 50 Pa between exposed and unexposed surfaces of assembly to meet Code requirements for Combustible Pipes for Use in Drain, Waste and Vent Piping.

- 1.3.2.2. Ratings: Rating of firestop system applies to its use in specific assembly of materials, penetration and floor or walls in which it is tested as follows:

- 1.3.2.2.1. F Rating: When system remains in opening during fire test for rating period without permitting passage of flame through openings or occurrence of flaming on any element of unexposed side of assembly.

- 1.3.2.2.2. FT Rating: When system remains in opening during fire test in accordance with F Rating requirement and additionally, transmission of heat through firestop system during rating period shall not have been such as to raise temperature of any thermocouple on unexposed surface of system more than 163 deg C (325 deg F) above initial temperature.

- 1.3.2.2.3. FH Rating: When system remains in opening during fire and hose test in accordance with F Rating requirement and additionally, during hose stream test firestop system shall not develop any opening that would permit a projection of water from stream beyond unexposed side.

- 1.3.2.2.4. FTH Rating: When system remains in opening during fire test and hose stream test within limitations described for F, FT and FH ratings.
- 1.3.2.2.5. L Rating: Based on volume of air flowing, per unit of time through opening around test sample under specified pressure difference applied across surface of system. L Ratings are intended to determine acceptability of firestop systems with reference to control of air movement through assembly. Rating is expressed in litres per second (ℓ/s) per linear metre of opening for joint systems.
- 1.3.3. Reference Standards:
- 1.3.3.1. ASTM C679-15(22) - Standard Test Method for Tack-Free Time of Elastomeric Sealants
- 1.3.3.2. ASTM D6904-03(13) - Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry
- 1.3.3.3. ASTM E2307-20 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus
- 1.3.3.4. ASTM G21 -15 - Standard practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- 1.3.3.5. CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials
- 1.3.3.6. CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- 1.3.3.7. CAN/ULC-S115-18 - Standard Method of Fire Tests of Firestop Systems
- 1.3.3.8. UL Product iQ; www.ulprospector.com

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings:
- 1.4.1.1. Arrange preinstallation meeting 1 week before commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
- 1.4.1.2. Coordinate firestopping with other trades so obstructions are not placed in the way prior to installation of firestop systems.
- 1.4.1.3. Ensure a manufacturer's direct representative (not distributor or agent) is on-site during initial installation of firestop systems to train appropriate Subcontractor personnel in proper selection and installation procedures. Ensure this is done per manufacturer's written recommendations published in their literature and drawing details.

1.5. SUBMITTALS

- 1.5.1. Product Data:
 - 1.5.1.1. Submit manufacturers' specifications and technical data for each material including compositions, limitations, documentation conforming ULC and/or cUL firestop system proposed for this Project and manufacturers' installation instructions.
- 1.5.2. Shop Drawings:
 - 1.5.2.1. Submit Shop Drawings in accordance with Section 01 30 00. Submit complete and detailed Shop Drawings for each condition encountered on site. Indicate following:
 - 1.5.2.1.1. ULC and/or cUL assembly number certification and material safety data sheets.
 - 1.5.2.1.2. required temperature rise and flame rating.
 - 1.5.2.1.3. hose stream rating (where applicable).
 - 1.5.2.1.4. thickness.
 - 1.5.2.1.5. proposed installation methods.
 - 1.5.2.1.6. material of firestopping and smoke seals, primers, reinforcements, support and securement methods, damming materials, reinforcements and anchorages /fastenings.
 - 1.5.2.1.7. size of opening.
 - 1.5.2.1.8. adjacent materials.
 - 1.5.2.1.9. number of penetrations.
 - 1.5.2.2. Designate on Shop Drawings fixed penetrants, relative positions, number of penetrations, expansion and control joints in rated slabs and walls, firestopping details at receptacles and similar poke-through devices and surrounding permanent materials. Identify re-entry locations.
 - 1.5.2.3. Submit fireproofing manufacturer's written verification that manufacturers have identified where firestopping is required, have selected correct firestop system and applicators have been trained by system manufacturers. Products, systems and assemblies have been installed in accordance with manufacturer's requirements.
- 1.5.3. Samples: Submit only as requested and in accordance with Section 01 30 00, various types of firestopping and smoke seal material.
- 1.5.4. Certificates:
 - 1.5.4.1. Submit manufacturer's verification that installed firestopping and smoke seal materials comply with specified requirements.
 - 1.5.4.2. Submit copies of ULC, Warnock Hersey and/or cUL Listing cards for review.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operational and Maintenance Data: Provide maintenance data for materials and prefabricated devices, providing descriptions sufficient for identification on site in accordance with requirements of Section 01 70 00.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
 - 1.7.1.1. Installers: Provide work of this Section executed by competent installers experienced, trained, licensed and approved, by material or system manufacturer for application of materials and systems being used having minimum 5 years' experience in application of Products, systems and assemblies specified. Ensure firestopping systems conform to requirements of CAN/ULC-S115 tested assemblies that provide fire rating as shown.

- 1.7.2. Mock-Ups: Construct minimum 5 mock-up samples of various firestopping systems at Project locations designated by Consultant for review by Consultant, Building Official and/or authority having jurisdiction. Once reviewed with no objections recorded, samples remain part of finished work and used as a quality reference standard for balance of Project.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's sealed and labelled containers. Materials are subject to Consultant's inspection.
- 1.8.2. Storage and Handling Requirements:
- 1.8.2.1. Store materials inside building for 24 hours prior to use; store in area designated by Consultant. Protect from damage and environmental conditions detrimental to material.
- 1.8.2.2. Comply with manufacturer's temperature, relative humidity and substrate moisture content for storage, mixing, application and curing of Products.

1.9. SITE CONDITIONS

- 1.9.1. Ambient Conditions:
- 1.9.1.1. Comply with manufacturer's recommended requirements for temperature, relative humidity, moisture content and presence of any sealer or release agents on substrate during application and curing of materials. Ensure surfaces are dry and frost free.
- 1.9.1.2. Maintain minimum temperature of 5 deg C (40 deg F) for minimum period of 1 week before application, during application and until application is fully cured.
- 1.9.1.3. Ventilate areas in which firestopping is being applied. Protect water-soluble material from wetting until fully cured.

1.10. WARRANTY

- 1.10.1. Manufacturer Warranty: Warrant work of this Section against defects and deficiencies for period of 5 years in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no additional expense to Owner. Defects include but are not limited to cracking, breakdown of bond, failure to stay in place or bleeding.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer Lists: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. 3M Canada; www.3m.ca
- 2.1.1.2. Hilti (Canada) Corporation; www.hilti.ca
- 2.1.1.3. Tremco Canada; www.tremcosealants.com
- 2.1.2. Substitution Limitations: This Specification is based on Hilti (Canada) Corporation's Products. Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification. No further substitutions will be permitted.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Ensure firestop systems intended for installation in fire separations have assigned fire ratings as defined herein when tested in accordance with CAN/ULC-S115. Ensure firestop systems intended for use in fire resistive wall and/or floor assemblies are evaluated in accordance with CAN/ULC-S101 (Refer to "UL Product iQ").

- 2.2.1.2. For "L Rating" systems, ensure results do not exceed 5.0 cfm/sq ft of penetration opening at both ambient and elevated temperatures.
- 2.2.1.3. Mould Resistance: Provide penetration firestopping with mould and mildew resistance rating of 0 or 1 in accordance with ASTM G21.
- 2.2.1.4. Supply materials and systems capable of effectively impeding passage of fire, smoke, gasses and where specifically indicated passage of liquids. Use only firestop systems that have been ULC and/or cUL tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire rating involved for each separate instance.
- 2.2.1.5. Ensure firestopping system provides fire-resistance rating, flame and temperature not less than fire resistance rating of surrounding floor, wall or assembly, in accordance with requirements of OBC.
- 2.2.1.6. Firestop System Rating: Where applicable, comply with F Rating based on number of hours system can resist flames and gases; T Rating based on maximum temperature rise of 163 deg C (325 deg F) above ambient for any thermocouple in addition to flame, gas and stream performance and H Rating based on capacity to withstand hose stream after burn. Design combined and/or built-up site systems in accordance with approved restrictions and technical evaluations permitted by Consultant and authorities having jurisdiction.
- 2.2.1.7. Ensure systems provide fire and temperature rating in accordance with those outlined in OBC and effectively impeding passage of flame, smoke and gasses.
- 2.2.1.8. Firestopping seals except for wall joints in visible areas must be of easily identifiable colour, such as red or yellow to be clearly distinguished from other building materials.
- 2.2.1.9. Ensure service penetration components and assemblies, including back-up materials and supports are certified in accordance with CAN/ULC-S115 or CAN/ULC-S101 and be ULC listed by a certified authority recognized by building Code officials in locality in which Building is situated.
- 2.2.1.10. Ensure suitability of Products for application and compatibility of materials with surfaces to which it will be applied.
- 2.2.1.11. Ensure site system assembly is in accordance with CAN/ULC-S115 labeled and listed system design limitations, unless proposed assembly is approved by authorities having jurisdiction and meets Consultant's review. Design combined and/or built-up site systems in accordance with approved restrictions and technical evaluations acceptable to authorities having jurisdiction as reviewed by Consultant. Engineering Judgements from firestopping manufacturers reviewed by Consultant and authorities having jurisdiction may be used for conditions where a ULC and/or cUL firestopping system is not available. Ensure Engineering Judgements are performed in accordance with IFC's "Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs)"
- 2.2.1.12. Ensure sealants and putty for overhead and vertical joints are non-sagging; seals for floors, self-levelling. Ensure flexible fire stop sealant provides movement capability in fire rated joint applications. Ensure sealants are compatible with base materials such as without limitations masonry, concrete, metal, gypsum board and other similar items.
- 2.2.1.13. Ensure Products have a compressive strength capable of providing self support at a penetrating item and shall maintain their integrity as tested in a ULC vertical application.
- 2.2.1.14. Ensure Products are compatible with abutting dissimilar architectural coatings and finishes at floors, walls, ceilings, waterproofing membranes and the like. Check with Room Finish Schedule and manufacturer of selected materials being installed.

- 2.2.1.15. Integral Pipe Sleeves/Firestopping Components: Other Sections within Divisions 20, 21, 22 and 23 may specify fire-rated pipe sleeves, cast-in pipe/sleeve assemblies and integral firestopped penetration devices and accessories listed by authorized testing and certification authorities. These systems may eliminate need for separate firestopping applications at certain designated locations and it is responsibility of this Section to determine any and all locations where such devices will be utilized on Project.
- 2.2.1.16. Do not provide Products containing asbestos.
- 2.2.1.17. Firestopping System 1 (JF and/or PJ Systems):
- 2.2.1.17.1. This Firestopping System is primarily an expansion, control and perimeter seal without smoke resistance and be non-combustible, semi-rigid, felt fire protection. Certified assembly of 1 of listed manufacturers and permitted by Consultant.
- 2.2.1.17.2. Ensure firestop systems are from "Manufacturer List" specified herein and listed in UL (XHEZ7 and XHBN7) Fire Resistance Directory provided they conform to construction type and fire resistance rating involved in each separate instance.
- 2.2.1.17.3. Where required by listing, ensure impaling clips are heavy gauge galvanized wire or 25 mm (1") wide x 0.607 mm (24 ga) galvanized steel, Z formed with horizontal bottom and dimensions conforming to location of firestopping and width of void to be filled. Ensure compression of joint do not damage clips.
- 2.2.1.18. Firestopping System 2: Same materials as in System 1, but without use of impaling clips and with smoke and fluid seal with hose stream resistance. Certified assembly of 1 of listed manufacturers and permitted by Consultant.
- 2.2.1.19. Firestopping System 3: Fire, gas, fluid and hose stream resistant elastomeric sealant with movement capabilities, ULC labeled assembly of 1 of listed manufacturers and permitted by Consultant. Ensure materials have elastic characteristics where used at openings subject to movement. Intumescent pads may form part of this system, at Contractor's option.
- 2.2.1.20. Firestopping System 4: Ensure firestopping, gas, fluid and hose stream resistant seals at openings intended for ease of re-entry such as cables be an elastomeric seal or proprietary assembly of following types; a cementitious or rigid seal at such locations is not permitted. Certified assembly of 1 of listed manufacturers and permitted by Consultant.
- 2.2.1.21. Firestopping System 4-A: Where openings are considered large such as at cable trays and bus ducts. Certified assembly of 1 of listed manufacturers and permitted by Consultant.
- 2.2.1.22. Firestopping System 5 (Cavity Wall Compartment Closer and Firestopping): Strips of "ROXUL SAFE™" semi-rigid stone wool insulation by ROCKWOOL™ International A/S; www.rockwool.com 75 mm (3") wide by depth of cavity plus 13 mm (1/2") with galvanized skewers for securement at 300 mm (12") oc., or compressed 25% to fill depth of cavity.
- 2.2.1.23. Rain and Water Resistance: Provide perimeter joint sealants tested in accordance with ASTM D6904 with less than 1 hour tack free time as tested in accordance with ASTM C679.
- 2.2.2. Primers: To manufacturer's recommendations for specific material, substrate and end use.
- 2.2.3. Damming and Backup Materials, Supports and Anchoring Devices: Non-combustible, to manufacturer's recommendations in accordance with tested assembly being installed and as acceptable to authorities having jurisdiction. Ensure sheet steel covers over temporarily unused sleeves in tenant and similar spaces are minimum 0.912 mm (20 ga) thick galvanized sheet steel formed to a tight fit over opening with specified firestopping materials installed beneath. Combustible materials are permitted only if they are approved under ULC or cUL systems, otherwise they should be removed after permanent firestop materials have cured.
- 2.2.4. Pre-Installed Firestop Devices: For use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors, provide 1 of following Products:
- 2.2.4.1. "Cast-In Firestop Device (CP 680-P)" by Hilti (Canada) Corporation.

- 2.2.4.2. "Cast-In Firestop Device (CP 680-PX)" by Hilti (Canada) Corporation for use with XFR pipe.
- 2.2.4.3. "Cast-In Firestop Device (CP 680-M)" by Hilti (Canada) Corporation for use with non-combustible penetrants.
- 2.2.4.4. "Cast-In Firestop Device (CFS-CID MD P/M)" by Hilti (Canada) Corporation.
- 2.2.4.5. "Firestop Drop-In Device (CFS-DID)" by Hilti (Canada) Corporation for use with non-combustible and combustible penetrants.
- 2.2.5. Pre-Formed Materials: For use with standard head-joint top tracks and slip-type head joints in fire-rated construction at top of partition in concrete construction, provide following Product:
 - 2.2.5.1. "Firestop Top Track Seal (CFS-TTS)" by Hilti (Canada) Corporation.
 - 2.2.5.2. "Firestop Top Track Seal (CFS-TTS MD)" by Hilti (Canada) Corporation.
 - 2.2.5.3. "Firestop Top Track Cover (CFS-TTS MD C FS)" by Hilti (Canada) Corporation.
 - 2.2.5.4. "Firestop Top Track Plugs (CFS-TTS MD P FS)" by Hilti (Canada) Corporation.
- 2.2.6. Re-Penetrable, Round Cable Management Devices:
 - 2.2.6.1. For use with new cable bundles penetrating gypsum board or masonry walls, provide following Product:
 - 2.2.6.1.1. "Speed Sleeve (CP 653 BA / CFS SL GA L)" by Hilti (Canada) Corporation with integrated smoke seal fabric membrane.
 - 2.2.6.1.2. "CFS-MSL Modular Sleeve" by Hilti (Canada) Corporation.
 - 2.2.6.2. For use with existing cable bundles penetrating gypsum board or masonry walls, provide 1 of following Products:
 - 2.2.6.2.1. "Firestop Cable Collar (CFS-CC)" by Hilti (Canada) Corporation.
 - 2.2.6.2.2. "Firestop Retrofit Sleeve Kit (CFS-SL RK)" by Hilti (Canada) Corporation.
 - 2.2.6.2.3. "CFS-MSL Modular Sleeve" by Hilti (Canada) Corporation.
- 2.2.7. Single or Cable Bundles up to 25 mm (1") Diameter: Penetrating gypsum board, masonry, concrete walls or wood floor assemblies, provide following Product:
 - 2.2.7.1. "Firestop Cable Disc (CFS-D 1")" by Hilti (Canada) Corporation.
- 2.2.8. Pipe and Duct Insulation and Wrappings Compatible with Firestopping Systems: "TREMstop WS" by Tremco Canada or "3M™ Fire Barrier Duct Wrap 615" by 3M Canada.
- 2.2.9. Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical raceways, provide 1 of following:
 - 2.2.9.1. "Firestop Block (CFS-BL)" by Hilti (Canada) Corporation.
 - 2.2.9.2. "Composite Sheet (CFS-COS)" by Hilti (Canada) Corporation.
 - 2.2.9.3. "Firestop Mortar (CP 637)" by Hilti (Canada) Corporation.
 - 2.2.9.4. "Firestop Foam (CP 620)" by Hilti (Canada) Corporation.
 - 2.2.9.5. "Flexible Firestop Foam (CP 660)" by Hilti (Canada) Corporation.
- 2.2.10. Firestop Collar or Wrap Devices: Devices attached to assemble around combustible plastic pipe (closed and open piping systems) tested to 50 Pa pressure differential, following Products are permitted:
 - 2.2.10.1. "Firestop Collar (CP 643N)" by Hilti (Canada) Corporation.
 - 2.2.10.2. "Firestop Wrap Strip (CP 648-S/648-E)" by Hilti (Canada) Corporation.

- 2.2.11. Wall Opening Protective Devices: Wall opening protective materials for use with cUL/ULC listed metallic and specified nonmetallic outlet boxes, following Products are permitted:
 - 2.2.11.1. "Firestop CP 617 Putty Pad" by Hilti (Canada) Corporation.
 - 2.2.11.2. "Firestop Box Insert" by Hilti (Canada) Corporation.
- 2.2.12. Preformed, Spray or Sealant Materials for Use with Fire-Rated Construction at Perimeter Slab Joints: Provide 1 of following Products tested in accordance with ASTM E2307 and/or CAN/ULC-S115:
 - 2.2.12.1. "CFS-EOS QuickSeal Preformed Firestop System" with "CFS-EOS WS Edge of Slab Waterstop" used at brackets and butt joints by Hilti (Canada) Corporation.
 - 2.2.12.2. "CFS-SP WB Firestop Joint Spray" by Hilti (Canada) Corporation.
 - 2.2.12.3. "CFS-SP SIL Firestop Silicone Joint Spray" by Hilti (Canada) Corporation.
 - 2.2.12.4. "CFS-S SIL SL Firestop Silicone Sealant, Self-Leveling" by Hilti (Canada) Corporation.
- 2.2.13. Spray or Sealant Materials for Use with Fire-Rated Construction Joints: Provide 1 of following:
 - 2.2.13.1. "CFS-SP WB Firestop Joint Spray" by Hilti (Canada) Corporation.
 - 2.2.13.2. "CFS-SP SIL Firestop Silicone Joint Spray" by Hilti (Canada) Corporation.
 - 2.2.13.3. "CP 606 Flexible Firestop Sealant" by Hilti (Canada) Corporation.
 - 2.2.13.4. "CFS-S SIL GG Firestop Silicone Sealant, Gun-Grade" by Hilti (Canada) Corporation.
 - 2.2.13.5. "CFS-S SIL SL Firestop Silicone Sealant, Self-Leveling" by Hilti (Canada) Corporation.
- 2.2.14. Sealant Materials for Use with Fire-Rated Construction Penetrations: Provide 1 of following:
 - 2.2.14.1. "FS ONE MAX Firestop Intumescent Sealant" by Hilti (Canada) Corporation.
 - 2.2.14.2. "CFS-S SIL GG Firestop Silicone Sealant, Gun-Grade" by Hilti (Canada) Corporation.
 - 2.2.14.3. "CFS-S SIL SL Firestop Silicone Sealant, Self-Leveling" by Hilti (Canada) Corporation.
 - 2.2.14.4. "CP 606 Flexible Firestop Sealant" by Hilti (Canada) Corporation.
- 2.2.15. Spray or Sealant Materials for Use with Non-Fire-Rated Construction Joints and Other Gaps: Provide 1 of following:
 - 2.2.15.1. "Lightweight Smoke and Acoustic Sealant CS-S SA Light" by Hilti (Canada) Corporation.
 - 2.2.15.2. "CP 572 Smoke and Acoustic Spray" by Hilti (Canada) Corporation.
- 2.2.16. Pre-Formed Materials: For use with standard head-joint top tracks and bottom-joint tracks and slip type head joints in non-fire-rated construction at top or bottom of partition in flat concrete construction, provide following Product:
 - 2.2.16.1. "CS-TTS SA Smoke and Acoustic Track Seal" by Hilti (Canada) Corporation.
- 2.2.17. Mixes:
 - 2.2.17.1. Mix materials at correct temperature and in accordance with manufacturer's directions.
- 2.2.17.2. Cleaning Materials: As recommended by firestop manufacturer.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

- 3.1.1.2. Verify openings, dimensions and surfaces conform to fire and smoke seal assembly.
- 3.1.1.3. Examine sizes of penetrating service, percentage fill and sleeve or opening sizes with exact annular space calculations, anticipated movement and conditions necessary to establish correct type, thickness and installation of back-up materials and seals.
- 3.1.1.4. Since firestop systems do not re-establish structural integrity of load bearing partitions/assemblies, or support live loads and traffic, consult structural engineer prior to penetrating any load bearing assembly.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Provide primer or surface conditioner if required by Product manufacturer. Prime surfaces in accordance with manufacturer's directions.
 - 3.2.1.2. Remove combustible material and loose material detrimental to bond from edges of penetration. Clean, prime or otherwise prepare substrate material to manufacturer's recommendation.
 - 3.2.1.3. Remove insulation from insulated pipe and duct where such pipes or ducts penetrate a fire separation unless ULC certified assembly permits such insulation to remain within assembly, or where mechanical trades have installed special fire rated insulated sleeves. Ensure continuity of thermal and vapour barriers where such are removed, altered or replaced, to satisfaction of Divisions 20, 21, 23 and 23 and Consultant.
 - 3.2.1.4. Alternatively, ensure pipe and duct insulation and wrappings occurring within openings to receive firestopping and smoke seals under this Section are installed prior to work of this Section and insulation and wrappings within fire seals are ULC listed components of system to be installed under this Section, unless ULC certified assembly permits such other insulation and wrappings to remain within assembly. Coordinate work of this Section with Divisions 20, 21, 22 and 23.
 - 3.2.1.5. Clean bonding surfaces to remove deleterious substances including dust, paint, rust, oil, grease, moisture, frost and other foreign matter which may otherwise impair effective bonding.

3.3. INSTALLATION

- 3.3.1. Do not apply firestop material to surfaces previously painted or treated with sealer, curing compound, water repellent to other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- 3.3.2. Provide temporary forming, packing and bracing materials necessary to contain firestopping. Upon completion, remove forming and damming materials not required to remain as part of system.
- 3.3.3. Install damming and firestopping materials as per manufacturer's instructions.
- 3.3.4. Mix and apply firestopping and smoke seals in accordance with manufacturer's instructions and tested designs to provide required fire (temperature and flame) rated seal, to prevent passage of smoke and where specifically designated, passage of fluids.
- 3.3.5. Provide temporary forming and packing as required. Apply materials with sufficient pressure to properly fill and consolidate mass to seal openings.
- 3.3.6. Tool or trowel exposed surfaces. Allow materials to cure by not covering up materials until full curing has taken place.
- 3.3.7. Where a designated system described hereinafter does not meet Code requirements for particular service condition, substitute with next higher system meeting required rating.
- 3.3.8. Notify Consultant when completed installations are ready for inspection and prior to concealing or enclosing firestopping and smoke seals.

- 3.3.9. System 1:
- 3.3.9.1. Install fire rated joint firestopping by compressing material minimum of 25% to ensure complete sealing and to follow irregularities of concrete slabs at perimeter of building where junction occurs with back of cladding system. Apply firestopping sealant of spray over compressed mineral wool.
- 3.3.9.2. Butt succeeding sections of firestopping material tightly up against preceding. Leave no voids.
- 3.3.9.3. Provide firestopping between exterior wall cladding and concrete floor slab. Secure and support to suit design requirements.
- 3.3.9.4. Use this System for joint seals through fire-resistance rated floor slabs, ceilings and roofs unless otherwise stipulated.
- 3.3.10. System 2:
- 3.3.10.1. At fire-rated masonry walls and gypsum board partitions which extend nominally to within 19 mm (3/4") of underside of deck above, insert fire rated joint assembly firestopping material in 25% compression in accordance with ULC test requirements and manufacturer's instructions. Provide adequate depth of material to fill gap flush with face of wall, except as otherwise specified. Apply firestopping sealant of spray over compressed mineral wool.
- 3.3.10.2. Insert at intersection of fire-resistance rated masonry and gypsum board partitions.
- 3.3.10.3. Insert at both sides of control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- 3.3.10.4. Where wall/slab junction is exposed in finished work, keep fibre back 9 mm (3/8") from face of block and apply fire-resistant sealant to gap, tooling to a concave joint.
- 3.3.10.5. At perimeter slab locations where this system would otherwise be exposed in finished work and where smoke seal is required, provide cover spray material of thickness as recommended by manufacturer of System 3 material set flush with top of slab and tooled smooth. Minimum cover spray thickness 3 mm (1/8"). Where anticipated movement in joint width is inevitable, select sealant with elastic capabilities.
- 3.3.11. System 3:
- 3.3.11.1. This System establishes fire rated firestopping for service penetrations throughout the Project. Seal gaps and holes in fire-rated walls and slabs and composite construction through which conduit, wire, cables, ductwork, piping and other protrusions pass as a result of work using fire-resistant penetration sealant. Include opening which have been formed, sleeved and cored.
- 3.3.11.2. Apply at unpenetrated openings and sleeves installed for future use through fire-resistance rated assemblies.
- 3.3.11.3. Apply this System between spaces having different air pressures. (See Mechanical Drawings for pressurized areas and locations of moving penetrants.)
- 3.3.11.4. Apply at "wet" rooms supported by suspended slabs at locations over Electrical and Equipment Rooms or similar areas containing power devices in which future re-entry is not required.
- 3.3.11.5. Apply at Mechanical Rooms and similar rooms having systems containing liquids, including piping runs, unless such rooms are located over slab-on-grade.
- 3.3.11.6. Install System 3 materials at elevator shafts, duct shafts and other similar locations over occupied spaces.
- 3.3.11.7. Install 6 mm to 9 mm (1/4" to 3/8") bead of firestop caulking at interface of retaining angles around fire dampers, where angles meet fire-rated assembly and between retaining angles and fire damper, both sides of penetration. At floor locations, sealant bead at top of assembly is adequate.
- 3.3.11.8. Where necessary, remove insulation from insulated pipe and duct where such services penetrate a fire separation unless certified assembly permits such insulation to remain within assembly. Apply wrapping materials as listed herein.

- 3.3.11.9. Install System 3 materials at open wall joints, including expansion joints between fire rated enclosures and assemblies.
- 3.3.12. Systems 4 and 4A: Install at following locations:
 - 3.3.12.1. At Electrical, Electrical Switchgear, Electrical Transformer Rooms and at Telephone Equipment Rooms requiring re-entry for additional services.
 - 3.3.12.2. Install at communications and computer cable penetration points throughout.
- 3.3.13. Accessories: At hollow fire-rated walls, apply intumescent pads to back surfaces and cable entry points of electrical boxes, panels and other service penetration points, ensuring close coordination with electrical, mechanical and drywall trades. Where greater dimension of panel exceeds 500 mm (20"), gypsum board trades construct fire-rated enclosure around recessed panels.
- 3.3.14. System 5: Maintain maximum cavity wall compartments to lesser of following 2 criteria by bridging gap between cavity back-up material and back face of brick with full-depth strips of compartment closer and firestopping material, securing in position with mechanical fasteners and sealing against firm, primary cavity materials:
 - 3.3.14.1. 10 m² (100 sq ft).
 - 3.3.14.2. Division B, Part 3, Paragraph 3.1.11 of OBC.
- 3.3.15. Penetration Sizing: Ensure following regulates sizing of service penetrations to be firestopped, other than for fire damped openings:
 - 3.3.15.1. Ensure single, circular penetration is sleeved by work of Divisions 20, 21, 22, 23, 26, 27 and 28.
 - 3.3.15.2. Multiple penetrations of circular elements are defined as more than 1 circular penetration having a maximum space of 100 mm (4") between closest faces of such penetrating elements. Forming of such multiple penetrations is responsibility of respective trades whose service penetrates rated assembly and such formed opening shall be square or rectangular frame around group of penetrations in which maximum clearance between outer penetration element and face of opening shall be 25 mm (1").
 - 3.3.15.3. Create single and multiple rectangular penetrations in same manner as specified above, but edge clearance may be increased to a maximum of 50 mm (2").
 - 3.3.15.4. Exception; at fire dampers, clearances are governed by testing authorities' requirements.
 - 3.3.15.5. For purposes of this Specification, a moving penetrant is defined as a penetrating device having an anticipated movement of greater than 9 mm (3/8") when measured at right angles to face of rated assembly.
- 3.3.16. Cable Tray Penetrations:
 - 3.3.16.1. Seal (firestop) cable tray penetrations with re-enterable/re-penetrable matrices/devices with applicable ratings determined in accordance with CAN/ULC-S115 having a minimum L Rating not exceeding 5.0 cfm/sq ft of penetration opening at both ambient and elevated temperatures. For penetrations through a fire wall or horizontal fire separation provide a firestop system with a FT Rating as determined by ULC or cUL which is equal to fire resistance rating of construction being penetrated.
 - 3.3.16.2. Ensure ULC or cUL tested listings for cable tray and cable penetrations conform to annular space requirements, (construction assembly type, penetrating item type and fire rating) for each separate instance per manufacturer's listings.

3.4. SITE QUALITY CONTROL

- 3.4.1. Ensure firestopping systems do not affect structural integrity of load bearing walls and assemblies. Coordinate with Consultant prior to penetrating any load bearing assembly. For unusual firestop application for which no tested system is available, ensure manufacturers submit their proposal to local authorities having jurisdiction for their review and approval prior to installation.
- 3.4.2. Ensure work of this Section is by 1 Subcontractor responsible for firestopping materials and systems for all work except as specified herein.
- 3.4.3. Conform to both temperature and flame ratings of standards listed hereinafter and other requirements of authorities having jurisdiction.
- 3.4.4. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
- 3.4.5. Manufacturer Services: Consult with Product manufacturer's technical representative about following items:
 - 3.4.5.1. fire stopping system for fire separation required.
 - 3.4.5.2. curing characteristics of materials specified.
 - 3.4.5.3. joint characteristics as built.
 - 3.4.5.4. to be on-site during initial installation of firestop systems to train appropriate Subcontractor personnel in proper selection and installation procedures. Ensure this is done per manufacturer's written recommendations published in their literature and drawing details.

3.5. CLEANING

- 3.5.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of Consultant. Remove and or correct staining and discolouring of adjacent surfaces as directed.
- 3.5.2. Remove temporary dams after initial set of firestopping and smoke seal materials where such materials are left exposed in finished areas and flame spread rating of such materials exceed a value of 25, in accordance with CAN/ULC-S102.

3.6. PROTECTION

- 3.6.1. Fully protect walls, windows, floors and other surfaces around areas to be firestopped from marring or damage. Mask where necessary to avoid spillage on to adjoining surfaces. Mask areas adjacent to openings, where necessary to prevent contamination or marring of adjacent surface materials. Remove masking after seal has been completed and an initial set has been achieved. Remove stains on adjacent surfaces as required.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide joints sealants including but not limited to following:
 - 1.2.1.1. Exterior:
 - 1.2.1.1.1. control and expansion joints in cast-in-place concrete.
 - 1.2.1.1.2. control and expansion joints in unit masonry.
 - 1.2.1.1.3. joints between metal panels.
 - 1.2.1.1.4. perimeter joints between materials listed above and frames of doors and windows.
 - 1.2.1.1.5. control and expansion joints in soffits and overhead surfaces.
 - 1.2.1.1.6. joints between different materials listed above.
 - 1.2.1.1.7. other joints as indicated.
 - 1.2.1.2. Interior:
 - 1.2.1.2.1. control and expansion joints on exposed interior surfaces of exterior walls.
 - 1.2.1.2.2. perimeter joints of exterior openings where indicated.
 - 1.2.1.2.3. tile control and expansion joints.
 - 1.2.1.2.4. perimeter joints between interior wall surfaces and frames for interior doors and windows and elevator entrances.
 - 1.2.1.2.5. joints between plumbing fixtures and adjoining walls, floors and counters.
 - 1.2.1.2.6. joints between different materials listed above.
 - 1.2.1.2.7. other joints as indicated.
 - 1.2.1.3. mildew resistant sealants.
 - 1.2.1.4. self leveling sealants.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Filling and sealing of sawcut joints in concrete slab: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Masonry control and expansion joint fillers and gaskets: Section 04 20 00, Masonry Units.
 - 1.2.2.3. Sealing and sealants in conjunction with conventional roofing system: Section 07 52 16, Modified Bituminous Sheet Roofing.
 - 1.2.2.4. Firestopping and smoke seals: Section 07 84 00, Firestopping and Smoke Seals.
 - 1.2.2.5. Sealing and sealants between aluminum curtain wall members and between aluminum curtain wall and adjacent construction: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.6. Sealing of joints around sound attenuating gypsum board partitions: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.7. Read other Sections of Specifications for extent of sealing specified in those Sections. Do other sealing indicated, specified or required.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. IPA: Isopropyl Alcohol (99.9% pure).
 - 1.3.1.2. MEK: Methyl-ethyl-ketone.
 - 1.3.1.3. SWRI: Sealant, Waterproofing, & Restoration Institute; www.swrionline.org.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM C661-15(22) - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
 - 1.3.2.2. ASTM C719-22 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
 - 1.3.2.3. ASTM C834-17 - Standard Specification for Latex Sealants
 - 1.3.2.4. ASTM C920-18 - Standard Specification for Elastomeric Joint Sealants
 - 1.3.2.5. ASTM C1021-08(19) - Standard Practice for Laboratories Engaged in Testing of Building Sealants
 - 1.3.2.6. ASTM C1248-22 - Standard Test Method for Staining of Porous Substrate by Joint Sealants

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meeting:
 - 1.4.1.1. Prior to start of work, arrange for Project site meeting of parties associated with work of this Section. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Testing Company's Representative, Contractor's consultants of applicable discipline and manufacturer's representative.
 - 1.4.1.2. Review Specification for work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of this Section. Discuss also following items:
 - 1.4.1.2.1. verify with sealant manufacturer that specified sealants are compatible with and will satisfactorily adhere to substrates.
 - 1.4.1.2.2. weather conditions under which work will be done.
 - 1.4.1.2.3. anticipated frequency and extent of joint movement.
 - 1.4.1.2.4. joint design.
 - 1.4.1.2.5. suitability of durometer hardness and other properties of material to be used.
 - 1.4.1.2.6. recommendations of manufacturer for mixing of multi-component sealants.
 - 1.4.1.2.7. number of beads to be used in sealing operation and priming operation if required.

1.5. SUBMITTALS

- 1.5.1. Product Data:
 - 1.5.1.1. Submit Product information from sealant manufacturer prior to commencement of work of this Section verifying:
 - 1.5.1.1.1. selected sealant materials are from those specified.
 - 1.5.1.1.2. composition and physical characteristics.
 - 1.5.1.1.3. surface preparation requirements.
 - 1.5.1.1.4. priming and application procedures.
 - 1.5.1.1.5. suitability of sealants for purposes intended and joint design.
 - 1.5.1.1.6. test report on adhesion, compatibility and staining effect on samples of adjacent materials used on Project.
 - 1.5.1.1.7. sealants compatibility with other materials and Products with which they come in contact including but not limited to sealants provided under other Sections, insulation adhesives, bitumens, brick, stone, concrete, masonry, metals and metal finishes, ceramic tile, plastic laminates and paints.
 - 1.5.1.1.8. suitability of sealants for temperature and humidity conditions at time of application.
- 1.5.2. Test and Evaluation Reports:
 - 1.5.2.1. Compatibility Testing Report: Submit in accordance with Section 01 30 00. Prior to supply or installation, test exterior sealant materials for compatibility with joint substrates. Test for staining and adhesion including substrates treated with sealers, curing compounds and water repellants, etc. Submit a written report of test results to Consultant.
 - 1.5.2.2. Colour: Submit colours for review in accordance with following general colour hierarchy i.e. Between 2 dissimilar materials, colour the sealant to match the material with the higher relative position on the colour hierarchy scale (highest is at ".1"):
 - 1.5.2.2.1. concrete.
 - 1.5.2.2.2. masonry.
 - 1.5.2.2.3. metal extrusions.
 - 1.5.2.2.4. metal (formed).
- 1.5.3. Samples: Submit samples in accordance with Section 01 30 00. Provide cured, colour samples of manufacturer's standard range of colours in each type of sealant and caulking compound for colour selection by Consultant. Submit samples of primer, bond breaker tape and joint backing material, if requested.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
 - 1.6.1.1. Installers: Provide work of this Section executed by competent installers who have a membership in good standing with SWRI and have minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.
 - 1.6.1.2. Testing Agencies: An independent testing agency qualified according to ASTM C1021 to conduct testing indicated. Ensure Products are verified by SWRI in accordance with ASTM C719 and ASTM C661.
- 1.6.2. Preconstruction Testing:
 - 1.6.2.1. Test for compatibility of sealant and accessory Products with joint substrates. Provide test results and written recommendations for primers and substrate preparation required for proper adhesion. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures, including use of specialty formulated primers.

- 1.6.2.2. Test elastomeric joint sealants for compliance with requirements of ASTM C920 and where applicable, to other standard test methods.
- 1.6.2.3. Test elastomeric joint sealants for compliance with requirements of ASTM C719 for adhesion and cohesion under cyclic movement, adhesion-in peel and indentation hardness.
- 1.6.2.4. Test other joint sealants for compliance with requirements indicated by referencing standard Specifications and test methods.
- 1.6.3. Include lists of completed Projects with Name of Consultants and contact persons.
- 1.6.4. Mock-Ups: Conform to requirements of Section 01 40 00. At site, in area(s) designated by Consultant, erect sample panels 1 m (39") long for each type of sealant joint design, showing location, size, shape and depth of joint complete with backup materials, primer, caulking and sealant, bond, colour and quality of installation work. If requested conduct field test for joints designated. Construct additional samples if required to obtain no objections. Do no sealant work until samples have been reviewed with no objections recorded. Samples become standard of comparison for sealant and caulking work on site and may become part of Work.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements: Deliver caulking and sealant materials to site in original, unopened containers with manufacturers' labels and seals intact. Labels to identify manufacturer's name, brand name of Product, grade and type, application directions and shelf life or expiry date of Product.
- 1.7.2. Storage and Handling Requirements:
 - 1.7.2.1. Handle and store materials in accordance with manufacturer's printed directions. Store flammable materials in safe, approved containers to eliminate fire hazards.
 - 1.7.2.2. Do not use caulking and sealant materials that have been stored for period of time exceeding maximum recommended shelf life of materials.

1.8. SITE CONDITIONS

- 1.8.1. Ambient Conditions:
 - 1.8.1.1. Do not apply any sealant under adverse weather conditions, when joints to be sealed are damp, wet or frozen or when at ambient temperatures below 5 deg C (40 deg F). Maintain minimum temperature of application during application and for 8 hours after application. Consult manufacturer for specific instructions before proceeding and obtain Consultant's review.
 - 1.8.1.2. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated and until contaminants capable of interfering with adhesion are removed from joint substrates.

1.9. WARRANTY

- 1.9.1. Manufacturer Warranty: Warrant work of this Section for period of 10 years for silicone type sealants and 5 years for other sealants against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; cracking, crumbling, melting, shrinkage, sag, failure of adhesion, cohesion or reversion, air and moisture leakage, marbling or streaking due to improper mixing, discolouration due to dirt pick-up during curing and staining of adjacent materials.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. BASF; www.master-builders-solutions.basf.com
 - 2.1.1.2. CPD Construction Products; www.cpd.com
 - 2.1.1.3. The Dow Chemical Company; www.consumer.dow.com
 - 2.1.1.4. Euclid Chemical Canada Ltd.; www.euclidchemical.com
 - 2.1.1.5. Momenive Performance Materials; www.momentive.com
 - 2.1.1.6. Pecora Corporation; www.pecora.com
 - 2.1.1.7. Sika Canada Inc.; www.sika.ca
 - 2.1.1.8. Tremco Canada; www.tremcosealants.com
 - 2.1.1.9. W.R. Meadows of Canada; www.wrmeadows.com

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria: Provide exterior and interior elastomeric joint sealants establishing and maintaining water tight, water resistant and air tight continuous joint seals without staining or deteriorating joint substrates.
- 2.2.2. General: Ensure elastomeric sealants comply with Standards specified herein for type, grade, class and uses.
- 2.2.3. Provide Products with capability, when tested for adhesion and cohesion under maximum cyclic movement in accordance with ASTM C719, to withstand required percentage change in joint width existing at time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.
- 2.2.4. Where non-staining elastomeric sealants are applied to porous substrates, provide Products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.
- 2.2.5. Type A Sealant: Provide 1 of following:
- 2.2.5.1. Non-sag type, 1 component ultra low-modulus, pre-pigmented, elastomeric silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 100/50, Use NT, G, M, A and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.5.1.1. "DOWSIL™ 790 Silicone Building Sealant" by The Dow Chemical Company.
 - 2.2.5.1.2. "GE SCS2700 SilPruf* LM" by Momenive Performance Materials.
 - 2.2.5.1.3. "Pecora 890NST" by Pecora Corporation.
 - 2.2.5.1.4. "Sikasil® WS-290" by Sika Canada Inc.
 - 2.2.5.1.5. "Spectrem® 1" by Tremco Canada.
 - 2.2.6. Type B Sealant: Non-sag type, 1 component, mildew resistant silicone containing non-toxic fungicidal agents sealant conforming to ASTM C920, Type S, Grade NS, Class 25, Use NT. Supply in clear or white as selected. Supply 1 of following:
 - 2.2.6.1. "DOWSIL™ 786" by The Dow Chemical Company.
 - 2.2.6.2. "DOWSIL™ Tub, Tile & Ceramic Silicone Sealant" by The Dow Chemical Company.
 - 2.2.6.3. "GE Sanitary SCS1701 or SCS1702" by Momenive Performance Materials.

- 2.2.6.4. "Sikasil®-GP" by Sika Canada Inc.
- 2.2.6.5. "Tremsil® 200" by Tremco Canada.
- 2.2.7. Type C Sealant: Provide 1 of following:
 - 2.2.7.1. Non-sag type, 1 component, acrylic latex sealant conforming to ASTM C834, Type OP, Grade - 18°C. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.7.1.1. "GE RCS20" by Momentive Performance Materials.
 - 2.2.7.1.2. "AC-20® +Silicone" by Pecora Corporation.
 - 2.2.7.1.3. "Tremflex® 834" by Tremco Canada.
 - 2.2.7.2. Non-sag type, multi-component polyurethane sealant conforming to ASTM C920, Type M, Grade NS, Class 50, Use T, I, M, A and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.7.2.1. "MasterSeal® NP 2™" by BASF.
 - 2.2.7.2.2. "Sikaflex® 2c NS" by Sika Canada Inc.
 - 2.2.7.2.3. "Dymeric® 240FC" by Tremco Canada.
 - 2.2.7.3. Non-sag type, 1 component polyurethane sealant conforming to ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.7.3.1. "MasterSeal® NP 1™" by BASF.
 - 2.2.7.3.2. "Eucolastic 1NS" by Euclid Chemical Canada Ltd.
 - 2.2.7.3.3. "Sikaflex® 1a" by Sika Canada Inc.
 - 2.2.7.3.4. "Dymonic® FC" or "Dymonic® 100" or "Vulkem 116" by Tremco Canada.
- 2.2.8. Type D Sealant: Provide 1 of following:
 - 2.2.8.1. Pour grade, 1 component polyurethane sealant conforming to ASTM C920, Type S, Grade P, Class 25, Use T, M, A, I and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.8.1.1. "MasterSeal® SL 1™" by BASF.
 - 2.2.8.1.2. "Eucolastic 1SL" by Euclid Chemical Canada Ltd.
 - 2.2.8.1.3. "Sikaflex® Self-Leveling Sealant" by Sika Canada Inc.
 - 2.2.8.1.4. "Vulkem® 45SSL" by Tremco Canada.
 - 2.2.8.2. Pour grade, multi-component, polyurethane sealant conforming to ASTM C920, Type M, Grade P, Class 25, Use T, M, A, I and O. Supply 1 of following:
 - 2.2.8.2.1. "MasterSeal® SL 2™" by BASF.
 - 2.2.8.2.2. "Sikaflex® 2c SL" by Sika Canada Inc.
 - 2.2.8.2.3. "THC-901 or Vulkem® 245" by Tremco Canada.
- 2.2.9. Joint Primer: Non-staining, suitable for substrate surfaces, compatible with joint forming materials and as recommended by sealant manufacturer for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- 2.2.10. Joint Backing: Preformed, compressible, resilient, non-waxing, non-extruding, non-staining strips of closed cell polyethylene or urethane foam, compatible with joint substrates and are approved by sealant manufacturer based on field experience and laboratory test. Sizes and shapes to suit various conditions, diameter 25% greater than joint width. Ensure backing is compatible with sealant, primer and substrate.
- 2.2.11. Bond Breaker Tape: As recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

- 2.2.12. Masking Tape: Provide non-staining, non-absorbent tapes and sheets which effectively mask substrate without leaving an adhesive residue compatible with joint sealants and surfaces adjacent to joints.
- 2.2.13. Cleaning Material: Non-corrosive, non-staining, solvent type, xylol, MEK, toluol, IPA or as recommended by sealant manufacturer and acceptable to material or finish manufacturers for surfaces adjacent to sealed areas free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants with joint substrates.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Examine joints for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Ensure joints are suitable to accept and receive sealants.
 - 3.1.1.2. Verify joint surfaces are clean, sound, free of defects and dimensions are within sealant manufacturer's size requirements.
 - 3.1.1.3. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 3.1.1.4. Do not apply sealant to masonry until mortar has cured.
- 3.1.2. Preinstallation Testing: Before any sealing work is commenced, test materials for indications of staining or poor adhesion.
- 3.1.3. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- 3.2.2. Surface Preparation:
 - 3.2.2.1. Clean joints and spaces which are to be sealed and ensure they are dry and free of dust, loose mortar, oil, grease, oxidation, coatings, form release agents, sealers and other foreign material.
 - 3.2.2.2. Clean porous surfaces such as concrete, masonry or stone by wire brushing, grinding or blast cleaning, mechanical abrading or combination of these methods as required to obtain clean and sound surfaces.
 - 3.2.2.3. Remove laitance by grinding or mechanical abrading.
 - 3.2.2.4. Remove oils by sandblast cleaning.
 - 3.2.2.5. Remove loose particles present or resulting from grinding, abrading or sandblast cleaning by thorough brushing.
 - 3.2.2.6. Clean ferrous metals of rust, mill scale and foreign materials by wire brushing, grinding or sanding.
 - 3.2.2.7. Wipe non-porous surfaces such as metal and glass to be sealed, except pre-coated metals, with cellulose sponges or clean rags soaked with ethyl alcohol, ketone solvent, xylol or toluol and wipe dry with clean cloth. Where joints are to be sealed with silicone based sealants clean joint with MEK or xylol. Do not allow solvent to air-dry without wiping. Clean pre-coated metals with solutions or compounds which will not injure finish and which are compatible with joint primer and sealant. Check ferrous metal surfaces are painted before applying sealant.

- 3.2.2.8. Examine joint sizes and where depth of joint exceed required depth of sealant correct to achieve proper following width/depth ratio:
- 3.2.2.8.1. Maintain 2:1 Width/Depth Ratio: Ensure maximum sealant depth is 13 mm (1/2") and minimum contact width with each substrate is 6 mm (1/4"). Confirm width/depth ratios with sealant manufacturers.
- 3.2.2.9. Install joint backing material to achieve correct, uniform joint profile and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- 3.2.2.10. Do not leave gap between ends of sealant backing; do not stretch, twist, puncture, or tear sealant backings; remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- 3.2.2.11. Confirm with sealant manufacturer selected bond breaker material works with chosen sealant.
- 3.2.2.12. Where joint design or depth of joint prevents use of joint backing material, apply bond breaker tape at back of joint to prevent 3-sided adhesion.
- 3.2.2.13. Do not stretch, twist, puncture or tear joint backing. Butt joint backing at intersections. Install bond breaker tape at back of joint where joint backing is not required or cannot be installed.
- 3.2.2.14. On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.
- 3.2.2.15. Where surfaces adjacent to joints are likely to become coated with sealant during application, mask them prior to priming and sealing.
- 3.2.2.16. Do not exceed shelf life and pot life of materials and installation times, as stated by manufacturer.
- 3.2.2.17. Be familiar with work life of sealant to be used. Do not mix multiple component materials until required for use.
- 3.2.2.18. Use materials as received from manufacturer, without additions, deletions and adulterations of materials.
- 3.2.2.19. Mix multiple component sealants and bulks sealants using mechanical mixer capable of mixing without mixing air into material, in accordance with manufacturer's directions and recommendations. Continue mixing until material is homogeneously blended, uniform in colour and free from streaks of unmixed material. Install compound prior to start of hardening or curing cycle.
- 3.2.2.20. Prior to painting, seal joints in surfaces to be painted. Where surfaces to be sealed are prime painted in shop before sealing ensure prime paint is compatible with primer and sealant. If they are incompatible, inform Consultant and change primer and sealant to compatible types reviewed by Consultant.
- 3.2.2.21. Where irregular surface or sensitive joint border exists, apply masking tape at edge of joint to ensure joint neatness and protection.
- 3.2.2.22. Prime exterior horizontal joints. Prime sides of joints for type of surface being sealed prior to application of joint backing, bond breaker or sealant as recommended by sealant manufacturer.
- 3.2.3. Removal:
- 3.2.3.1. Remove existing caulking and/or sealant from joints as required.
- 3.2.3.2. Remove existing caulking and/or sealants including any residual caulking/sealant material using suitable methods to prevent damage to adjacent surfaces. Take care to ensure no damage or visible changes take place to surface of substrate not covered by replacement sealant material.
- 3.2.3.3. Clean surfaces of joints and spaces in accordance with procedures specified herein under "Surface Preparation".
- 3.2.3.4. Ensure materials in contact with sealant are compatible.

- 3.2.3.5. Where required, mask adjacent surfaces prior to priming and application of sealant to prevent staining.
- 3.2.3.6. Prime inner surfaces of joint, where required, immediately prior to caulking, in accordance with sealant manufacturer's recommendations, to provide full adhesion and to prevent staining of adjacent exposed surfaces.

3.3. APPLICATION

- 3.3.1. Apply in accordance with manufacturer's directions and recommendations unless more stringent requirements apply.
- 3.3.2. Apply sealant by proven techniques using hand operated guns or pressure equipment fitted with suitable nozzle size and equipment approved by sealant manufacturer.
- 3.3.3. Force sealant into joint and against sides of joints to obtain uniform adhesion. Use sufficient pressure to completely fill voids in joint regardless of variation in joint widths and to proper joint depth as prepared. Ensure full firm contact with interfaces of joint. Superficial pointing with skin bead is not permitted.
- 3.3.4. Finish face of compound to form smooth, uniform beads. At recesses in angular surfaces, finish compound with flat face, flush with face of materials at each side. At recesses in flush surfaces, finish compound with concave face flush with face of materials at each side.
- 3.3.5. Compound may be tooled, provided such tooling does not damage seal or tear compound. Avoid pulling of sealant from sides.
- 3.3.6. Tool surfaces as soon as possible after sealant application or before any skin formation has occurred, particularly when using silicone sealants.
- 3.3.7. Ensure joint surfaces are straight, neatly finished, free from ridges, wrinkles, sags, dirt, stains, air pockets and embedded foreign matter or other defacement and be uniform in colour, free from marbling and/or colour streaking due to improper mixing or use of out of shelf life Products.
- 3.3.8. Do not use solvent curing sealants indoors.
- 3.3.9. Joint designation in "SEALANT LOCATION SCHEDULE" specified herein and the fact that Drawings do not show all locations to be sealed does not limit responsibility of this Section to seal all locations except those indicated in other Sections of work, required to create and ensure continuous enclosure.
- 3.3.10. Firestopping and Smoke Seal: Sealants part of firestopping systems and smoke seals provided within fire rated assemblies are part of work of Section 07 84 00 and carried out under supervision of this Section.

3.4. REPAIR

- 3.4.1. Repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.5. SITE QUALITY CONTROL

- 3.5.1. Site Tests and Inspections:
 - 3.5.1.1. Independent inspection and testing company may be appointed and paid for by Owner to carry out inspection and testing as directed by Consultant. Refer to Section 01 40 00.
 - 3.5.1.2. Inspect joints for complete fill, for absence of voids and for joint configuration complying with specified requirements. Record results in a manner permitted by Consultant.
 - 3.5.1.3. Tests may include sampling of installed Product where adhesion, cohesion or reversion failure is suspected.
 - 3.5.1.4. Where work or materials fail to meet requirements as indicated by test results, pay costs of additional inspection and testing required for new replacement work or materials.

3.5.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5.3. Manufacturer Services: Prior to commencement of sealing, arrange for sealant manufacturer's technical representative to visit the Place of the Work and inspect surfaces and joints to be sealed.

3.6. CLEANING

3.6.1. Immediately clean adjacent surfaces which have been soiled and leave work in neat, clean condition. Remove excess materials, compounds smears or other soiling resulting from application of sealants. Use recommended cleaners and solvents. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

3.7. PROTECTION

3.7.1. Provide permitted, non-staining means of protection for completed joint sealant installations where required to protect work from mechanical, thermal, chemical and other damage by construction operations and traffic.

3.7.2. Maintain protection securely in place until completion of Work. Remove protection when so directed by Consultant.

3.8. ATTACHMENTS

3.8.1. SEALANT LOCATION SCHEDULE

3.8.1.1. Use 1 of sealants specified for each type in following locations. Ensure sealant chosen (from several specified under each type under "MATERIALS") for each location is recommended by manufacturer for use for conditions encountered:

3.8.1.1.1. Type A: Typically used in joints between metal frames and adjacent masonry and/or concrete construction in exterior walls, exterior and interior sides; control and expansion joints in exterior and interior surfaces of poured-in-place concrete walls and unit masonry walls; and other locations where sealant is required or noted on Drawings except in locations designated for Type B, C and D and except where sealant is specified in other Sections.

3.8.1.1.2. Type B: Typically used in joints between urinals and walls, around washrooms accessories, at corners of walls, between splash backs and walls, in shower, damp or wet areas, at ceramic tiles where mildew resistant sealant is required.

3.8.1.1.3. Type C: Typically used in joints between interior metal and/or wood frames and adjacent construction in interior partitions.

3.8.1.1.4. Type D (traffic bearing): Typically used in joints with movement in horizontal surfaces between concrete slabs, pavers and precast concrete panels.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide expansion joint control assemblies including but not limited to following:
 - 1.2.1.1. interior pedestrian floor joints.
 - 1.2.1.2. interior wall and/or ceiling joints.
 - 1.2.1.3. fire rated assemblies where applicable.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Placing concrete: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Provision of unit masonry: Section 04 20 00, Masonry Units.
 - 1.2.2.3. Provision of structural steel: Section 05 12 00, Structural Steel.
 - 1.2.2.4. Miscellaneous metal fabrications: Section 05 50 00, Metal Fabrications.
 - 1.2.2.5. Provision of firestopping and smoke seals: Section 07 84 00, Firestopping and Smoke Seals.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AODA: Accessibility for Ontarians with Disabilities Act; www.aoda.ca.
 - 1.3.1.2. EPDM: Ethylene Propylene Diene Monomer.
 - 1.3.1.3. PVC: Polyvinyl Chloride.
 - 1.3.1.4. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM A666-23 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - 1.3.2.2. ASTM B209/B209M-21 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 1.3.2.3. ASTM B221M-21 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
 - 1.3.2.4. ASTM E1612/E1612M-94(22) - Standard Specification for Preformed Architectural Compression Seals for Buildings and Parking Structures
 - 1.3.2.5. ASTM E1783/E1783M-96(17) - Standard Specification for Preformed Architectural Strip Seals for Buildings and Parking Structures

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Sequencing: Plan delivery and commencement of expansion joint control work to allow sufficient time for manufacturer's production and delivery scheduling.

1.5. SUBMITTALS

- 1.5.1. Product Data:
 - 1.5.1.1. Submit manufacturer's Product specification, construction details, material, finish descriptions and dimensions of individual components and seals.
 - 1.5.1.2. Submit Product test reports from qualified independent testing agency acceptable to authorities having jurisdiction conforming compliance with design and Code requirements.
- 1.5.2. Shop Drawings:
 - 1.5.2.1. Submit Shop Drawings or catalogue sheets in accordance with Section 01 30 00 to fully illustrate the work of this Section. Ensure Shop Drawings or manufacturer's catalogue sheets contain detailed description and bear item numbers, marked to show quantity, colour, model numbers, fabrication details and installation instructions.
 - 1.5.2.2. Submit Shop Drawings showing complete fabrication details for expansion joint control covers including requiring anchorage to adjacent construction, recesses, blocking, backing and connections between similar and dissimilar joint cover assemblies.
- 1.5.3. Samples: Submit 150 mm (6") samples of specified expansion control devices and finishes when required.
- 1.5.4. Certificates: Submit certificates, copies of independent test reports or research reports showing compliance with fire resistance rating or other special performance requirements to suit design requirements.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
 - 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.6.2. Mock-Ups: Construct minimum 2 m (6') long mock-up samples of each type of expansion joint (floor, wall and ceiling) at Project locations designated by Consultant for review. Once reviewed with no objections recorded, samples remain part of finished work and used as a quality reference standard for balance of Project.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements: Deliver packaged materials in original, undamaged containers with manufacturer's labels and seals intact.
- 1.7.2. Storage and Handling Requirements: Handle and store materials in accordance with manufacturer's and Supplier's recommendations to prevent damage thereto.

1.8. WARRANTY

- 1.1.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; inability of joint assemblies to perform its designated task (water and weather tight, structurally sound, capable of withstanding types of loads while accommodating kinds of movement for which they are designed); visual metal fatigue; disengagement of components; broken components; dislocation and loss of components, deformation scaling, cracking, tearing, cohesive failure, buckling, failure of seals, gaskets, bond failure, extensive colour fading, cracking and peeling.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Balco, Inc.; www.balcousa.com
- 2.1.1.2. C/S Construction Specialties Company; www.c-sgroup.com
- 2.1.1.3. Emseal Joint Systems, Ltd.; www.emseal.com
- 2.1.1.4. InPro Corporation; www.inprocorp.com
- 2.1.1.5. MM Systems Corporation; www.mmsystemscorp.com
- 2.1.1.6. Tremco Canada; www.tremcosealants.com
- 2.1.2. Substitution Limitations: This Specification is based on Emseal Joint Systems, Ltd.'s Products. Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.
- 2.1.3. Obtain expansion joint control assemblies through 1 source from single manufacturer as far as practical.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Design, fabricate and install expansion joint control assemblies to accommodate anticipated building movements due to thermal expansion and contraction, wind movements, shrinkage, creep and other movements.
- 2.2.1.2. Design expansion joint control cover plates suitable to sustain uniform load and concentrated load for heavy duty system where applicable to suit structural design requirements.
- 2.2.1.3. Design system to allow maximum vertical deflection of 1.6 mm (1/16") at neutral position.
- 2.2.1.4. Ensure expansion joint control system permits unrestrained movement of joint without disengagement of expansion joint cover system without affecting integrity of fire rating of joint assembly.
- 2.2.1.5. Horizontal, Vertical and Lateral Joint Movement: To suit design requirements.
- 2.2.1.6. Design fire rated expansion joint control assemblies to meet fire rating to suit design requirements including hose stream test at full rated period and be tested by an independent testing organization or laboratory acceptable to authorities having jurisdiction. Ensure system is not less than fire rating of adjacent construction.
- 2.2.1.7. Where indicated or required, provide expansion joint control assemblies including fire barriers that are identical to those assemblies tested for fire resistance in accordance with ULC tested assemblies including hose test of vertical assemblies by testing and inspecting agency acceptable to authorities having jurisdiction.
- 2.2.2. Aluminum: Supply following alloys conforming to ASTM B221M:
- 2.2.2.1. Extrusions: Alloy 6063-T5 with maximum 12,000 psi stress.
- 2.2.2.2. Plates: ASTM B209/B209M, Alloy 6063-T6 with maximum 28,000 psi stress.
- 2.2.2.3. Aluminum Sheet: ASTM B209/B209M Alloy 5052-H32 with maximum 16,000 psi stress.
- 2.2.3. Stainless Steel Plate: Supply stainless steel plate conforming to ASTM A666, Type 303, 304 or 316.
- 2.2.4. PVC Vinyl: Extruded wall and ceiling joint cover.

- 2.2.5. Seal and Flexible Transition Membrane: Neoprene or EPDM: Single or dual durometer elastomeric seal, 0.762 mm (30 mils) thick.
- 2.2.6. Preformed Seal: Single or multi-cellular extruded elastomeric seals designed with or without continuous longitudinal, internal baffles. Formed to be installed in frames or with anchored flange in colour selected by Consultant from manufacturer's standard colour range.
- 2.2.7. Strip Seal: Elastomeric membrane or tubular extrusions with continuous longitudinal internal baffle system throughout complying with ASTM E1783/E1783M, used with compatible frames, flanges and molded rubber anchor block.
- 2.2.8. Compression Seal: Preformed elastomeric extrusions having internal baffle system complying with ASTM E1612/E1612M in sizes and profiles indicated or as recommended by manufacturer.
- 2.2.9. Preformed Cellular Foams: Neoprene or polyurethane extruded and/or compressible foam.
- 2.2.10. Intumescent compressible block or mineral wool or silicone sealant fire barrier to meet design requirements for rated fire resistance in accordance with requirements of Section 07 84 00.
- 2.2.11. Anchors, fasteners and fastening devices, accessories compatible with metal being fastened. Size and type to suit applicable conditions. Use proper type where connecting directly to concrete.
- 2.2.12. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.

2.3. COMPONENTS

- 2.3.1. Interior Floor/Floor Joints (EJ01):
 - 2.3.1.1. "SJS-FR2-M-0200-CVRA-M-38-06.00-LC-SYS" by Emseal Joint Systems, Ltd. with aluminum cover plate installed flush to adjacent finishes.
- 2.3.2. Interior Wall/Wall and Ceiling/Ceiling Joints - Gypsum/Gypsum (EJ02 and EJ04):
 - 2.3.2.1. "Wabo® FastWall EWH-200" by Emseal Joint Systems, Ltd. with aluminum cover plate.
- 2.3.3. Interior Wall - Curtain Wall/Brick Joints (EJ03):
 - 2.3.3.1. "Seismic Colorseal®" by Emseal Joint Systems, Ltd.
- 2.3.4. Interior Wall - Cast-In-Place Concrete/Brick Joints (EJ03-FR):
 - 2.3.4.1. "Emshield® WFR2" by Emseal Joint Systems, Ltd.
- 2.3.5. Fabrication:
 - 2.3.5.1. Shop fabricate assemblies as far as possible. Field fabricate to suit special site conditions. Field assemble components with pre-packaged anchors and fittings. Provide components in largest lengths where possible.
 - 2.3.5.2. Fabricate expansion joint control cover assemblies to detail indicated complete with adjustment bars, sealing washers, gaskets, splice covers and closures to suit design requirements.
 - 2.3.5.3. Fabricate transitions and corner fittings.
 - 2.3.5.4. Fabricate fire barriers and provide fire resistant sealant which form integral part of expansion joint control assemblies for fire resistant installation. Mitre and weld joints as applicable.
- 2.3.6. Finishes:
 - 2.3.6.1.1. Colour Anodized Finish: Ensure aluminum finish is colour anodized in accordance with Aluminum Association; www.aluminum.org, Finish Designation AA-M12C22A44, Class I, minimum 0.018 mm (0.7 mils) thick finish for interior exposure. Colour to match reviewed sample.
 - 2.3.6.1.2. Clear Anodized Finish: Ensure aluminum finish is clear anodized in accordance with Aluminum Association; www.aluminum.org, Finish Designation AA-M12C22A31, Class II, minimum 0.01 mm (0.4 mils) thick for interior exposure.

- 2.3.6.1.3. Exposed Stainless Steel Finish:
 - 2.3.6.1.3.1. Remove tool and die marks and stretch lines or blend into finish.
 - 2.3.6.1.3.2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 2.3.6.1.3.3. Satin, directional polish: No: 6 finish.
 - 2.3.6.1.3.4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- 2.3.6.1.4. Vinyl: White, grey or black as designated by Consultant.
- 2.3.6.1.5. Neoprene: Black.
- 2.3.6.1.6. EPDM: Black, white, grey or beige as designated by Consultant.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Prepare substrates to joint system manufacturer's written instructions.
 - 3.2.1.2. Coordinate and supply anchorages, placement drawings and other instructions for installing expansion joint control assemblies and other components which are to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting in of frames.
 - 3.2.1.3. Provide anchoring devices and fasteners where necessary to secure joint systems to be placed into cast-in-place concrete constructions, including threaded fasteners with drilled in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type and size to suit type of constructions indicated to provide secure attachment of joint system.

3.3. INSTALLATION

- 3.3.1. Provide work of this Section true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.
- 3.3.2. Provide expansion joint control systems of design, basic profile, materials and operation indicated. Provide unit with capability to accommodate joint widths indicated and variations in adjacent surfaces.
- 3.3.3. Provide cutting, drilling and fitting required to install joint assembly systems.
- 3.3.4. Include closure materials and transition pieces, tee joints, corners, curbs, cross sections and other accessories as required to provide continuous expansion joint control assemblies.
- 3.3.5. Ensure frames for strips are designed with semi-closed cavity that provides mechanical lock for seals of type required.
- 3.3.6. Ensure slip resistant seals designed for installation on horizontal surfaces lie flat with adjacent surfaces and comply with AODA guidelines for public areas.

- 3.3.7. Finish units in longest possible lengths to minimize number of joints. Provide hairline mitred corners where joint changes directions or abuts other materials.
- 3.3.8. Make allowance for change in joint size design requirements. Factory mitre and seal assembly at change in direction. Ensure continuity of assemblies at joints using adhesive or welded seals as recommended by manufacturer.
- 3.3.9. Expansion Joint Control Assemblies:
 - 3.3.9.1. Conform to manufacturers' printed instructions for accurate, secure installation. Ensure proper operation. Install assemblies in accordance with reviewed Shop Drawings.
 - 3.3.9.2. Coordinate installation of expansion joint control assemblies, materials and associated work, so complete assemblies comply with performance requirements. Coordinate work with Sections in building envelope work and with other Sections providing adjacent work.
 - 3.3.9.3. Securely fasten components. Align interior assemblies to be flush with adjacent finishes unless indicated otherwise. Adjust expansion joint control covers to accommodate design joint movement.
 - 3.3.9.4. Install preformed seals in continuous lengths. Vulcanize or heat weld field splice joints to provide watertight jamb. Install foam seals with adhesive recommended by manufacturer which does not affect foam and heat seal splices.
 - 3.3.9.5. Provide fire rated expansion joint control covers to requirements of fire rated design complete with fire barriers, transitions, end joints and sealant as required.
 - 3.3.9.6. Construct expansion joints within roof construction in locations indicated on Drawings. Pack compressible mineral fibre into substrate joint and neatly cutting roofing membrane along centre of joint. Mop or torch flanges of expansion joint complete to detail shown as recommended by joint manufacturer.
 - 3.3.9.7. Provide water barriers to suit design requirements. Ensure air and watertight seals assemblies. Take into account climatic conditions at time of installation.

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. PROTECTION

- 3.5.1. Cover finished surfaces and protect exposed corners and areas vulnerable to damage by persons or by movement of materials, tools or equipment.
- 3.5.2. Protect work of this Section from damage of any kind. Provide temporary protective covers on metal finished surfaces. Protect other work from damage resulting from work of this Section.

END OF SECTION

PART 1 - GENERAL

1.1. REFERENCES

- 1.1.1. American Society for Testing and Materials International, (ASTM International).
- 1.1.2. ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.1.3. ASTM A653/A653M 13, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvanealed) by the Hot Dip Process.
- 1.1.4. Canadian Standards Association, (CSA International).
- 1.1.4.1. CSA B111 1974(R2003), Wire Nails, Spikes and Staples.
- 1.1.4.2. CSA O121 17(R2022), Douglas Fir Plywood.
- 1.1.4.3. CSA O141 23, Canadian Standard Lumber.
- 1.1.4.4. CSA O325 07(R2012), Construction Sheathing.
- 1.1.5. Service Ontario/King's Printer for Ontario.
- 1.1.5.1. Ontario Building Code (OBC), latest edition.
- 1.1.6. South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards.

1.2. ACTION AND INFORMATIONAL SUBMITTALS

- 1.2.1. Submit in accordance with Section 01 33 00 – Submittal Requirements.
- 1.2.2. Product Data:
 - 1.2.2.1. Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - 1.2.2.2. Submit copies of WHMIS SDS Safety Data Sheets.
- 1.2.3. Database:
 - 1.2.3.1. After all existing finishes have been stripped, and bare wood is visible, contractor is to submit drawings that locate and quantify required wood repairs on each element (entrance door, transom window). Contractor is to submit photographs of each element to support drawing submittal.
- 1.2.4. Submit proof of workers experience in heritage conservation work of similar complexity.
- 1.2.5. Manufacturer's Instructions:
 - 1.2.5.1. Submit manufacturer's installation instructions, including storage, handling and Project conditions.
- 1.2.6. Manufacturer's Warranty:
 - 1.2.6.1. Submit manufacturer's warranty documents for review.

1.3. QUALITY ASSURANCE

- 1.3.1. Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board. Plywood, particleboard, and wood based composite panels in accordance with CSA and ANSI standards.
- 1.3.2. Single Source Responsibility for "Products": Obtain each type "Product" from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.

- 1.3.3. Contractor: a company specializing in performing the work of this section must have documented experience and successful completion of at least three (3) projects of similar scope and complexity.
- 1.3.4. Workers abilities:
 - 1.3.4.1. Work shall be performed by personnel having substantial experience with heritage restoration work of the type specified and displaying appropriate abilities as demonstrated through mock-ups.
 - 1.3.4.2. Workers shall be specialized in techniques related to the type of heritage material involved.
 - 1.3.4.3. Only accepted procedures and the personnel that performed them during the mock-ups may be utilized to do that procedure throughout the duration of the work.
 - 1.3.4.4. No approved specialized workers shall be replaced during the progress of the work without written acceptance by the Consultant.
 - 1.3.4.5. One specialized worker is to be responsible for the complete repair of a particular woodwork assembly.

1.4. DELIVERY, STORAGE AND HANDLING

- 1.4.1. Deliver, store and handle materials in accordance with manufacturer's written instructions.
- 1.4.2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- 1.4.3. Storage and Handling Requirements:
 - 1.4.3.1. Store materials off and in accordance with manufacturer's recommendations in clean, dry, well-ventilated, covered area.
 - 1.4.3.2. Store and protect wood from nicks, scratches, and blemishes.
 - 1.4.3.3. Replace defective or damaged materials with new.

1.5. WORK RESULTS

- 1.5.1. The objectives are to strip, repair and re-finish existing heritage architectural woodwork in order to restore it to its original state.
- 1.5.2. Materials and procedures specified in this Section shall serve as basis for submittals.
- 1.5.3. Contractor is responsible for any damage to or loss of heritage materials occurring as a result of site, handling, transport and/or storage activities.
- 1.5.4. Ensure materials, equipment and procedures do not affect the existing structure.
- 1.5.5. Apply methods that minimize the risk of damage to heritage materials.
- 1.5.6. All procedural methods and techniques employed shall meet requirements of Part 3 – Execution.

1.6. MOCK-UPS

- 1.6.1. Construct mock-ups demonstrating the abilities and skill of the workers performing the work and the tools and materials required to perform the work.
- 1.6.2. Consultant shall be present to perform review process. Advise Consultant minimum 7 days prior to beginning of mock-up preparation.
- 1.6.3. Each type of work or procedure specified in Part 3 of this Section requires a mock-up. Consultant reserves the right to have additional mock-ups prepared to suit Project conditions.
- 1.6.4. As indicated, only the workers that perform the mock-ups may be utilized to do that work or procedure throughout the duration of the work.

- 1.6.5. When multiple teams of workers are to perform a certain type of work, every team shall prepare required mock-ups to ensure consistent results for the entire work specified in this Section.
- 1.6.6. Mock-ups shall be kept protected and intact during the entire duration of the work of this Section.
- 1.6.7. Consultant will determine if mock-ups may form part of finished work or if they must be removed from the site in which case they shall be dismantled and disposed of in accordance with local regulations.

PART 2 - PRODUCTS

2.1. MATERIALS – WOOD REPAIRS

- 2.1.1. Solid wood with a moisture content not exceeding 10%, in accordance with:
 - 2.1.1.1. National Hardware Lumber Association
 - 2.1.1.2. AWMAC requirements, custom grade wood with specified moisture content.
 - 2.1.1.3. Species: Douglas fir, quarter cut with edge grain to the weather, grade 'C' select, quarter-sawn, free of holes, insect damage and defects.
- 2.1.2. Dowels: Hardwood lumber to National Hardwood Lumber Association (NHLA) requirements, size 9.5 mm diameter, length as designed, with moisture content to maximum 10 %.
- 2.1.3. Fastener: nails, wood screws, wood pegs, wood pins, wood glues; stainless steel 300 series; size to suit application.
- 2.1.4. Adhesives:
 - 2.1.4.1. Adhesive shall be a two-part epoxy formulated specifically for exterior architectural wood work repairs, with a proven track record of minimum 20 years.
 - 2.1.4.2. Adhesive shall have superior adhesive and cohesive strength.
 - 2.1.4.3. Acceptable products; ConServe LLC, Abatron, West System
- 2.1.5. Epoxy Repair system:
 - 2.1.5.1. The epoxy system, namely both the consolidant and the patching compound, shall be by the same manufacturer and shall be a system formulated specifically for exterior architectural wood work repairs, with a proven track record of a minimum of 25 years and compatible with a linseed oil based paint system.
 - 2.1.5.2. Consolidant shall consist of a two parts and patching compound shall consist of a four parts, mixed immediately before use.
 - 2.1.5.3. Flexibility of the cured patching compound is important for compatibility with woodwork. It shall be possible to take a cured sample of both the consolidant and patching compound, 100 mm in diameter, by 4-5 mm. thick, and to bend them double and for them to return to their former shape without breaking.
 - 2.1.5.4. Fumed silica: fumed silica or equal may be used to thicken the patch to enhance tooling and application.
 - 2.1.5.5. Acceptable products; ConServe LLC, Abatron, West System
- 2.1.6. Detergent: non-ionic mild detergent.
- 2.1.7. Borate.

2.2. MATERIALS – ACCESSORIES

- 2.2.1. Glazing:
 - 2.2.1.1. Transom window: Salvage and reinstate existing glazing

- 2.2.1.2. Door: Install new glazing, glazing type TBD
- 2.2.2. Hardware: Salvage, clean and reinstall all hardware
- 2.2.3. Weatherstripping: Install new weatherstripping, type to match existing
- 2.2.4. Finishing: All architectural woodwork shall be finished in accordance with Section 09 91 00 – Painting
- 2.2.5. Temporary protection: refer to Section 01 35 91 – Heritage Protective Measures and Section 01 50 00 – Temporary Facilities and Controls.

2.3. SHOP FABRICATION

- 2.3.1. All fabrication to conform to AWMAC QSI Premium Grade and to reviewed shop drawings.
- 2.3.2. All faces and edges are to be finished as indicated.
- 2.3.3. Nail heads of finishing nails and press screws into countersunk holes. Holes to be filled with wood fill, then sanded until a smooth surface is obtained.

PART 3 - EXECUTION

3.1. DISMANTLING

- 3.1.1. Remove window sashes and door leaves for shop restoration. Fit the openings with insulated, weather tight closures.
- 3.1.2. Label salvaged components with gasket paper, mark with a waterproof marker, and securely attach to the component on a hidden surface. For smaller components that are dismantled on site – such as hardware – place in a sealable plastic bag with label visible within the bag.
- 3.1.3. Window and door frames to remain in-situ, to be restored on site.
- 3.1.4. Protect and transport window sashes and door leaves to an off-site facility for shop work. Protect sashes and doors for transport individually as follows:
 - 3.1.4.1. Wrap window sashes and door leaves with polyethylene foam sheeting, crate and identify.
- 3.1.5. Handle crates with care; do not drop or damage packing and crating during transport.
- 3.1.6. In shop, remove hardware from window sashes and door leaves. clean the screw heads for removal. Apply penetrating oil 24 hours in advance of removal. Use screw drivers that fit the heads.
 - 3.1.6.1. Remove and salvage door hardware. Door hardware to be cleaned and restored in shop.
 - 3.1.6.2. Remove and discard weatherstripping

3.2. REMOVAL OF EXISTING FINISHES

- 3.2.1. Strip finishes as per Section 09 91 00 – Painting.
- 3.2.2. When working in situ, build containment around work area. Clean contained area using HEPA vacuums once stripping is complete. Leave containment in place until final painting and varnish is cured.

3.3. EPOXY REPAIR

- 3.3.1. Prior to application, remove dirt, loose friable material, and soft wood decay (deterioration from fungal attack) to sound wood. Discard loose fragments and blow out dust.
- 3.3.2. Riddle large or deep checks and/or cavities. Drill with 3 mm diameter holes at 13 mm spacing. Protect the prepared area.
- 3.3.3. Apply Borate to surface in areas of wood decay.

- 3.3.4. Obtain approval from Consultant of preparation work prior to proceeding with installation.
- 3.3.5. Consolidation:
 - 3.3.5.1. Apply epoxy consolidant by pouring and brushing onto the wood surface until prepared area is fully saturated. Applicator bottle can be used to inject into drilled holes or larger openings in the wood. Consolidant will readily follow grain of wood. For vertical surfaces, drill small holes in wood on angle to hold consolidant. Apply wood consolidant while absorption continues.
 - 3.3.5.2. Apply liberally to prepared area but not beyond. Do not allow consolidant to touch adjacent areas, materials or building components. Repeat application 4 to 6 times over an 8 hour period or until surfaces do not accept more consolidant. Allow approximately 1 hour between applications.
 - 3.3.5.3. Protect until epoxy has cured. Keep treated area out of direct sunlight and at temperatures above 15 degrees C until cured. Shade treated area for minimum of 8 hours following application.
 - 3.3.5.4. After curing, infill voids with epoxy patching compound.
- 3.3.6. Patching:
 - 3.3.6.1. Apply epoxy patching compound with a putty knife, trowel or similar tool.
 - 3.3.6.2. Apply patch to prepared cavities or checks previously encapsulated with epoxy consolidant. Do not apply in thicknesses greater than 38 mm or in any one area exceeding one quart at one time. Allow epoxy to set before applying additional layers.
 - 3.3.6.3. In certain situations, such as with window sills where the outside corner has abraded away, the patch material shall be mixed at a low viscosity and cast to form the desired shape. Use butcher's wax as a release on the form. After the patch has cured remove all traces of the release with turpentine to ensure adhesion of paint films.
 - 3.3.6.4. Do not fill construction joints, such as that between a stile and rail, with epoxy.
 - 3.3.6.5. Plane, tool and sand surfaces smooth so that the epoxy is limited to voids. In the process, remove excess epoxy to expose sound wood surface where possible.
 - 3.3.6.6. For best results, allow 15-20 minutes of standing time after application before roughly shaping and moulding.
 - 3.3.6.7. Let filler cure 36-72 hours, depending on temperature. Cured epoxy can be worked and tooled similar to real wood.
 - 3.3.6.8. Sanding can generally take place within 24-48 hours. Premature sanding will gum up sand paper. Always sand with wood grain.
 - 3.3.6.9. Restore original profile and ensure proper fit of wood components.

3.4. MINOR WOOD REPAIRS

- 3.4.1. Repair small holes and small areas of damage found on the wood surfaces using a round wood plug repair.
- 3.4.2. Wood used for this type of repair must match the host species and grain orientation.
- 3.4.3. Size of repairs should range from 5 to 25 mm in diameter. The smallest possible diameter should be used for each repair to ensure that the original materials are being reused as much as possible.
- 3.4.4. Glue in repairs using specified glue. Hand plane or chisel off excess wood.
- 3.4.5. Sand area until even surface has been attained to allow for proper application of finishes.

3.5. MAJOR WOOD REPAIRS

- 3.5.1. Large damaged areas found on the wood surfaces shall be repaired using larger dutchman repairs.

- 3.5.2. Wood used for this type of repair should match the host species and grain orientation.
- 3.5.3. The repairs should be glued in place using specified slow drying epoxy resin glue with wood fillers added to seal the gaps.
- 3.5.4. Hand plane or chisel off excess wood.
- 3.5.5. Sand area until even surface has been attained to allow for proper application of finishes.

3.6. THIN WOOD DUTCHMAN REPAIRS

- 3.6.1. Clean out large cracks or checks in frames and sashes. Use thin metal scrapers to dig any embedded particulates out of the cracks.
- 3.6.2. Clean area using oil free compressed air.
- 3.6.3. Mask areas to avoid glue run off.
- 3.6.4. Shape replacement piece of wood to size while ensuring that new piece matches species and grain orientation.
- 3.6.5. Glue wood into place using specified glue.
- 3.6.6. Hand plane or chisel off excess wood.
- 3.6.7. Sand area until even surface has been attained to allow for proper application of finishes.

3.7. REPLACEMENT OF INDIVIDUAL COMPONENT

- 3.7.1. Layout joints and pieces as per existing approved mock-ups.
- 3.7.2. Shape repair piece, to match size and profile of existing according to approved sample.
- 3.7.3. Trial fit joints before fastening in place. Adjust as necessary to ensure close accurate fit with adjacent surfaces.
- 3.7.4. Select dowel length to suit application, glue in place, and trim prior to sanding as required.

3.8. RESTORATION OF FRAMES, WINDOW SASHES AND DOORS

- 3.8.1. Repair frames, salvaged window sashes and salvaged door leaves with epoxy and/or dutchman repairs. Location of repairs to be determined by Consultant and Contractor after the paint has been stripped off the frames and the sashes.
- 3.8.2. Stabilize joinery of salvaged sashes and doors; assume 100% of joints require stabilization. Remove existing wedges, reset with small amount of adhesive, and fill gaps with epoxy patch.
- 3.8.3. Plug holes or grooves in frames and salvaged sashes from discarded hardware, weatherstripping, and from obsolete fasteners with wood filler matching wood in colour. Apply to indentations, sand smooth and leave ready to receive finish.

3.9. PROTECTION

- 3.9.1. Protect installed products and components from damage during construction. Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide glazing schedule including but not limited to following:
 - 1.2.1.1. glass types (GL).
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Installation of glazing units: Section 05 73 13, Glazed Decorative Metal Railings.
 - 1.2.2.2. Installation of glazing units: Section 08 11 13, Hollow Metal Doors and Frames.
 - 1.2.2.3. Installation of glazing units: Section 08 11 16, Aluminum Doors and Frames.
 - 1.2.2.4. Installation of glazing units: Section 08 15 00, Plastic Laminate Wood Doors.
 - 1.2.2.5. Installation of glazing units: Section 08 43 14, Aluminum Framed Fire-Rated Storefronts.
 - 1.2.2.6. Installation of glazing units: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.7. Installation of glazing units: Section 08 51 13, Aluminum Windows.
 - 1.2.2.8. Installation of glazing units: Section 08 80 00, Glass and Glazing.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. FGIA: Fenestration & Glazing Industry Alliance; www.fgiaonline.org.
 - 1.3.1.2. FRCGL: Fire-Rated Ceramic Glass.
 - 1.3.1.3. HSGL: Heat-Strengthened Glass.
 - 1.3.1.4. PVB: Polyvinyl Butyral.
 - 1.3.1.5. SGP: SentryGlas® ionoplast interlayer; www.sentryglas.com.
 - 1.3.1.6. TGL: Tempered Glass.
 - 1.3.1.7. TLGL: Tempered Laminated Glass.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM C1376-21a - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
 - 1.3.2.2. CAN/CGSB-12.8-17 - Insulating Glass Units

1.4. SUBMITTALS

- 1.4.1. Samples:
 - 1.4.1.1. Submit samples of materials in accordance with Section 01 30 00 identifying quality and type of glass before commencing work. Ensure samples are clearly labelled with manufacturer's name and type.

- 1.4.1.2. Submit following samples:
- 1.4.1.2.1. 300 mm x 300 mm (12" x 12") tempered glass.
- 1.4.1.2.2. 300 mm x 300 mm (12" x 12") laminated glass.
- 1.4.1.2.3. Glass (GL): 300 mm x 300 mm (12" x 12") of each GL glass unit type complete with specified glass pane types and thicknesses.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List for Glass: Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Cardinal Glass Industries; www.cardinalcorp.com
 - 2.1.1.2. Guardian Industries Canada Corp.; www.guardian.com
 - 2.1.1.3. Pilkington Building Products; www.pilkington.com
 - 2.1.1.4. Vitro Architectural Glass; www.vitro.com
- 2.1.2. Manufacturer List for Insulated Glass Units: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.2.1. Oldcastle Building Envelope; www.obe.com
 - 2.1.2.2. Prelco; www.prelco.ca
 - 2.1.2.3. Saand Inc.; www.saand.ca
 - 2.1.2.4. Trulite Glass & Aluminum Solutions, LLC; www.trulite.com
 - 2.1.2.5. Viracon; www.viracon.com
 - 2.1.2.6. Vista Glass Corp.

2.2. MATERIALS

- 2.2.1. Glazing Materials:
 - 2.2.1.1. For glass material types, refer to "Related Sections" specified herein.
 - 2.2.1.2. Primary Seal: Provide a polyisobutylene based sealant exhibiting excellent long-term stability remaining permanently flexible, even at low temperatures, "ADOTHERM™ PIB Series" by ADCO; www.adcocorp.com. Provide in black or grey colour as selected by Consultant.
 - 2.2.1.3. Secondary Seal: Provide 1 of following:
 - 2.2.1.3.1. 2 component high-modulus elastomeric silicone sealant, "DOWSIL™ 982 Silicone Insulating Glass Sealant" by The Dow Chemical Company; www.consumer.dow.com or "Sikasil® IG-25 UV Resistant Insulating Glass Sealant" by Sika Canada Inc.; www.sika.com. Provide in colour specified herein.
 - 2.2.1.3.2. 1 component high-modulus, moisture cure elastomeric silicone sealant, "DOWSIL™ 3-0117 Silicone Insulating Glass Sealant" by The Dow Chemical Company or "Sikasil® IG-16 UV Resistant Insulating Glass Sealant" by Sika Canada Inc. Provide in colour specified herein.

- 2.2.1.4. Low Emissivity Glass Coating (Low 'E'): To glass units specified herein, as applicable and unless otherwise designated apply Low 'E' coating to No. 2 surface of a sealed insulating glass unit to meet criteria specified herein. Permitted manufacturers and applicators of Low 'E' coatings are Cardinal Glass Industries; www.cardinalcorp.com, Guardian Industries Corp.; www.guardianglass.com, Saint Gobain; www.saint-gobain.com, Pilkington Building Products; www.pilkington.com, Viracon; www.viracon.com and Vitro Architectural Glass; www.vitro.com. Uniformly apply Low 'E' coating to glass. Edge delete Low 'E' coating where silicone sealant is in contact with glass.
- 2.2.1.5. Factory sealed insulating glass units to requirements of CAN/CGSB-12.8 using dual seal. Maintain separation of panes with non-corrosive desiccant filled spacer core. Dehydrate air space and hermetically seal inner and outer panes at periphery with flexible sealer. Ensure thermal resistance of glazing system edge seals are maximum 1.0 m²•°C/W for units to qualify as "warm edge spacers" and maximum 0.5 m²•°C/W for areas with a higher risk of condensation.
- 2.2.2. Fabrication: Manufacture factory sealed insulating glass units in accordance with FGIA's "IGMAC Certification Program Manual".

PART 3 - EXECUTION

3.1. GLAZING SCHEDULE

- 3.1.1. Glass Types (GL):
- 3.1.1.1. Type GL-1 (Guards): Laminated glass (TLGL) unit consisting of:
- 3.1.1.1.1. Outboard Pane: 6 mm (1/4") thick low iron tempered glass (TGL).
- 3.1.1.1.2. Interlayer: 1.6 mm (0.060") thick clear SGP.
- 3.1.1.1.3. Inboard Pane: 6 mm (1/4") thick low iron tempered glass (TGL).
- 3.1.1.2. Type GL-2 (Doors, etc.): Single glass unit consisting of:
- 3.1.1.2.1. Glass Type: clear tempered glass (TGL).
- 3.1.1.2.2. Glass Thickness: 6 mm (1/4").
- 3.1.1.3. Type GL-11: Factory sealed insulating glass unit assembly consisting of:
- 3.1.1.3.1. Outboard Pane: minimum 6 mm (1/4") thick low-iron heat-strengthened glass (HSG).
- 3.1.1.3.2. Low 'E' Coating: "Solarban® 60" by Vitro Architectural Glass on surfaces #2 & #4.
- 3.1.1.3.3. Air Space: 12.7 mm (1/2") thick 90% Argon filled.
- 3.1.1.3.4. Spacer: Black non-metallic.
- 3.1.1.3.5. Secondary Sealant Colour: Black.
- 3.1.1.3.6. Middle Pane: minimum 6 mm (1/4") thick low-iron tempered glass (TGL).
- 3.1.1.3.7. Air Space: 12.7 mm (1/2") thick 90% Argon filled.
- 3.1.1.3.8. Spacer: Black non-metallic.
- 3.1.1.3.9. Secondary Sealant Colour: Black.
- 3.1.1.3.10. Inboard Pane: minimum 6 mm (1/4") thick low-iron tempered glass (TGL).
- 3.1.1.4. Type GL-12: Factory sealed insulating glass unit assembly consisting of:
- 3.1.1.4.1. Outboard Pane: minimum 6 mm (1/4") thick low-iron heat-strengthened glass (HSG).

- 3.1.1.4.2. Low 'E' Coating Performance Requirements on Surface #2:
- 3.1.1.4.2.1.1. Visible Light Transmittance: 64%.
- 3.1.1.4.2.1.2. Winter Night-Time U-Value: 0.24.
- 3.1.1.4.2.1.3. Shading Coefficient: 0.31.
- 3.1.1.4.2.1.4. Solar Heat Gain Coefficient: 0.27.
- 3.1.1.4.3. Air Space: 12.7 mm (1/2") thick 90% Argon filled.
- 3.1.1.4.4. Spacer: Black non-metallic.
- 3.1.1.4.5. Secondary Sealant Colour: Black.
- 3.1.1.4.6. Inboard Pane: minimum 6 mm (1/4") thick low-iron tempered glass (TGL).
- 3.1.1.5. Type GL-13: Laminated glass (LGL) unit consisting of:
- 3.1.1.5.1. Outboard Pane: 6 mm (1/4") thick low-iron tempered glass (TGL).
- 3.1.1.5.2. Interlayer: 1.6 mm (0.060") thick clear SGP.
- 3.1.1.5.3. Inboard Pane: 6 mm (1/4") thick low-iron tempered glass (TGL).
- 3.1.1.6. Types GL-20 & GL-21: FRCGL – Refer to Section 08 80 00.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide hollow metal doors and frames including but not limited to following:
 - 1.2.1.1. supply of interior hollow metal doors.
 - 1.2.1.2. supply of exterior insulated hollow metal doors.
 - 1.2.1.3. supply of fire-rated hollow metal doors.
 - 1.2.1.4. supply of hollow metal door frames.
 - 1.2.1.5. supply of hollow metal frames and mullions for borrowed lights and glazed screens.
 - 1.2.1.6. preparation of hollow metal doors and frames for door hardware.
 - 1.2.1.7. glazing stops.
 - 1.2.1.8. preparation of hollow metal doors and frames for security system including CSA approved wiring, conduit and junction boxes for electronic hardware.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Building in hollow metal door frames in masonry walls: Section 04 20 00, Masonry Units.
 - 1.2.2.2. Setting in place hollow metal door frames in masonry: Section 06 90 00, General Installations.
 - 1.2.2.3. Hanging of doors and installation of door hardware: Section 06 90 00, General Installations.
 - 1.2.2.4. Caulking and/or sealing door frames: Section 07 92 00, Joint Sealants.
 - 1.2.2.5. Provision of glazing schedule: Section 08 06 80, Glazing Schedule.
 - 1.2.2.6. Supply of door hardware: Section 08 71 00, Door Hardware.
 - 1.2.2.7. Provision of glass: Section 08 80 00, Glass and Glazing.
 - 1.2.2.8. Installation of snap-in clips and frames in gypsum board partitions: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.9. Finish painting doors and frames: Section 09 91 00, Painting.
 - 1.2.2.10. Wiring and conduit for electronic hardware in frame: Division 26, Electrical.
 - 1.2.2.11. Provision of security system: Division 28, Electronic Safety and Security.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CSDMA: Canadian Steel Door Manufacturers Association; www.csdma.org.
 - 1.3.1.2. HMMA: Hollow Metal Manufacturers Association; www.naamm.org/hmma/.
 - 1.3.1.3. NAAMM: National Association of Architectural Metal Manufacturers; www.naamm.org.
 - 1.3.1.4. OBC: Ontario Building Code.
 - 1.3.1.5. RRPC: Resin Reinforced Polychloroprene.

- 1.3.1.6. TRR: Temperature Rise Rated.
- 1.3.1.7. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ANSI/SDI A250.4-18 - Test Procedure and Acceptance Criteria for - Physical Endurance for Steel Doors, Frames and Frame Anchors
 - 1.3.2.2. ANSI/SDI A250.10-20 - Test Procedure and Acceptance Criteria for - Prime Painted Steel Surfaces for Steel Doors and Frames
 - 1.3.2.3. ASTM A568/A568M-19a - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
 - 1.3.2.4. ASTM A653/A653M-23 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.2.5. ASTM C177-19e1 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - 1.3.2.6. ASTM C518-21 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 1.3.2.7. ASTM C578-22 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - 1.3.2.8. CSA W59-18(23) - Welded steel construction
 - 1.3.2.9. NAAMM-HMMA 840-16 - Guide Specification for Receipt, Storage and Installation of Hollow Metal Doors and Frames
 - 1.3.2.10. NAAMM-HMMA 860-13 - Guide Specifications for Hollow Metal Doors and Frames
 - 1.3.2.11. NFPA 80-22 - Standard for Fire Doors and Other Opening Protectives
 - 1.3.2.12. NFPA 252-22 - Standard Methods of Fire Tests of Door Assemblies
 - 1.3.2.13. NFPA 257-22 - Standard on Fire Tests for Window and Glass Block Assemblies
 - 1.3.2.14. CAN/ULC-S104-15 - Standard Method for Fire Tests of Door Assemblies
 - 1.3.2.15. CAN/ULC-S105-16 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104
 - 1.3.2.16. CAN/ULC-S106-15(20) - Standard Method for Fire Tests of Window and Glass Block Assemblies
 - 1.3.2.17. CAN/ULC-S702.1-21 - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Scheduling: Submit a schedule indicating each door and frame related to the Door Schedule.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings:
 - 1.5.1.1. Submit Shop Drawings in accordance with Section 01 30 00. Show each type of frame, door, core, metal thicknesses and finishes, openings (glazing), fire ratings, location of exposed fasteners, cutouts, hardware blanking, reinforcing, tapping and drilling arrangements. Show large scale frame sections and anchoring details. Submit door and frame schedule identifying each unit. Ensure each unit bears legible identifying mark corresponding to that listed in Door Schedule.
 - 1.5.1.2. For each door and frame scheduled for electrical hardware, show following items in addition to minimum requirements (coordinate with Division 26):
 - 1.5.1.2.1. location and size of junction boxes and conduit for electrical hardware and wiring (electrical junction back boxes by this Section).
 - 1.5.1.2.2. conduit cutouts (conduit and connectors by Division 26).
 - 1.5.1.2.3. other information related to electrical hardware or interrelated systems such as fire alarm and security systems/controls.
 - 1.5.2. Samples: Submit samples in accordance with Section 01 30 00. Provide 1 cut-away corner sample minimum 300 mm (12") square for each type of door and frame to indicated following:
 - 1.5.2.1. Doors:
 - 1.5.2.1.1. core.
 - 1.5.2.1.2. reinforcing.
 - 1.5.2.1.3. facing.
 - 1.5.2.1.4. frame.
 - 1.5.2.1.5. insulation if applicable.
 - 1.5.2.1.6. glazing if applicable.
 - 1.5.2.1.7. factory applied finishes if applicable.
 - 1.5.2.2. Frames:
 - 1.5.2.2.1. frame profile.
 - 1.5.2.2.2. corner joints.
 - 1.5.2.2.3. floor and wall anchors.
 - 1.5.2.2.4. silencers.
 - 1.5.3. Test and Evaluation Reports: Submit following test and evaluation reports in accordance with NAAMM/HMMA 860:
 - 1.5.3.1. Hollow metal door and frame assemblies supplied under this Section meet acceptance criteria of ANSI/SDI A250.4, Level A.
 - 1.5.3.2. Primer applied on hollow metal door and frame assemblies meet acceptance criteria of ANSI/SDI A250.10.
 - 1.5.3.3. Insulated doors supplied in exterior openings meet specified thermal resistance rating.
 - 1.5.3.4. Ensure reports include name of testing authority, date of test, location of test facility, description of test specimen, procedures used in testing and indicate compliance with specified acceptance criteria.
 - 1.5.3.5. Submit in addition to fire label, certificate to substantiate design and construction of fire-rated screen assemblies, if required by Consultant or authorities having jurisdiction.

1.6. QUALITY ASSURANCE

1.6.1. Qualifications:

- 1.6.1.1. Manufacturers: Execute work of this Section by a manufacturer who is a member of CSDMA and/or HMMA ensuring Product quality meets standards set by these associations.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Delivery and Acceptance Requirements:

- 1.7.1.1. Identify Products with a label indicating: manufacturer's name, Consultant's opening number, Product description and dimensions.

- 1.7.1.2. Protect doors and frames during shipping.

- 1.7.1.3. Inspect materials thoroughly upon receipt and report discrepancies, deficiencies and damage immediately in writing to Consultant. Note damages on carrier's Bill of Lading.

1.7.2. Storage and Handling:

- 1.7.2.1. Store and protect doors and frames during storage in accordance with NAAMM-HMMA 840. Coordinate this requirement with Section 06 90 00 for installing doors.

- 1.7.2.2. Remove wrappings or coverings from doors upon delivery at site. Store doors in vertical position, spaced by blocking at least 100 mm (4") off ground to permit air circulation between them.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work manufactured from ASTM A653/A653M, A40 galvanized steel, touched up only with zinc-rich rust inhibitive primer where coating was removed during its manufacture for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; rust perforation when stored, installed and finish painted in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

- 2.1.1.1. Artek Door Ltd.; www.artekdoor.com

- 2.1.1.2. Baron Steel Doors & Frames; www.baronmetal.com

- 2.1.1.3. Daybar Industries Limited; www.daybar.com

- 2.1.1.4. Fleming Door Products Ltd.; www.flemingdoor.com

- 2.1.1.5. Gensteel Doors, Inc.; www.gensteeldoors.com

- 2.1.1.6. Shanahan's Limited Partnership; www.shanahans.com

- 2.1.2. Provide doors and frames for work of this Section by a single source manufacturer.

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

- 2.2.1.1. Ensure Product is manufactured by a firm experienced in design and production of standard and custom commercial metal door and frame assemblies, integration of builders' or electronic hardware and glazing assemblies and other items affecting work.

- 2.2.1.2. Cycle Test Acceptance Criteria: Ensure door and frame assembly is testing in accordance with ANSI/SDI A250.4 for "High Usage" and is certified as Level "A" (1,000,000 cycles).
- 2.2.1.3. Twist Test Acceptance Criteria: Maximum permanent deflection not to exceed 3 mm (1/8") under a maximum 136 kg (300 lb) load, total deflection not to exceed 32 mm (1-1/4") when tested in accordance with ANSI/SDI A250.4. Ensure tests are conducted by an independent nationally recognized accredited laboratory.
- 2.2.1.4. Test fire rated doors, frames, transom frames and sidelight assemblies in accordance with requirements of CAN/ULC-S104 and NFPA 252. Test borrowed lights and screens in accordance with CAN/ULC-S106 and NFPA 257. Ensure Products are listed by a nationally recognized testing agency acceptable to authorities having jurisdiction and reviewed by Consultant having factory inspection services.
- 2.2.1.5. Ensure core materials for exterior doors attain a thermal resistance of RSI = 1.23 (R = 7) when tested in accordance with ASTM C177 or ASTM C518.
- 2.2.2. Sheet Steel:
 - 2.2.2.1. Interior Doors and Frames: Commercial grade steel to ASTM A568/A568M, Class 1, hot-dip galvanized to ASTM A653/A653M, ZF120 (A40), known commercially as "Galvanneal". Steel sheet thicknesses specified are base metal thicknesses prior to galvanizing.
 - 2.2.2.2. Exterior Doors and Frames: Commercial grade steel to ASTM A568/A568M, Class 1, hot-dip galvanized to ASTM A653/A653M, Z275 (G90). Steel sheet thicknesses specified are base metal thicknesses prior to galvanizing.
- 2.2.3. Door Cores:
 - 2.2.3.1. Steel Stiffened: Continuous vertically formed steel sections, full thickness of interior space between door faces. Stiffeners 0.66 mm minimum thickness, spaced 150 mm (6") apart and securely fastened to both face sheets by industrial glue for moderate duty doors or laser welds for heavy duty doors spaced a maximum of 125 mm (5") oc vertically.
 - 2.2.3.2. Insulation: Mineral wool insulation, density 24 kg/m³ (1.5 pcf) minimum consisting of durable fibrous material processed from rock, slag or glass, bound with deterioration resistant binders, CAN/ULC-S702.1, Type 1.
 - 2.2.3.3. TRR Core: Core composition to limit temperature rise on unexposed side of door to 250 deg C (450 deg F) at 30 or 60 minutes, as determined by OBC requirements. Test core as part of complete door assembly in accordance with CAN/ULC-S104 or NFPA 252 and listed by nationally recognized testing agency having factory inspection service.
 - 2.2.3.4. Polyisocyanurate (Exterior Doors): Rigid polyisocyanurate, closed cell board, 32 kg/m³ (2.0 lb/cu ft) density and a minimum RSI = 1.9 (R = 10.8).
- 2.2.4. Adhesives:
 - 2.2.4.1. Steel Components: Heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
 - 2.2.4.2. Polyisocyanurate Cores: Heat resistant, epoxy resin based, low viscosity, contact cement.
 - 2.2.4.3. Lock-Seam Doors: Fire resistant, RRPC, fire resistant, high viscosity sealant/adhesive.
- 2.2.5. Primer: Rust inhibitive touch-up only.
- 2.2.6. Door Silencers (Bumpers): Single stud rubber/neoprene type.
- 2.2.7. Fasteners for Stops: Cadmium plated steel, counter sunk flat or oval head sheet metal Phillips screws.
- 2.2.8. Mortar Guard Boxes: Minimum 0.66 mm thick steel.

- 2.2.9. Frame Anchors:
 - 2.2.9.1. Floor Anchors: Minimum 3 mm (1/8") thick adjustable floor anchors with 2 holes for bolting to floor.
 - 2.2.9.2. Wall Anchors:
 - 2.2.9.2.1. Masonry T-strap Type Wall Anchors: Minimum 1.06 mm thick steel.
 - 2.2.9.2.2. Existing Masonry/Concrete Wall Type Anchors: Minimum 0.81 mm thick steel.
 - 2.2.9.2.3. Masonry Stirrup-strap Type 50 mm x 250 mm (2" x 10"): Minimum 1.34 mm thick steel.
 - 2.2.9.2.4. Steel/Wood Stud Type: Minimum 0.81 mm thick steel.
 - 2.2.9.2.5. Steel/Wood Stud Tension and Associated Wall Type: Minimum 0.81 mm thick steel.
- 2.2.10. Fire Rated Door and Frame Assemblies: Conform to CAN/ULC-S104, CAN/ULC-S105, NFPA 80 and NFPA 252.
- 2.2.11. Fabrication:
 - 2.2.11.1. Welding: Carry out welding in accordance with CSA W59.
 - 2.2.11.2. Grind exposed welds smooth and flush. Fill open joints, seams and depressions with filler or by continuous brazing or welding. Grind smooth to true sharp arises and profiles and sand down to smooth, true, uniform finish.
 - 2.2.11.3. Hardware Requirements: Blank, mortise, reinforce, drill and tap doors and frames to receive mortised templated hardware. Check hardware list for requirements.
 - 2.2.11.4. Frames - General:
 - 2.2.11.4.1. Fabricate frames for doors, screens and borrowed lights to profiles indicated.
 - 2.2.11.4.2. Ensure exterior frames are welded type construction. Ensure interior frames are welded type construction.
 - 2.2.11.4.3. Reinforce frame as required for surface mounted hardware. For door frames wider than 1500 mm (5'), reinforce door frame head and jamb and mullions at junction of head.
 - 2.2.11.4.4. Protect mortise cut outs with mortar guard boxes. Omit for gypsum board applications.
 - 2.2.11.4.5. Where frames occur in masonry provide strip strap, T-strap or wire type anchors. Where frames occur in gypsum board provide stud type anchors.
 - 2.2.11.4.6. Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb. Provide 2 anchors for rebate opening heights up to and including 1500 mm (5') and 1 additional anchor for each additional 760 mm (30") of height or fraction thereof, except as indicated below. For frames in previously placed concrete, masonry or structural steel provide anchors located not more than 150 mm (6") from top and bottom of each jamb and intermediate anchors at 660 mm (26") on centre maximum.
 - 2.2.11.4.7. Where floor finishes allow, fabricate frames to extend 38 mm (1-1/2") below finished floor level. Where frames are to terminate at finished floor level, provide plates for anchorage to slabs.
 - 2.2.11.4.8. Prepare each door opening for single stud door silencers: 3 for single door openings placed opposite hinges: 2 for double door openings approximately 150 mm (6") each side of centreline of head stop.
 - 2.2.11.4.9. Supply removable portion of stop and frame where required for overhead concealed door closers and properly connect to frame and prepare for attachment to closer prior to shipment.
 - 2.2.11.4.10. Provide 0.81 mm thick steel snap-in or welded-in "Z" type stud anchors for door frames installed in steel stud gypsum board partitions. Ensure snap-in clips are supplied to Section 09 21 16.
 - 2.2.11.4.11. Factory apply touch-up primer to areas where zinc coating has been removed during fabrication.

- 2.2.11.4.12. Construct door frames of labelled fire doors as detailed in Follow-up Service Procedures/ Factory Inspection Manuals issued by nationally recognized listing agency to individual manufacturers and tested in conformance with CAN/ULC-S104. Ensure ratings for frames match doors as minimum requirement. Locate label on frame jamb on hinge side, so it is concealed when door is closed.
- 2.2.11.5. Hollow Metal Door Frames:
 - 2.2.11.5.1. Steel:
 - 2.2.11.5.1.1. Interior: Minimum 1.34 mm thick steel.
 - 2.2.11.5.1.2. Exterior: Minimum 1.70 mm thick steel.
 - 2.2.11.5.2. Reinforcements:
 - 2.2.11.5.2.1. Lock and Strike Reinforcements: Minimum 1.34 mm thick steel.
 - 2.2.11.5.2.2. Hinge Reinforcements: Minimum 3.12 mm thick steel.
 - 2.2.11.5.2.3. Flush Bolt Reinforcement: Minimum 1.34 mm thick steel.
 - 2.2.11.5.2.4. Reinforcement for Surface Applied Hardware: Minimum 1.06 mm thick steel.
 - 2.2.11.5.2.5. Concealed Door Closer or Holder Reinforcements: Minimum 2.36 mm thick steel.
 - 2.2.11.5.2.6. Top and Bottom End Channels: Minimum 1.06 mm thick steel.
 - 2.2.11.5.3. Jamb Shipping Bars: Minimum 0.81 mm thick steel.
- 2.2.11.6. Sidelight and Window Frame Assemblies:
 - 2.2.11.6.1. Steel: Minimum 1.34 mm thick steel.
 - 2.2.11.6.2. Glazing Stops: Minimum 0.81 mm thick steel, formed, drilled and countersunk for fastenings.
- 2.2.11.7. Welded Type Frames:
 - 2.2.11.7.1. Punch mitre corners of frames. Punch mitres accurately with slots and tabs and weld continuously on inside of frame faces.
 - 2.2.11.7.2. When required due to site access or due to shipping limitations, fabricate frame Product for large openings in sections, with splice joints for field assembly. Provide alignment plates or angles at each joint, fabricated of same metal thickness as frame. Indicate joints for field assembly on Shop Drawings.
 - 2.2.11.7.3. Accurately cope and securely weld butt joints of mullions, transom bars, centre rails and sills. Grind welded joints to a smooth, uniform finish.
 - 2.2.11.7.4. Securely attach floor anchors to inside of each jamb profile.
 - 2.2.11.7.5. Weld in 2 temporary jamb shipping bars at each frame to maintain alignment during shipment.
 - 2.2.11.7.6. Use formed channel glazing stops, minimum 16 mm (5/8") in height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- 2.2.11.8. Doors - General:
 - 2.2.11.8.1. Fabricate doors to be swing type flush with 1 continuous face free from joints, tool markings and abrasions and with provisions for glass and/or louvre openings as indicated on Door Schedule and Drawings.
 - 2.2.11.8.2. Fabricate exterior doors using insulated steel stiffened construction. Fabricate interior doors using steel stiffened construction.
 - 2.2.11.8.3. For heavy duty and exterior hollow metal doors, ensure longitudinal edges have continuously welded seams, filled and sanded flush full height of door.
 - 2.2.11.8.4. Fabricate doors with top and bottom inverted recessed spot-welded channels.

- 2.2.11.8.5. Reinforce, blank, drill and tap doors for mortised, templated hardware.
- 2.2.11.8.6. Reinforce doors for surface mounted hardware.
- 2.2.11.8.7. Undercut 19 mm (3/4") for air intake at washrooms and other doors indicated on Door Schedule.
- 2.2.11.8.8. Factory prepare holes 13 mm (1/2") diameter and larger. Factory prepare holes less than 13 mm (1/2") when required for function of device for knob, lever, cylinder, turn pieces or when these holes overlap function holes.
- 2.2.11.8.9. Fabricate fire rated door assemblies as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by nationally recognized listing agency to individual manufacturer and tested in conformance with CAN/ULC-S104. Provide labels for fire rated doors.
- 2.2.11.8.10. Fabricate fire rated doors where indicated in Door Schedule or Drawings, to meet required maximum temperature rise on unexposed side of door in accordance with OBC and ULC requirements.
- 2.2.11.9. Interior Hollow Metal Doors:
 - 2.2.11.9.1. Face Sheets: 1.34 mm thick minimum galvanized steel sheet.
 - 2.2.11.9.2. Vertical Stiffeners: 0.81 mm thick minimum unprimed steel sheet.
 - 2.2.11.9.3. Glazing Stops: 1.34 mm thick minimum unprimed steel sheet, formed, drilled and countersunk for fastenings.
- 2.2.11.10. Interior Fire Rated Hollow Metal Doors:
 - 2.2.11.10.1. Face Sheets: 1.34 mm thick minimum galvanized steel sheet.
 - 2.2.11.10.2. Vertical Stiffeners: 0.81 mm thick minimum unprimed steel sheet.
- 2.2.11.11. Exterior Hollow Metal Doors:
 - 2.2.11.11.1. Face Sheets: 1.34 mm thick minimum galvanized steel sheet.
 - 2.2.11.11.2. Vertical Stiffeners: 0.81 mm thick minimum unprimed steel sheet.
 - 2.2.11.11.3. Glazing Stops: 1.34 mm thick minimum unprimed steel sheet, formed, drilled and countersunk for fastenings.
 - 2.2.11.11.4. End Channels:
 - 2.2.11.11.4.1. Top of Door: Close top of door with same material as face sheets. Steel flush channel, putty-filled seam and ground smooth, sealed, projection welded.
 - 2.2.11.11.4.2. Bottom of Door: Close bottom of door with same material as face sheets. Steel inverted channel.
 - 2.2.11.11.4.3. Provide weep-holes openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- 2.2.11.12. Doors (Steel Stiffened Construction):
 - 2.2.11.12.1. Fabricate door faces with a single sheet of galvanized steel welded to steel stiffeners.
 - 2.2.11.12.2. Reinforce steel stiffened doors with 0.912 mm thick (20 ga) continuous interlocking vertical steel stiffeners spaced 150 mm (6") oc maximum, spot welded at 150 mm (6") oc maximum to face sheets. Fill voids with mineral wool insulation specified herein.
- 2.2.11.13. Fabrication Tolerances:
 - 2.2.11.13.1. Frames:
 - 2.2.11.13.1.1. Width and Height: +1.6 mm (+1/16"), -0.8 mm (-1/32").
 - 2.2.11.13.1.2. Face, Stop and Rabbet: +/-0.8 mm (+/-1/32").
 - 2.2.11.13.1.3. Jamb Depth: +/-1.6 mm (+/-1/16").

- 2.2.11.13.2. Doors:
 - 2.2.11.13.2.1. Width and Height: +/-1.2 mm (+/-3/64").
 - 2.2.11.13.2.2. Thickness: +/-1.6 mm (+/-1/16").
 - 2.2.11.13.2.3. Edge Flatness: 1.6 mm (1/16") maximum.
 - 2.2.11.13.2.4. Surface Flatness: 3 mm (1/8") maximum.
 - 2.2.11.13.2.5. Door Twist: +/-1.6 mm (+/-1/16").
- 2.2.11.13.3. Hardware:
 - 2.2.11.13.3.1. Cutouts: Template dimension +0.38 mm (+0.015"), -0 mm (-0").
 - 2.2.11.13.3.2. Location: +/-0.8 mm (+/-1/32").
 - 2.2.11.13.3.3. Between Hinge Centrelines: +/-0.4 mm (+/-1/64").
- 2.2.11.14. Prime Painting: Apply factory touch up primer at areas where zinc coating has been damaged during fabrication.

2.3. SOURCE QUALITY CONTROL

- 2.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Supply hollow metal doors and frames to Section 06 90 00 for installation.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide aluminum doors and frames including but not limited to following:
 - 1.2.1.1. aluminum swing doors.
 - 1.2.1.2. aluminum door framing.
 - 1.2.1.3. aluminum closures and cover plates.
 - 1.2.1.4. back painting.
 - 1.2.1.5. wood blocking required for aluminum framing.
 - 1.2.1.6. weatherstripping, thresholds, pulls on aluminum swing doors.
 - 1.2.1.7. preparation of frames and doors for balance of door hardware.
 - 1.2.1.8. sealant within aluminum work and between aluminum framing and adjacent construction.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of glazing schedule: Section 08 06 80, Glazing Schedule.
 - 1.2.2.2. Provision of curtain wall: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.3. Hardware supplied by Section 08 71 00, Door Hardware, installed by Section 06 90 00, General Installations.
 - 1.2.2.4. Thermally broken threshold supplied by Section 08 71 00, Door Hardware, installed by Section 06 90 00, General Installations.
 - 1.2.2.5. Provision of glass: Section 08 80 00, Glass and Glazing.
 - 1.2.2.6. Wiring and conduit for electronic hardware in frame Product: Division 26, Electrical and Division 28, Electronic Safety and Security.

1.3. REFERENCES

- 1.3.1. Abbreviation and Acronyms:
 - 1.3.1.1. PVDF: Polyvinylidene Fluoride.
- 1.3.2. Reference Standards:
 - 1.3.2.1. AAMA 2605-22
 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusion and Panels (with Coil Coating Appendix)
 - 1.3.2.2. ASTM B117-19
 - Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 1.3.2.3. ASTM B244-09(21)
 - Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments

- | | | |
|-----------|-------------------|--|
| 1.3.2.4. | ASTM C920-18 | - Standard Specification for Elastomeric Joint Sealants |
| 1.3.2.5. | ASTM D523-14(18) | - Standard Test Method for Specular Gloss |
| 1.3.2.6. | ASTM D714-02(17) | - Standard Test Method for Evaluating Degree of Blistering of Paints |
| 1.3.2.7. | ASTM D968-22 | - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive |
| 1.3.2.8. | ASTM D2244-22 | - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates |
| 1.3.2.9. | ASTM D2247-15(20) | - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity |
| 1.3.2.10. | ASTM D3363-22 | - Standard Test Method for Film Hardness by Pencil Test |
| 1.3.2.11. | ASTM D4214-07(15) | - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Coordination: Review and coordinate door with hardware supplied by hardware supplier. Be responsible to provide adequate reinforcing, clearances, rebates and brackets for hardware specified and for accurate installation of door and hardware on site.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Submit Shop Drawings for aluminum doors and frames in accordance with Section 01 30 00. Indicate relation to adjoining work and location, construction and back-up, joint sealant, interior structure and/or reinforcements, door and glazing modules, head and frame details, extrusion sections (in half full size, if not of the manufacture specified and drawn), glazing and glass stop details, thermal break sections and vinyl or neoprene mouldings (in half full size) and anchorage and assembly fixings. Clearly indicate materials used for every component on Shop Drawings.
- 1.5.2. Samples: Submit to Consultant, duplicate sample sections of component parts of doors and glass, finished in specified colours. Ensure samples of extruded shapes are 300 mm (12") long; samples of each type of glass 300 mm (12") square.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data: Provide in form of a manual, maintenance instructions for aluminum doors and associated door hardware.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
- 1.7.1.1. Installers: Provide the work of this Section, executed by competent installers with minimum of 5 years' experience in the application of Products, systems and assemblies specified and with the approval and training of the Product manufacturers.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Transport materials to site storage in a manner to prevent in-transit damage. These measures include, but are not limited to, crating, polyethylene wrapping system, etc.
- 1.8.2. Storage and Handling Requirements:
- 1.8.2.1. Store in a dry, protected area on site, in original undamaged containers with manufacturer's labels and seals intact.

- 1.8.2.2. Comply with unpacking procedures as recommended by framing and glass manufacturers.

1.9. WARRANTY

- 1.9.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; leakage in excess of the specified tolerances and limits, glass breakage, failure of insulating glass units and condensation in excess of the specified tolerances and limits (without limit to other defects which may become apparent), organic fluoropolymer coating specified herein will not peel, check, blister or crack and be non-convertible and fading will be within +5 NBS.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Alumicor Limited; www.alumicor.com
- 2.1.1.2. Commdoor Aluminum; www.commdooraluminum.com
- 2.1.1.3. Kawneer Company Canada Limited; www.kawneer.com
- 2.1.1.4. Oldcastle Building Envelope®; www.obe.com

2.2. MATERIALS

- 2.2.1. Basic Material: Aluminum Association Alloy AA-6063-T5 for extruded shapes, commercial quality AA-1100-H14 aluminum sheet for formed shapes.
- 2.2.2. Hardware: Doors complete with weatherstripping around frame and along bottom of door and aluminum sill. Prepare doors to templates provided by hardware supplier, refer to Section 08 71 00.
- 2.2.3. Cover Plates: Extruded aluminum and sheet stock formed or brake shaped to profiles shown on Drawings.
- 2.2.4. Glass Materials: As specified in Section 08 80 00.
- 2.2.5. Glass Units (GL): For single glass unit types, refer to Section 08 06 80.
- 2.2.6. Factory Sealed Insulating Glass Units (GL): For factory sealed insulating vision glass unit types, refer to Section 08 06 80.
- 2.2.7. Sealant: Multi-component conforming to ASTM C920, Type M, Grade NS for sealant to be incorporated between aluminum framing and adjacent structures. Colours later selected by Consultant from standard colour selection. Supply non-hardening, non-skimming, non-sagging, non-bleeding polyisobutylene or partially vulcanized rubber base sealant for use in concealed-sealing of thin joints in metal work.
- 2.2.8. Screws, Bolts and Fasteners: Self tapping cadmium plated steel for aluminum to aluminum contact and stainless steel for aluminum to steel contact.
- 2.2.9. Steel Reinforcements and Anchors: Conforming to Section 05 50 00.
- 2.2.10. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.
- 2.2.11. Thermal Break Material: Polyvinyl chloride, of semi-rigid durometer hardness of 80, plus or minus 5, located on external side of glass pane.

- 2.2.12. Door Weatherstripping: Material designed for easy removal and replacement when worn; silicone treated twin-tuft pile at jambs and heads and 2.4 mm (3/32") white vinyl strips at toes, complete with adjustable fixing to ensure a full "wipe" of the thresholds below.
- 2.2.13. Compressible Filler: Supply "Unifoam R1009" by Goodco Limited.
- 2.2.14. Temporary Strips and Safety Markings: Supply 25 mm (1") wide, light reflecting, easily removable, pressure sensitive tape applied over glass lites in doors.

2.3. MANUFACTURED UNITS

- 2.3.1. Exterior Doors: Fully thermally broken; "Thermaporte 7700 - T600A" by Alumicor Limited or "560 Insulpour Door" by Kawneer Company Canada Limited. Provide double glazing on exterior doors unless indicated otherwise. Thermally clad (ie. Thermally improved) doors are not permitted.
- 2.3.2. Exterior Framing: "FlushGlaze BF3400 Series" by Alumicor Limited or "Trifab® VG 451/451T" by Kawneer Company Canada Limited.
- 2.3.3. Interior Doors: "Canadiana 600A" by Alumicor Limited, "500 Standard Door" by Kawneer Company Canada Limited or "Series 500 – Wide Stile" by Oldcastle Building Envelope®. Provide single glazed doors and double glazing on doors as shown on Drawings.
- 2.3.4. Interior Framing: "FlushGlaze TL 1800" by Alumicor Limited, "Trifab® VG 450" by Kawneer Company Canada Limited or "Standard Frame" by Oldcastle Building Envelope®.
- 2.3.5. Fabrication:
 - 2.3.5.1. Form sections true to detail, free from defects impairing appearance, strength and durability.
 - 2.3.5.2. Ensure frames are tubular extruded shapes with sharp, well defined corners.
 - 2.3.5.3. Ensure overall assembled profiles are as detailed on Drawings.
 - 2.3.5.4. Fabricate frames with continuous thermal breaks. Locate thermal break on exterior side of the glazing as detailed on Drawings and hold by snap-in methods without the use of any metallic fasteners which could reduce the effectiveness of the thermal barrier.
 - 2.3.5.5. Corners of formed work must be mitred and closely fitted. Apply back-up sealants designed for this purpose on inside of joints in aluminum work by this Section.
 - 2.3.5.6. Attach anchors on warm side.
 - 2.3.5.7. Carry out welding with argon shielded electric arcs to ensure complete fusion of the metal.
 - 2.3.5.8. Doors:
 - 2.3.5.8.1. Ensure aluminum doors have bevelled glazing beads designed for neoprene glazing system; except at exterior doors with insulating lites, use glazing system compatible with secondary sealant of the glass unit.
 - 2.3.5.8.2. Equip doors with full weatherstripping at perimeter. Install weatherstripping throughout full length and width of doors at jambs and heads.
 - 2.3.5.8.3. Fabricate doors and frames complete with necessary internal reinforcements, cutouts, recesses, mortising or milling operations required for a rigid assembly and to accommodate door hardware. Ensure connections have adequate strength.
 - 2.3.5.8.4. Fabricate frames with joints accurately fitted and securely joined together in a manner to ensure tightly fitting joints. Internally caulk and seal corners of frames and joints exposed to water penetration using a material compatible to resist flow at the high surface summer temperatures to be experienced by the metal.

2.3.6. Finishes: Provide 1 of following systems:

2.3.6.1. Superior Performance Coating Finish Process: (3 Coat Wet System (primer/colour coat/clear coat)) including thermal setting application of 70% fluoropolymer resin minimum, PVDF with added colour pigment finish exceeding or meeting AAMA 2605 requirements. Ensure fluoropolymer baked resins form a continuous physically locked finish during manufacturing process. Apply fluoropolymer finish after multistage chemical treatment cleaning providing corrosion resistance surface ready to receive primer. During baking process apply primer in accordance with manufacturer's recommendations followed by a flash process whereby evaporating solvent and then fluoropolymer finish sprayed on to aluminum; apply another flash procedure and then bake for approximately 10 minutes when aluminum surface reaches a temperature of 232 deg C (450 deg F). Permitted Products: "Duranar XL" by PPG Industries; www.ppgideascales.com or "Fluoropon® Classic" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

| | Description | Performance Characteristics |
|-------------|--|--|
| 2.3.6.1.1. | Coating Thickness: | 0.0063 mm +/-0.0013 mm (0.25 +/-0.05 mils) primer 0.025 mm (1.0 mil) min barrier coat (if applicable) 0.025 mm (1.0 mil) min colour coat 0.015 mm +/-0.0005 mm (0.6 +/-0.02 mil) clear top coat |
| 2.3.6.1.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.3.6.1.3. | Gloss (ASTM D523 @ 60°): | Medium gloss |
| 2.3.6.1.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.3.6.1.5. | Abrasion Resistance Falling Sand (ASTM D968): | 50 l/ml |
| 2.3.6.1.6. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.3.6.1.7. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.3.6.1.8. | Colour Retention 10 yrs, 45° South Florida (ASTM D2244): | ΔE <5.0 |
| 2.3.6.1.9. | Humidity Resistance: ASTM D714, ASTM D2247, 4000 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.3.6.1.10. | Salt Spray Resistance: ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.3.6.1.11. | Chalking Resistance 10 yrs, 45° South Florida (ASTM D4214): | No more than #8 (#6 for Whites) |
| 2.3.6.1.12. | Erosion Resistance: 10 yrs, 45° South Florida (ASTM B244): | Maximum 5% |

2.3.6.2. Superior Performance Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2605 with minimum 100% fluoropolymer resin. Permitted Product: "Interpon D3000 Fluoromax Powder Coating" by Akzo Nobel Coatings, Inc.; www.akzonobel.com with following characteristics:

| | Description | Performance Characteristics |
|------------|---|---|
| 2.3.6.2.1. | Coating Thickness: | 0.060 mm to 0.115 mm (2.4 mils to 4.5 mils) with no reading less than 0.045 mm (1.8 mils) |
| 2.3.6.2.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.3.6.2.3. | Gloss (ASTM D523 @ 60°): | 20% - 40% |
| 2.3.6.2.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.3.6.2.5. | Abrasion Resistance Falling Sand (ASTM D968): | 40 l/ml |
| 2.3.6.2.6. | Colour Retention 10 yrs, 45° South Florida (ASTM D2244): | ΔE <5.0 |
| 2.3.6.2.7. | Humidity Resistance ASTM D714, ASTM D2247, 4000 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.3.6.2.8. | Salt Spray Resistance ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.3.6.3. | Colours and Sheens: Refer to "Material and Finish Schedule" appended to Section 00 10 20. | |

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment Requirements: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Doors:
 - 3.2.1.1. Install doors plumb, square, level, free from warp, twist and superimposed loads.
 - 3.2.1.2. Secure work adequately and accurately to structure in required position, in a manner not restricting thermal movement.
 - 3.2.1.3. Provide compressible filler over aluminum work at locations shown on Drawings.
 - 3.2.1.4. Install doors complete with finish hardware supplied by hardware supplier, in accordance with templates supplied by same.
 - 3.2.1.5. After installation of hardware, have hardware supplier check operation of hardware. Do readjustments as required.
 - 3.2.1.6. Use aluminum or stainless steel screws, nuts, bolts, washers, rivets and other fastening devices, colour to match doors and frames where exposed to view.

- 3.2.2. Glazing:
 - 3.2.2.1. Use extruded gaskets for door glazing and of type compatible with secondary sealant in insulating glass unit locations.
 - 3.2.2.2. Thoroughly wipe surfaces receiving glazing materials with a cloth dampened in xylol to assure a clean surface.
 - 3.2.2.3. Place setting blocks at quarter points from each corner, centre sealed unit in opening and press firmly against tape. Provide isolation tape at edges of laminated glass to prevent staining of interply plastic from glazing materials. Roll-in inside resilient extrusion.
- 3.2.3. Caulking: At interior and exterior joints between aluminum framing and adjacent work of others execute following work:
 - 3.2.3.1. Install backer rod over compressible filler material or perimeter blocking to provide sealant joints of proper form, thickness to width ratios and bond break at back side of sealant. Where backer rod cannot be used or is not shown provide bond breaker tape to back side of sealant joint substrate.
 - 3.2.3.2. Clean substrate surfaces where sealant is to bond and apply sealant primers as recommended by sealant manufacturer.
 - 3.2.3.3. Caulk joints continuous to produce weatherproof and aesthetically pleasing joint installation.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Maintain aluminum work in a clean condition throughout construction period, so it will be without deterioration or damage at time of review. Select methods of cleaning which will promote achievement of uniform appearance and stabilized colours and textures for materials that weather or age with exposure.
- 3.4.2. Immediately before time of Substantial Performance, clean aluminum work thoroughly, inside and out. Demonstrate proper cleaning methods to Owner during this final cleaning. Prepare a "Cleaning and Maintenance Manual" listing types of cleaning compounds, cleaning methods, sealants and glazing materials of the work and submit 2 copies to Consultant.
- 3.4.3. Remove protective covering and coating from aluminum surfaces, inside and out and clean surfaces, remove labels, stripes and protective devices and polish glass surfaces, immediately prior to final review of the work by Consultant.

3.5. PROTECTION

- 3.5.1. Protect the work of this Section from damage. Protect work of other trades resulting from the work of this Section.
- 3.5.2. Provide at factory, strippable coatings on exposed surfaces of aluminum. Ensure coating and protective wrappings remain on surfaces through period other trades' works proceed on the building and removed by this trade on completion of building.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide plastic laminate wood doors including but not limited to following:
 - 1.2.1.1. plastic laminate wood doors.
 - 1.2.1.2. fire-rated plastic laminate wood doors.
 - 1.2.1.3. glass stops.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Setting steel door frames in masonry: Section 04 20 00, Masonry Units.
 - 1.2.2.2. Setting steel door frames in place: Section 06 90 00, General Installations.
 - 1.2.2.3. Installation of plastic laminate wood doors: Section 06 90 00, General Installations.
 - 1.2.2.4. Provision of glazing types: Section 08 06 80, Glazing Schedule.
 - 1.2.2.5. Supply steel door frames: Section 08 11 13, Hollow Metal Doors and Frames.
 - 1.2.2.6. Supply of door hardware: Section 08 71 00, Door Hardware.
 - 1.2.2.7. Supply of glass: Section 08 80 00, Glass and Glazing.
 - 1.2.2.8. Setting steel door frames in gypsum board partitions: Section 09 21 16, Gypsum Board Assemblies.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AWMAC/WI: Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute; www.awmac.com.
 - 1.3.1.2. ITS: (Warnock Hersey) - Certification Listings for Fire Doors.
 - 1.3.1.3. NAAWS: North American Architectural Woodwork Standards – 4.0, 2021, as amended.
 - 1.3.1.4. OBC: Ontario Building Code.
 - 1.3.1.5. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ANSI/NEMA LD 3-05 - High-Pressure Decorative Laminates
 - 1.3.2.2. NFPA 80-22 - Standard for Fire Doors and Other Opening Protectives
 - 1.3.2.3. NFPA 252-22 - Standard Methods of Fire Tests of Door Assemblies
 - 1.3.2.4. CAN/ULC-S104-15 - Standard Method for Fire Tests of Door Assemblies
 - 1.3.2.5. CAN/ULC-S105-16 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104
 - 1.3.2.6. UL 10B - Underwriters Laboratories Fire Tests for Door Assemblies

1.4. SUBMITTALS

- 1.4.1. Product Data: Submit Product data indicating door core materials and construction and face type - plastic laminate.
- 1.4.2. Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00. Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special bevelling, special blocking for hardware, identify cut outs for glazing and other openings.
- 1.4.3. Samples: Submit samples in accordance with Section 01 30 00. Provide 1 cut-away corner sample minimum 300 mm (12") square for each type of door to indicate following:
 - 1.4.3.1. core.
 - 1.4.3.2. head rail and jamb stile blocking.
 - 1.4.3.3. cross band and facing layers.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
 - 1.5.1.1. Provide work of this Section in accordance with Section 09 of NAAWS produced by AWMAC/WI, except as specified otherwise herein and by reference are hereby made a part of this Section. Ensure any reference to grades and terminology in this Section is as defined in NAAWS.
 - 1.5.1.2. Requirements of this Section govern and modify NAAWS.
 - 1.5.1.3. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and be a member of AWMAC/WI.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Delivery and Acceptance Requirements:
 - 1.6.1.1. Do not deliver finished Products during rainy or damp weather.
 - 1.6.1.2. Do not deliver work of this Section until the building and storage areas are sufficiently dry so Products will not be damaged by excessive changes in moisture content.
 - 1.6.1.3. Deliver Products of this Section in accordance with Section 13, 13.5.1.2 of NAAWS.
 - 1.6.1.4. Do not deliver and install damaged Products. Replace in accordance with the requirements of this Section.
- 1.6.2. Storage and Handling Requirements:
 - 1.6.2.1. Store and handle Products of this Section in accordance with Section 13, 13.5.1.3 and 13.5.1.4 of NAAWS.
 - 1.6.2.2. Remove from the Place of the Work, doors having scratches or other blemishes which cannot be removed by sanding and replace with new unblemished doors.

1.7. WARRANTY

- 1.7.1. Manufacturer Warranty: Warrant work of this Section against defects and deficiencies for a period of 3 years. Promptly correct defects and deficiencies which become apparent during warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include, but are not limited to, bubbling, delamination of faces, or edges, warp, twist bow exceeding 6 mm (1/4") and telegraphing of core. "Correct" referred to herein includes labour and materials for removal, repair, refinishing and replacement of Products provided as part of work of this Section, installing hardware, finishing, hanging and fitting.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Plastic Laminate Wood Doors Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Door Schedule and Specifications:
- 2.1.1.1. "8600-ME" by Baillargeon; www.masonitearchitectural.ca
- 2.1.1.2. "5-PC-ME" by Lambton Doors; www.lambtondoors.com
- 2.1.1.3. "Cendura™ Series | Mohawk - Everyday Laminate-Faced" by Masonite Architectural; www.masonitearchitectural.com
- 2.1.1.4. "Series 7000" by RK Doors Inc.; www.rkdoors.ca
- 2.1.2. Fire-Rated Plastic Laminate Wood Doors (20 Minute) Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Door Schedule and Specifications:
- 2.1.2.1. "8620-ME" by Baillargeon; www.masonitearchitectural.ca
- 2.1.2.2. "5-PC-ME" by Lambton Doors; www.lambtondoors.com
- 2.1.2.3. "Cendura™ Series | Mohawk - Everyday Laminate-Faced" by Masonite Architectural; www.masonitearchitectural.com
- 2.1.2.4. "Series 7000" by RK Doors Inc.; www.rkdoors.ca
- 2.1.3. Mineral Core Fire-Rated Plastic Laminate Wood Doors (45, 60 and 90 Minute) Manufacturer List: Products of following manufacturers are permitted for subject to conformance to requirements of Drawings, Door Schedule and Specifications:
- 2.1.3.1. "5045-MO", "5060-MO" or "5090-MO" with approved fire retardant reinforcing by Baillargeon; www.masonitearchitectural.ca
- 2.1.3.2. "5-FD45-ME", "5-FD60-ME" or "5-FD90-ME" with approved fire retardant reinforcing by Lambton Doors; www.lambtondoors.com
- 2.1.3.3. "Cendura™ Series | Mohawk - Everyday Laminate-Faced" by Masonite Architectural; www.masonitearchitectural.com
- 2.1.3.4. ["RK 45 Minute Fire Rated", "RK 60 Minute Fire Rated" or "RK 90 Minute Fire Rated" with approved fire retardant reinforcing by RK Doors Inc.; www.rkdoors.ca

2.2. MATERIALS

- 2.2.1. Description:
- 2.2.1.1. Regulatory Requirements:
- 2.2.1.1.1. Submit certification that fire-rated door [and panel construction] has been tested in conformance to CAN/ULC-S104, CAN/ULC-S105 or UL 10B, NFPA 80 and NFPA 252 as indicated on Drawings and Schedule.
- 2.2.1.1.2. Ensure plastic laminate wood doors requiring fire-rating carry either UL or ITS (Warnock Hersey) label.
- 2.2.2. Plastic Laminate Wood Doors:
- 2.2.2.1. Core: 448 kg/m³ (28 pcf) density solid particle core, mat-formed.
- 2.2.2.2. Stiles: Minimum 30 mm (1-3/16") wide laminated low density wood with minimum 22 mm (7/8") White Oak edge strips, before trim.
- 2.2.2.3. Rails: Minimum 30 mm (1-3/16") wide softwood.

- 2.2.2.4. Plastic Laminate Adhesive: Provide in accordance with Section 04, 04.5.5.2 and "Adhesive Usage Guide" in "Appendix" of NAAWS.
- 2.2.2.5. Crossbands: Minimum 3.2 mm (1/8") thick composite complete with veneer.
- 2.2.2.6. High Pressure, Paper Base, Decorative Laminates (HPDL): Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.2.2.6.1. Formica Inc.; www.formica.com
 - 2.2.2.6.2. Nevamar Company, LLC; www.nevamar.com
 - 2.2.2.6.3. Wilsonart Canada; www.wilsonart.com
 - 2.2.2.6.4. Provide types and thicknesses conforming to ANSI/NEMA LD 3 and Section 04, "Table: 04-009 – HPL TYPES and MINIMUM PERFORMANCE REQUIREMENTS" of NAAWS.
 - 2.2.2.6.5. Colours and Finishes: Refer to "Material and Finish Schedule" appended to Section 00 01 20.
 - 2.2.2.7. Vision Framing: White Oak stops.
- 2.2.3. Fire-Rated Plastic Laminate Wood Doors (20 Minute):
 - 2.2.3.1. Core: 448 kg/m³ (28 pcf) density solid particle core, mat-formed.
 - 2.2.3.2. Stiles: Minimum 30 mm (1-3/16") wide laminated low density wood with minimum 22 mm (7/8") White Oak edge strip facing, before trim.
 - 2.2.3.3. Rails: Minimum 30 mm (1-3/16") wide softwood.
 - 2.2.3.4. Plastic Laminate Adhesive: Provide in accordance with Section 04, 04.5.5.2 and "Adhesive Usage Guide" in "Appendix" of NAAWS.
 - 2.2.3.5. Crossbands: Minimum 1.6 mm (1/16") thick composite complete with veneer.
 - 2.2.3.6. High Pressure, Paper Base, Decorative Laminates (HPDL): Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.2.3.6.1. Formica Inc.; www.formica.com
 - 2.2.3.6.2. Nevamar Company, LLC; www.nevamar.com
 - 2.2.3.6.3. Wilsonart Canada; www.wilsonart.com
 - 2.2.3.6.4. Provide types and thicknesses conforming to ANSI/NEMA LD 3 and Section 04, "Table: 04-009 – HPL TYPES and MINIMUM PERFORMANCE REQUIREMENTS" of NAAWS.
 - 2.2.3.6.5. Colours and Finishes: Refer to "Material and Finish Schedule" appended to Section 00 01 20.
 - 2.2.3.7. Vision Frames for Fire Doors: Solid wood with intumescent incorporated, veneer wrapped steel, of same species as facing or rolled painted steel with mitre corners; prepared for countersink style tamperproof screws.
- 2.2.4. Fire-Rated Plastic Laminate Wood Doors (45, 60 & 90 Minute):
 - 2.2.4.1. Core: Mineral or agrifibre core.
 - 2.2.4.2. Stiles: Approved fire retardant reinforcement minimum 19 mm (3/4"). On doors over 900 mm (36") wide, provide additional 25 mm (1") of approved fire retardant reinforcement to hinge stile of door.
 - 2.2.4.3. Top Rail: Approved fire retardant reinforcement minimum 35 mm (1-3/8") after trim.
 - 2.2.4.4. Bottom Rail: Approved fire retardant reinforcement minimum 35 mm (1-3/8") after trim.
 - 2.2.4.5. Interior Blocking: Approved fire retardant reinforcement minimum 127 mm (5") high at top and bottom rails and at mid height of door.
 - 2.2.4.6. Crossbands: As required to conform to door manufacturer's labelling authority.

- 2.2.4.7. High Pressure, Paper Base, Decorative Laminates (HPDL): Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.2.4.7.1. Formica Inc.; www.formica.com
 - 2.2.4.7.2. Nevamar Company, LLC; www.nevamar.com
 - 2.2.4.7.3. Wilsonart Canada; www.wilsonart.com
 - 2.2.4.7.4. Provide types and thicknesses conforming to ANSI/NEMA LD 3 and Section 04, "Table: 04-009 – HPL TYPES and MINIMUM PERFORMANCE REQUIREMENTS" of NAAWS.
 - 2.2.4.7.5. Colours and Finishes: Refer to "Material and Finish Schedule" appended to Section 00 01 20.
- 2.2.4.8. Vision Frames for Fire Doors: Solid wood with intumescent incorporated, veneer wrapped steel, of same species as facing or rolled painted steel with mitre corners; prepared for countersink style tamperproof screws.
- 2.2.5. Glass: Provided as part of the work of Section 08 80 00.
- 2.2.6. Glass Units (GL): For single glass unit types, refer to Section 08 06 80.
- 2.2.7. Hardware: Coordinate location of interior blocking with work of Section 08 71 00. Hardware is supplied by Section 08 71 00 for installation as part of the work of Section 06 90 00.
- 2.2.8. Fabrication:
 - 2.2.8.1. Fabricate doors in accordance with Section 09 of NAAWS except as specified herein.
 - 2.2.8.2. Fabricate plastic laminate wood doors 45 mm (1-3/4") thick, unless otherwise indicated.
 - 2.2.8.3. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions.
 - 2.2.8.4. Factory cut glass light openings. Ensure openings are square with internal corners slightly rounded. Ensure portion between cutout and door edge is not less than 127 mm (5") wide at any point. Ensure cut out area is not greater than 40% of area of door face. Ensure cut out does not exceed half height of door.
 - 2.2.8.5. Provide hardwood glass stops, finished to match face veneer, for vision panels in unrated doors.
 - 2.2.8.6. Provide metal glass stops for vision panels in fire-rated labelled doors. Ensure glass size conforms to OBC requirements.
 - 2.2.8.7. Fabricate plastic laminate wood doors with necessary interior blocking to suit hardware installation.
 - 2.2.8.8. Fabricate following bevels at 1.6 mm (1/16") in 50 mm (2"):
 - 2.2.8.8.1. Single Doors: Bevel both stiles.
 - 2.2.8.8.2. Pairs of Doors: Bevel hanging styles and bevel and rabbet meeting styles.
 - 2.2.8.9. Fabricate plastic laminate wood doors with following edge clearances:
 - 2.2.8.9.1. 3 mm (1/8") clearance at top and sides.
 - 2.2.8.9.2. 6 mm (1/4") clearance at bottom to top of carpets and thresholds unless doors are indicated in the Door Schedule to be undercut.
- 2.3. SOURCE QUALITY CONTROL**
 - 2.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Installation of plastic laminate wood doors and door hardware forms part of the work of Section 06 90 00.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide access doors and frames including but not limited to following:
 - 1.2.1.1. access doors and frames.
 - 1.2.1.2. fire-rated access doors and frames.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. SSPC: The Society for Protective Coatings (formerly known as Steel Structures Painting Council); www.sspc.org.
 - 1.3.1.2. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
 - 1.3.1.3. WHI: Warnock Hersey (Intertek); www.intertek-eltsemko.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ANSI/UL 10B-08 - Fire Tests of Door Assemblies
 - 1.3.2.2. ANSI/UL 263-14 - Fire Tests of Building Construction and Materials
 - 1.3.2.3. ASTM A653/A653M-23 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.2.4. ASTM E119-22 - Standard Test Methods for Fire Tests of Building Construction and Materials
 - 1.3.2.5. CSA G40.20-13(23) - General Requirements for Rolled or Welded Structural Quality Steel
 - 1.3.2.6. CSA G40.21-13(23) - Structural Quality Steel
 - 1.3.2.7. NFPA 80-22 - Standard for Fire Doors and Other opening Protectives
 - 1.3.2.8. NFPA 252-22 - Standard Methods of Fire Tests of Door Assemblies
 - 1.3.2.9. SSPC-Paint 20-19 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic)

1.4. SUBMITTALS

- 1.4.1. Product Data: Submit Product data for each type of access door and frame indicated.
- 1.4.2. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to the minimum requirements indicate following:
 - 1.4.2.1. face or ceiling placement.
 - 1.4.2.2. tolerances and clearances.
 - 1.4.2.3. finishes.
 - 1.4.2.4. hardware.
- 1.4.3. Samples: Submit samples in accordance with Section 01 30 00. Provide 1 cut-away corner sample minimum 300 mm (12") square for each type of access door to indicated following:

- 1.4.3.1. core.
- 1.4.3.2. facing.
- 1.4.3.3. frame.
- 1.4.4. Certificates: Submit in addition to fire label, certificate to substantiate design and construction of fire-rated access doors and frames, if required by Consultant or authorities having jurisdiction.
- 1.4.5. Test and Evaluation Reports: Submit following test and evaluation reports:
 - 1.4.5.1. Ensure reports include name of testing authority, date of test, location of test facility, descriptions of test specimens, procedures used in testing and indicate compliance with acceptance criteria of the test.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
 - 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Acudor Products, Inc.; www.acudor.com
 - 2.1.1.2. Bar-Co, Inc. by Alfab, Inc.; www.alfabinc.com
 - 2.1.1.3. Bauco Access Panel Solutions Inc.; www.accesspanelsolutions.com
 - 2.1.1.4. Cendrex Inc.; www.cendrex.com
 - 2.1.1.5. Cesco Products; www.cescoproducts.com
 - 2.1.1.6. Jensen Industries; www.jensen-ind.com
 - 2.1.1.7. Karp Associates, Inc.; www.karpinc.com
 - 2.1.1.8. Larsen's Manufacturing Company; www.larsensmfg.com
 - 2.1.1.9. Nystrom Building Products Co.; www.nystrom.com
 - 2.1.1.10. Williams Brothers Corporation of America; www.wbdoors.com

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
 - 2.2.1.1. Fire-Rated Access Doors and Frames: Ensure units comply with NFPA 80 and are labeled and listed by ULC, WHI or another testing and inspecting agency acceptable to authorities having jurisdiction per test method indicated:
 - 2.2.1.1.1. Vertical Access Doors: NFPA 252, ANSI/UL 10B or ULC.
 - 2.2.1.1.2. Horizontal Access Doors and Frames: ASTM E119, ANSI/UL 263 or ULC.
 - 2.2.2. Steel Plates, Shapes and Bars: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.

- 2.2.3. Steel Sheet:
- 2.2.3.1. Metallic Coated: ASTM A653/A653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness.
- 2.2.4. Drywall Beads: Edge trim formed from 0.759 mm (22 ga) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum panels indicated.

2.3. MANUFACTURED UNITS

- 2.3.1. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames:
 - 2.3.1.1. Material: Metallic-coated steel sheet.
 - 2.3.1.2. Surface Type: Gypsum board.
 - 2.3.1.3. Locations: Walls and ceilings.
 - 2.3.1.4. Fire-Resistance Rating: As required.
 - 2.3.1.5. Temperature-Rise Rating: 250 deg F at the end of 30 minutes.
 - 2.3.1.6. Door: Flush panel with core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.912 mm (20 ga).
 - 2.3.1.7. Frame: Minimum 1.519 mm (16 ga) thick sheet metal with [drywall bead] [plaster bead].
 - 2.3.1.8. Hinges: Concealed pin type.
 - 2.3.1.9. Automatic Closer: Spring type.
 - 2.3.1.10. Latch: Self-latching bolt operated by knurled knob with interior release.
 - 2.3.1.11. Permitted Product: "FW-5015-DW" by Acudor Products, Inc.
- 2.3.2. Flush Access Doors and Trimless Frames:
 - 2.3.2.1. Material: Metallic-coated steel sheet.
 - 2.3.2.2. Surface Type: Gypsum board.
 - 2.3.2.3. Locations: Walls and ceilings.
 - 2.3.2.4. Door: Minimum 1.519 mm (16 ga) thick sheet metal, set flush with surrounding finish surfaces.
 - 2.3.2.5. Frame: Minimum 1.519 mm (16 ga) thick sheet metal with bead for type of surface indicated.
 - 2.3.2.6. Hinges: Spring-loaded concealed pin type.
 - 2.3.2.7. Latch: Screwdriver-operated cam latch.
 - 2.3.2.8. Permitted Product: "DW-5040" by Acudor Products, Inc.
- 2.3.3. Recessed Access Doors and Trimless Frames:
 - 2.3.3.1. Material: Metallic-coated steel sheet.
 - 2.3.3.2. Surface Type: Gypsum board.
 - 2.3.3.3. Locations: Walls and ceilings.
 - 2.3.3.4. Door: Minimum 1.519 mm (16 ga) thick sheet metal in the form of a pan recessed 16 mm (5/8") for infill of finish matching surface type indicated.
 - 2.3.3.5. Reinforce panel as required to prevent buckling.
 - 2.3.3.6. Frame: Minimum 1.519 mm (16 ga) thick sheet metal with bead or edge for surface type indicated.
 - 2.3.3.7. Hinges: Spring-loaded concealed pin type.
 - 2.3.3.8. Latch: Screwdriver-operated cam latch with plastic grommet for access through pan recess.

- 2.3.3.9. Permitted Product: "DW-5015" by Acudor Products, Inc.
- 2.3.4. Acoustic Access Panels for Gypsum Board Ceilings:
 - 2.3.4.1. Material: Aluminum.
 - 2.3.4.2. Surface Type: Gypsum board.
 - 2.3.4.3. Locations: Ceilings.
 - 2.3.4.4. Door: Aluminum in the form of a pan recessed 16 mm (5/8") for infill of finish matching surface type indicated. Door can be lifted out and have safety cables.
 - 2.3.4.5. Frame: Aluminum with continuous EPDM gasket
 - 2.3.4.6. Hinges: Concealed pivoting rod hinge.
 - 2.3.4.7. Latch: Concealed touch latch.
 - 2.3.4.8. Options:
 - 2.3.4.8.1. Barymat 5 - barium loaded rubber matt attached to gypsum board in access panel.
 - 2.3.4.8.2. 2nd layer of gypsum board laminated to back of access door.
 - 2.3.4.9. Permitted Product: "Bauco-Plus II" by Bauco Access panel Solutions Inc.
- 2.3.5. Finishes:
 - 2.3.5.1. Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Size and Location Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment and indicate on schedule.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts and anchoring devices.
- 3.2.2. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- 3.2.3. Install access doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. ADJUSTING

- 3.4.1. Adjust doors and hardware after installation for proper operation.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide fire-rated overhead coiling doors including but not limited to following:
 - 1.2.1.1. automatic closing fire-rated overhead coiling doors, electrically operated.
 - 1.2.1.2. door guides.
 - 1.2.1.3. door hood.
 - 1.2.1.4. counterbalance assembly.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Steel plate, angle and channel door frames: Section 05 50 00, Metal Fabrications.
 - 1.2.2.2. Provision of power for electrically operated overhead coiling doors: Division 26, Electrical.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CSA: Canadian Standards Association; www.csagroup.org.
 - 1.3.1.2. EEMAC: Electrical Equipment Manufacturers Association of Canada; www.eemac.ca.
 - 1.3.1.3. NEMA: The Association of Electrical Equipment and Medical Imaging Manufacturers; www.nema.org.
 - 1.3.1.4. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM A653/A653M-23
 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.2.2. ASTM E84-23
 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.2.3. CSA C22.1-21
 - Canadian Electrical Code, Part I
 - 1.3.2.4. CSA C22.1HB-21
 - Canadian Electrical Code Handbook - An Explanation of the Rules of the Canadian Electrical Code, Part 1
 - 1.3.2.5. NFPA 80-22
 - Standard for Fire Doors and Other Opening Protectives

1.4. SUBMITTALS

- 1.4.1. Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00 indicating:
 - 1.4.1.1. elevations, materials, sections and details, operating components, dimension, gauges, glazing hardware, accessories, finish and service rating.
 - 1.4.1.2. complete electrical wiring diagrams including electrical schematics and sequence of operation.
 - 1.4.1.3. complete engineering design data to confirm door meets design criteria specified.

1.5. CLOSEOUT SUBMITTALS

- 1.5.1. Operational and Maintenance Data: Provide data for maintenance of overhead coiling metal doors and hardware for incorporation into maintenance manual specified in Section 01 70 00.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:

- 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.7. WARRANTY

- 1.7.1. Manufacturer Warranty: Warrant work of this Section for period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

- 2.1.1.1. Amarr; www.amarr.com
2.1.1.2. Clopay Building Products; www.clopaydoor.com
2.1.1.3. Cookson; www.cooksondoor.com
2.1.1.4. Cornell Iron Works, Inc.; www.cornelliron.com
2.1.1.5. McKeon Door Company; www.mckeondoor.com

- 2.1.2. Substitution Limitations: This Specification is based on Cornell Iron Works, Inc.'s "Model ERD10". Comparable Products from other manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria: Provide doors with ULC label for required fire rating.
2.2.2. Curtain:
2.2.2.1. Slat Material:
2.2.2.1.1. Galvanized Steel: No. 5F, minimum 1.214 mm (18 ga), Grade 40, ASTM A653/A653M galvanized steel zinc coating.
2.2.2.2. Ensure slats have a Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
2.2.2.3. Ensure slat has a minimum R-value of 5.3 and a minimum STC rating of 22.
2.2.3. Bottom Bar Configuration:
2.2.3.1. Two steel angles minimum 50 mm x 50 mm x 3 mm (2" x 2" x 1/8").
2.2.3.2. Endlocks: Fabricate interlocking sections with high strength galvanized cast iron combination endlocks/windlocks on alternate slats each secured with a minimum 2 – 6 mm (1/4") rivets per ULC requirements.

- 2.2.4. Guides: Fabricate with minimum 4.8 mm (3/16") structural steel angles. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar. Ensure top 420 mm (16-1/2") of coil side guide angles is removable for ease of curtain installation and for future curtain service.
- 2.2.5. Counterbalance Shaft Assembly:
 - 2.2.5.1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 2.5 mm/m (0.03 in/ft) of width.
 - 2.2.5.2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 110 N (25 lbs). Provide wheel for applying and adjusting spring torque.
- 2.2.6. Brackets: Fabricate from minimum 6 mm (1/4") steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
- 2.2.7. Hood: 0.607 mm (24 ga) galvanized steel with reinforced top and bottom edges. Provide minimum 6 mm (1/4") steel intermediate support brackets as required to prevent excessive sag.
- 2.2.8. Combination Weather/Smoke Seals:
 - 2.2.8.1. Bottom Bar:
 - 2.2.8.1.1. Motor Operated Doors: Combination smoke seal/sensing edge.
 - 2.2.8.2. Guides and Head: Replaceable, ULC listed, nylon brush smoke seals sealing against fascia side of curtain.
- 2.2.9. Operation - Electrical:
 - 2.2.9.1. Design electrical components for doors in accordance with CSA C22.1, CSA C22.1HB and Ontario Hydro Electrical Safety Code.
 - 2.2.9.2. Electrical motors, controller units, remote push-button stations, relays and other electrical components: to CSA and ULC approval with EEMAC enclosures.
 - 2.2.9.3. AlarmGard Series Electric Tube Motor: ULC listed NEMA 1 enclosure, 230V/50 Hz/single phase service. Provide a totally enclosed non-ventilated motor, removable without affecting the setting of limit switches; thermal overload protection, planetary gear reduction, adjustable rotary limit switch mechanism and a transformer with 24V secondary output. Prewire internal electrical components to terminal blocks and as follows:
 - 2.2.9.3.1. Provide a failsafe tubular motor operated fire shutter assembly requiring no ancillary or externally mounted release devices, cables, chains, pulleys, reset handles or mechanisms.
 - 2.2.9.3.2. Provide an internal electrical failsafe release device that requires no additional wiring, external cables or mounting locations.
 - 2.2.9.3.3. Provide an internal solenoid brake mechanism to hold door at any position during normal door operation.
 - 2.2.9.3.4. Control automatic closure speed with an internal, totally enclosed, variable rate centrifugal governor without the use of electrical pulsation, constant rate viscosity, oscillation type or other exposed governing devices.
 - 2.2.9.3.5. Electrically activate door system automatic closure by notification from central alarm system and notification from local detectors.
 - 2.2.9.3.6. Maintain automatic closure speed at not more than 300 mm (12") per second.
 - 2.2.9.3.7. Enable safety edge function during alarm gravity closing while power is present. Enable door to rest upon obstruction following this sequence.

- 2.2.9.3.8. Electrically reset internal failsafe release device and door operating system upon restoration of electrical power and upon clearing of alarm signal without requiring human supervision.
- 2.2.9.3.9. Provide selectable ability for door system to automatically self-cycle to fully open position following automatic reset without requiring human supervision.
- 2.2.9.3.10. Ensure manual resetting of spring tension, release devices, linkages or mechanical dropouts is not required.
- 2.2.9.3.11. Notify Electrical Subcontractor to mount control station(s) and supply appropriate disconnect switch, conduit and wiring per door system wiring instructions.
- 2.2.9.3.12. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80, Section 5.
- 2.2.9.4. Control Stations:
 - 2.2.9.4.1. Surface Mounted: "Open/Close/Stop" push buttons; NEMA 1.
 - 2.2.9.4.2. Flush Mounted: "Open/Close/Stop" push buttons; NEMA 1B.
- 2.2.9.5. Control Operation:
 - 2.2.9.5.1. Constant pressure to close.
- 2.2.10. Electric Sensing Edge Device:
 - 2.2.10.1. Provide only a wireless sensing edge connection to motor operator.
 - 2.2.10.2. Electric coiling cords or take-up reels are not allowed to connect bottom sensing edge to motor.
- 2.2.11. Floor Level Test Device: For FireGard™ Motor, Chain or Crank operator. Provide assembly that allows activation and reset from floor level.
- 2.2.12. Trim Package: Minimum 1.519 mm (16 ga) powder coated steel to match guides.
- 2.2.13. Finishes:
 - 2.2.13.1. Exterior Slats:
 - 2.2.13.1.1. Galvanized Steel (No Paint Finish): Zirconium and bonding treatment only (no paint finish).
 - 2.2.13.2. Interior Slats:
 - 2.2.13.2.1. Galvanized Steel (No Paint Finish): Zirconium and bonding treatment only (no paint finish).
 - 2.2.13.3. Bottom Bar:
 - 2.2.13.3.1. Corrosion Inhibitive: Zirconium treatment followed by a corrosion inhibitive baked-on zinc enriched gray polyester powder coat; minimum 0.065 mm (2.5 mils) cured film thickness.
 - 2.2.13.4. Guides:
 - 2.2.13.4.1. Corrosion Inhibitive: Zirconium treatment followed by a corrosion inhibitive baked-on zinc enriched gray polyester powder coat; minimum 0.065 mm (2.5 mils) cured film thickness.
 - 2.2.13.5. Brackets:
 - 2.2.13.5.1. Corrosion Inhibitive: Zirconium treatment followed by a corrosion inhibitive baked-on zinc enriched gray polyester powder coat; minimum 0.065 mm (2.5 mils) cured film thickness.
 - 2.2.13.6. Hood:
 - 2.2.13.6.1. GalvaNex™ Coating System (Stock Colours): ASTM A653/A653M galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding baked-on base coat and gray baked-on polyester enamel finish coat.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Install fire-rated overhead coiling doors in accordance with NFPA 80 and manufacturer's printed instructions.
- 3.2.2. Install electrical motors, controlled units, push-button stations, relays and other electrical equipment required for door operation.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. ADJUSTING

- 3.4.1. Adjust fire-rated overhead coiling door operating components to ensure smooth opening and closing of doors.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide aluminum framed fire-rated storefronts including but not limited to following:
 - 1.2.1.1. interior fixed aluminum screens.
 - 1.2.1.2. glazing for work of this Section.
 - 1.2.1.3. standard hardware for swing doors.
 - 1.2.1.4. preparation of frames and doors for balance of door hardware.
 - 1.2.1.5. necessary steel framing, back painting, blocking, shims, anchoring and reinforcing required for securing of the work of this Section to the structure, to maintain design loads specified.
 - 1.2.1.6. separation of dissimilar metals with dielectric separator.
 - 1.2.1.7. sealing joints within work of this Section, at abutting joints of this work and interface work of adjacent trades.
 - 1.2.1.8. coordination with electrical, security and pneumatic trades for installation of their respective work within work of this Section.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Casting-in insert anchors at perimeter slab conditions: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Provision of concealed support of aluminum framed fire-rated storefronts: Section 05 50 00, Metal Fabrications.
 - 1.2.2.3. Provision of lock cylinders and other non-standard hardware: Section 08 71 00, Door Hardware.
 - 1.2.2.4. Wiring and conduit for electronic hardware in frame Product: Division 26, Electrical.
 - 1.2.2.5. Provision of door contacts: Division 28, Electronic Safety and Security.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AAMA: American Architectural Manufacturers Association; www.fgiaonline.org.
 - 1.3.1.2. EPDM: Ethylene Propylene Diene Monomer.
 - 1.3.1.3. GANA: Glass Association of North America; www.glass.org.
 - 1.3.1.4. OBC: Ontario Building Code.
 - 1.3.1.5. PVDF: Polyvinylidene Fluoride.
- 1.3.2. Definitions:
 - 1.3.2.1. Air/Vapour Barrier: A continuous membrane including joints of membrane to adjacent construction which seals or prevents rate of penetration of moisture laden air and diffusion of water vapour through it at air infiltration/exfiltration rates given.
 - 1.3.2.2. Glass Terminology: Conform to ASTM C162 for glossary of terms and definitions of glazing terminology.

| | | |
|-----------|----------------------|--|
| 1.3.3. | Reference Standards: | |
| 1.3.3.1. | AAMA 2604-22 | - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusion and Panels (with Coil Coating Appendix) |
| 1.3.3.2. | ASTM B117-19 | - Standard Practice for Operating Salt Spray (Fog) Apparatus |
| 1.3.3.3. | ASTM B209/B209M-21 | - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate |
| 1.3.3.4. | ASTM B221M-13 | - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) |
| 1.3.3.5. | ASTM B244-09(14) | - Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments |
| 1.3.3.6. | ASTM C162-05(15) | - Standard Terminology of Glass and Glass Products |
| 1.3.3.7. | ASTM D523-14(18) | - Standard Test Method for Specular Gloss |
| 1.3.3.8. | ASTM D714-02(17) | - Standard Test Method for Evaluating Degree of Blistering of Paints |
| 1.3.3.9. | ASTM D968-17 | - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive |
| 1.3.3.10. | ASTM D2244-16 | - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates |
| 1.3.3.11. | ASTM D2247-15(20) | - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity |
| 1.3.3.12. | ASTM D3363-20 | - Standard Test Method for Film Hardness by Pencil Test |
| 1.3.3.13. | ASTM D4214-07(15) | - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films |
| 1.3.3.14. | ASTM E330/E330M-14 | - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference |
| 1.3.3.15. | CAN/CGSB-12.1-17 | - Safety glazing |
| 1.3.3.16. | CSA G40.21-13(23) | - Structural quality steel |
| 1.3.3.17. | CSA S136-16(21) | - North American specification for the design of cold-formed steel structural members |
| 1.3.3.18. | CSA S157-17(22) | - Strength design in aluminum |
| 1.3.3.19. | GANAL 01-0300 | - Glass Information Bulletin – Proper Procedures for Cleaning Architectural Glass Products |
| 1.3.3.20. | CAN/ULC-S101-14 | - Standard Methods of Fire Endurance Tests of Building Construction and Materials |
| 1.3.3.21. | CAN/ULC-S104-15 | - Standard Method for Fire Tests of Door Assemblies |
| 1.3.3.22. | CAN/ULC-S106-20 | - Standard Method for Fire Tests of Window and Glass Block Assemblies |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Coordination:
 - 1.4.1.1. Be responsible to provide adequate reinforcing, clearances, rebates and brackets for hardware specified and for accurate installation of door and hardware on site.
 - 1.4.1.2. Coordinate installation of work of this Section with work of other Sections and in accordance with Contractor's construction schedule.
 - 1.4.1.3. Supply to other Subcontractors necessary items to be built into their work.
- 1.4.2. Preinstallation Meetings:
 - 1.4.2.1. Arrange preinstallation meeting 1 week prior to commencing work with parties associated with this trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
 - 1.4.2.2. Review installation methods, procedures, time schedule and conditions under which work shall proceed including manufacturer's written instructions and coordination required with related work.
 - 1.4.2.3. Review and finalize construction schedule, verify availability of materials, experienced installer, equipment and facilities needed to make progress and avoid delays.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings:
 - 1.5.1.1. Submit Shop Drawings for work of this Section in accordance with Section 01 30 00 for Consultant's review before any work is fabricated. In addition to minimum requirements indicate following:
 - 1.5.1.1.1. Indicate with plans, sections, elevations and sufficient full size details to indicate components and methods of assembly, materials, finishes, colour and their characteristics relative to their purpose and other fabrication information.
 - 1.5.1.1.2. Identify and describe material types and components being supplied, their manufacturers, wall thicknesses of extrusions and shapes including connections and grades, attachments, reinforcing, anchorage and locations of fastenings.
 - 1.5.1.1.3. allowances for thermal and structural movement between components and thermal isolation materials.
 - 1.5.1.2. Include description of materials, metal finishing specifications and other pertinent information.
 - 1.5.1.3. Do not fabricate work of this Section until Shop Drawings are reviewed.
 - 1.5.1.4. Ensure a licensed engineer specified herein is responsible for:
 - 1.5.1.4.1. production and review of Shop Drawings.
 - 1.5.1.4.2. sealing and signing each Shop Drawing and any associated calculations performed.
 - 1.5.1.5. Provide copies of final reviewed Shop Drawings as required for submission to authorities having jurisdiction.

- 1.5.2. Samples:
 - 1.5.2.1. Submit samples in accordance with Section 01 30 00. Submit following samples:
 - 1.5.2.1.1. extruded shapes 300 mm (12") long.
 - 1.5.2.1.2. each type of glass 300 mm (12") square.
 - 1.5.3. Test and Evaluation Reports:
 - 1.5.3.1. Submit in accordance with Section 01 30 00.
 - 1.5.3.2. Listings and Labels: Fire-rated framing and glazing shall be under current follow-up services by an approved independent agency and maintain a current listing or certification. Label assemblies in accordance with limits of listings.
 - 1.5.3.3. Ensure test results show compliance with standards specified under this Section.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
 - 1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum 10 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
 - 1.7.1.2. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Transport materials to site storage in a manner to prevent in-transit damage. These measures include, but are not limited to, crating, polyethylene wrapping system, etc.
- 1.8.2. Storage and Handling Requirements:
 - 1.8.2.1. Store in a dry, protected area on site, in original undamaged containers with manufacturer's labels and seals intact.
 - 1.8.2.2. Comply with unpacking procedures as recommended by framing and glass manufacturers.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List for Aluminum Framed Fire-Rated Storefronts: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Aluflam North America; www.aluflam-usa.com
- 2.1.2. Substitution Limitations: This Specification is based on Alufam North America's system. No further substitutions will be permitted.
- 2.1.3. Manufacturer List for Fire-Rated Glass: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.3.1. Vetrotech USA; www.vetrotech.com
- 2.1.4. Substitution Limitations: This Specification is based on Alufam North America's system. No further substitutions will be permitted.

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

- 2.2.1.1. Comply with requirements of OBC and regulations of authorities having jurisdiction, which shall be minimum, except where more stringent requirements are specified herein.
- 2.2.1.2. Ensure aluminum framed fire-rated storefronts acting as guards, including walls around shafts or where floor elevation on 1 side of a wall is more than 600 mm (23-5/8") higher than elevation of floor or ground on other side complies with OBC, Division B, Part 4, Article 4.1.5.16. Provide Shop Drawings bearing seal of a licensed engineer registered in Province of Ontario confirming this requirement.
- 2.2.1.3. Design glazing systems and framing to prevent thermal shock and pressure fracture damage to glass.
- 2.2.1.4. Design aluminum work as shown to provide free and noiseless movement of components of assembly due to structural erection or dead loads, without buckling, oil canning of any component and/or transmitting of stresses to any members.
- 2.2.1.5. Coordinate maximum allowable reaction loads with Structural Drawings.
- 2.2.1.6. Provide accessories, closures and trims required and necessary to complete work.
- 2.2.1.7. Provide parapet cap flashings to roofs where curtain wall extends to roof.
- 2.2.1.8. Structural Design Requirements:
 - 2.2.1.8.1. Design work to withstand within permitted deflection limitations, its own weight, forces applied by movements of building structure and attached adjacent components and maximum design loads due to pressure and suction of wind, snow, ice, rain and hail.
 - 2.2.1.8.2. Design curtain wall and aluminum panels to accept 150% of design loads without failure or permanent deformation in excess of L/1000.
 - 2.2.1.8.3. Design light gauge steel structural members in accordance with CSA S136.
 - 2.2.1.8.4. Design light gauge aluminum structural members in accordance with CSA S157.
 - 2.2.1.8.5. Design curtain wall and glazing systems (including accessories) to resist minimum wind pressure as required to meet design criteria and designated in OBC for this specific location of Project.
 - 2.2.1.8.6. Deflection of any framing member in a direction normal or perpendicular to the plane of the wall when subjected to a uniform and/or concentrated load deflection test in accordance with ASTM E330/E330M, loads shall not:
 - 2.2.1.8.6.1. exceed L/240 of its clear span or 19 mm (3/4") whichever is less.
 - 2.2.1.8.6.2. exceed 2L/175 of its cantilevered length or 19 mm (3/4") whichever is less.
 - 2.2.1.9. Firestopping/Smoke Seals: Coordinate with Section 07 84 00 for firestopping/smoke seal assemblies at floor levels where indicated and where required by local building authorities. Submit firestopping/smoke seal assemblies and fixing methods for review.
- 2.2.2. Aluminum Extrusions: ASTM B221M, minimum 3 mm (1/8") wall thickness, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T6 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.
- 2.2.3. Aluminum Sheet: ASTM B209/B209M, minimum thickness 3 mm (1/8") of type and characteristics to match finished extrusions; ensure sheet which is not exposed is Utility Aluminum mill finished; for intricate forming with decorative finishes use AA-1100 and for siding and exposed panels use AA-3003 with specified finish.
- 2.2.4. Screws, Bolts and Fasteners: At exterior to air seal and/or penetrating air seal, use Type 304 Series stainless steel or hardened aluminum. Fully to interior of air seal, use zinc chromate plated or Series 400 stainless steel is permitted.

- 2.2.5. Miscellaneous and Sub-Frame Steel: CSA G40.21, Grade 300W, prime painted.
- 2.2.6. Shims: Aluminum utility sheet when not in contact with concrete; stainless steel when in contact with concrete or cementitious substances of thickness required, or hot dip galvanized steel.
- 2.2.7. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.
- 2.2.8. Glazing Materials: Ensure glazing material perimeter is separated from perimeter framing system with approved flame retardant intumescent glazing tape. Place EPDM setting blocks between metal setting pads and glazing material. Setting pads and blocks provided by manufacturer.
- 2.2.9. Fire-Rated Glass:
- 2.2.9.1. Fire-rated intumescent glass clear and wireless glazing materials installed as doors, transoms, borrowed lights and screens in fire-rated frames.
- 2.2.9.2. Impact and safety rating conforming to CAN/CGSB-12.1; thickness to suit design, fire-rating requirements and in accordance with manufacturer's recommendations conforming to approved testing agencies acceptable to authorities having jurisdiction for respective performance criteria.
- 2.2.9.3. Test fire-rating in accordance with CAN/ULC-S101, CAN/ULC-S104 and CAN/ULC-S106 as applicable and acceptable to authorities having jurisdiction for specific application.
- 2.2.9.4. Fire-Rated Intumescent Glass (FRIGL): "Contraflam® 120": 39 mm (1-9/16") thick, (120 minute fire-rating), fire-rated clear transparent tempered safety glass by Vetrotech USA.
- 2.2.10. Standard Hardware: Provide following standard hardware:
- 2.2.10.1. Operating hardware for single doors:
- | Description | Manufacturer/Model | Finish |
|---|-------------------------|-------------------|
| 2.2.10.1.1. Surface mounted door closer | Dorma TS93 Series | Aluminum |
| 2.2.10.1.2. Hinges | Dr Hahn A901/951 Series | Aluminum |
| 2.2.10.1.3. Lever handles | FSB 1080 Series | Stainless steel |
| 2.2.10.1.4. Narrow stile mortise lock | Accurate 8600 Series | Stainless (front) |
| 2.2.10.1.5. Cylinder lock | Schlage compatible | Satin chrome |
- 2.2.10.2. Operating hardware for active/active pairs of doors:
- | Description | Manufacturer/Model | Finish |
|---|-------------------------|-----------------|
| 2.2.10.2.1. Surface mounted door closers | Dorma TS93 Series | Aluminum |
| 2.2.10.2.2. Hinges | Dr Hahn A901/951 Series | Aluminum |
| 2.2.10.2.3. Vertical rod exit devices (top rod only for 60 min and lower rated, top and bottom rods for 90 min) | Dorma 9800 Series | Stainless steel |
- 2.2.11. Fabrication:
- 2.2.11.1. Drawing details of storefront are based on "Alumflam CW-EI120" by Alumflam North America design performance requirements and criteria specified herein, frame depth and back section, cap depths and configuration as shown.
- 2.2.11.2. Form sections true to detail, free from defects impairing appearance, strength and durability to meet design requirements. Frames shall be tubular extruded shapes with sharp, well defined corners.
- 2.2.11.3. Overall assembled profiles shall be as detailed on Drawings. Conform to overall section dimensions and configurations detailed on Drawings.

- 2.2.11.4. Corners of formed work must be mitred and closely fitted. Back-up sealants designed for this purpose, shall be applied on inside of joints in aluminum work by this Section.
- 2.2.11.5. Carry out welding with argon shielded electric arcs to ensure complete fusion of the metal.
- 2.2.11.6. Conceal fastenings. Fasteners and anchorage system to conform to design performance and to provide a uniform, flat surface on metal panels, free from distortion and oil canning, after installation, in service, regardless of temperature.
- 2.2.11.7. Provide finishes for uniformity in appearance and texture throughout.
- 2.2.11.8. Fabricate and assemble frames at plant ready for installation in prepared openings. Carefully fit joints to be inconspicuous.
- 2.2.11.9. Back paint aluminum in contact with concrete, masonry, mortar or gypsum board with a full-bodied coat of bituminous paint. Use neoprene separator where aluminum is fastened to steel.
- 2.2.12. Finishes: Provide 1 of following systems:
- 2.2.12.1. High Performance Coating Finish Process: (2 Coat Wet System) including thermal setting application of 70% fluoropolymer resin minimum, PVDF with added colour pigment finish exceeding or meeting AAMA 2604 requirements. Ensure fluoropolymer baked resins form a continuous physically locked finish during manufacturing process. Apply fluoropolymer finish after multistage chemical treatment cleaning providing corrosion resistance surface ready to receive primer. During baking process apply acrylic or epoxy primer in accordance with manufacturer's recommendations followed by a flash process whereby evaporating solvent and then fluoropolymer finish sprayed on to aluminum; apply another flash procedure and then bake for approximately 10 minutes when aluminum surface reaches a temperature of 232 deg C (450 deg F). Permitted Product: "Duramar" by PPG Industries; www.ppgideascape.com or "Fluoropon® Classic" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

| | Description | Performance Characteristics |
|--------------|--|--|
| 2.2.12.1.1. | Coating Thickness: | 0.0063 +/-0.0013 mm (0.25 mil +/-0.05 mils) primer 0.025 mm (1.0 mil) colour coat |
| 2.2.12.1.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.12.1.3. | Gloss (ASTM D523 @ 60°): | Low and medium gloss |
| 2.2.12.1.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.2.12.1.5. | Abrasion Resistance Falling Sand (ASTM D968): | 20 t/ml |
| 2.2.12.1.6. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.12.1.7. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.12.1.8. | Colour Retention 5 yrs, 45° South Florida (ASTM D2244): | ΔE <5.0 |
| 2.2.12.1.9. | Humidity Resistance: ASTM D714, ASTM D2247, 4000 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.2.12.1.10. | Salt Spray Resistance: ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |

- 2.2.12.1.11. Chalking Resistance:
 10 yrs, 45° South Florida
 (ASTM D4214): No more than #8 (#6 for Whites)
- 2.2.12.1.12. Erosion Resistance:
 10 yrs, 45° South Florida
 (ASTM B244): Maximum 5%
- 2.2.12.2. High Performance Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2604. Permitted Product: "Interpon D2000 Ultra Durable Polyester Powder Coating" by Akzo Nobel Coatings, Inc.; www.akzonobel.com with following characteristics:
- | Description | Performance Characteristics |
|---|---|
| 2.2.12.2.1. Coating Thickness: | 0.060 mm to 0.115 mm (2.4 mils to 4.5 mils) with no reading less than 0.045 mm (1.8 mils) |
| 2.2.12.2.2. Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.12.2.3. Gloss (ASTM D523 @ 60°): | 20% - 80% |
| 2.2.12.2.4. Pencil Hardness (ASTM D3363): | F minimum |
| 2.2.12.2.5. Abrasion Resistance Falling Sand (ASTM D968): | 40 t/ml |
| 2.2.12.2.6. Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.12.2.7. Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.12.2.8. Colour Retention 5 yrs, 45° South Florida (ASTM D2244): | ΔE <5.0 |
| 2.2.12.2.9. Humidity Resistance ASTM D714, ASTM D2247, 3000 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.2.12.2.10. Salt Spray Resistance ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
- 2.2.12.3. Colours and Sheens: To be selected by Consultant. Include for texture and specialty finishes.
- 2.2.12.4. Clear Anodized Finish: Ensure aluminum finish is clear anodized in accordance with Aluminum Association; www.aluminum.org, Finish Designation AA-M12C22A41, Class I, minimum 0.018 mm (0.7 mils) thick for exterior exposure and AA-M12C22A31, Class II, minimum 0.01 mm (0.4 mils) thick for interior exposure.
- 2.2.12.5. Apply to metal exposed on interior and exterior with finishes specified herein to suit design requirements. Ensure colour and sheen are uniform with no visible variations.
- 2.2.12.6. Painting:
- 2.2.12.6.1. Prime steel at building interior and not exposed to view or to exterior environmental conditions with oil alkyd primer.
- 2.2.12.6.2. Provide a dielectric separator to concealed surfaces of aluminum and galvanized steel which would otherwise come in direct contact with structural steel, concrete and masonry.

- 2.2.12.6.3. Paint welded, galvanized items where galvanizing has been removed for welding. Make Good corrosion protection using 2 coats of touch-up primer for galvanized steel. Make Good protection on steel primed with oil alkyd primer using same primer.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
- 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.1.2. Ensure openings and recesses to receive work of this Section are within permitted tolerances.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Perform work of this Section in accordance with "GANA Glazing Manual, 50th Anniversary Edition" and "GANA Laminated Glazing Reference Manual, 2006" for laminated glazing installation methods.
- 3.2.2. Supply anchorage devices and inserts to appropriate trades where required for building in or casting-in-place and instruct as to proper location and position.
- 3.2.3. Erect work plumb and true and in proper alignment and relationship to established lines and grades.
- 3.2.4. Erection Tolerances: Maintain following tolerances:
- 3.2.4.1. maximum variation from plane or location shown on Shop Drawings: 1.6 mm (1/16") in 4420 mm (14' - 6") of length.
- 3.2.4.2. maximum offset from true alignment between 2 identical members abutting end-to-end in line: 0.8 mm (1/32").
- 3.2.4.3. Deviation from true plumb over full height of building: maximum 6 mm (1/4").
- 3.2.4.4. Deviation from true straightness in plane over full length of each building face; maximum 6 mm (1/4").
- 3.2.4.5. Ensure tolerances of relationship of individual components are as follows:
- 3.2.4.5.1. member to member, maximum 0.4 mm (1/64").
- 3.2.4.5.2. out of plane between faces of 2 halves of split mullions, 0.8 mm (1/32").
- 3.2.4.6. Joint width, mullion snap-on cap to mullion snap-on cap; maximum 1.6 mm (1/16"). Ensure each joint is of uniform width.
- 3.2.4.7. Joint width between soffits and base and sill panels; maximum 3 mm (1/8") and of uniform width within a 3 m (10') length. Do not apply sealants to joints between panels; use only "dry" gasket system of sealing.
- 3.2.4.8. Keep panel joints to a minimum and as shown. Ensure panel sizes are uniform and to direction of Consultant.
- 3.2.4.9. Tolerances are not cumulative.

- 3.2.5. Ensure devices for anchoring frame assemblies have sufficient adjustment to permit correct and accurate alignment. After alignment, positively secure anchorage devices to prevent movement other than those designed for expansion and contraction. Take into consideration climatic conditions prevailing at time of installation.
- 3.2.6. Ensure site located fixings are subject to Consultant's review. Perform welding and drilling of steel and drilling of concrete as required to install fixings. Repair concrete chipped by drilling or fixing operations.
- 3.2.7. Installed adjacent to each other, group components with shop applied finishes which relate most closely to 1 another, with regard to colour and appearance.
- 3.2.8. Glazing: Install glazing in accordance with manufacturer's recommendations.
- 3.2.9. Sealants: Seal joints between frame assemblies and adjacent construction except where specified to be done under other Sections and within glazed assemblies where required to maintain weathertightness and integrity of air/vapour barrier. Seal junctions in sheet metal air/vapour barriers and between air/vapour barriers and adjacent construction. Conform to requirements of Section 07 92 00.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Tests and Inspections:
 - 3.3.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
- 3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Clean work of this Section in accordance with "Cleaning Procedure" as recommended by Aluminum Company of Canada in publication D.I. 650, 1962 "Care During Construction" and as recommended by finish applicator.
- 3.4.2. Clean and polish glass in accordance with GANA 01-0300 including removal of markings indicating presence of glass.

3.5. PROTECTION

- 3.5.1. Protect finishes with strippable coating that will not mar, nor deface finish on removal, or a similar method designed to afford an equivalent amount of protection. Leave protected coating intact until damage risk is past or immediately prior to final cleaning.
- 3.5.2. In addition to foregoing, ensure finish surfaces are protected by adequate covering to ensure no detrimental effect on any and contaminants or other effects or elements.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.
- 1.1.2. Curtain wall Work will be treated as "Design-Assist". "Design-Assist" refers to the process where Subcontractor awarded work of this Section is responsible for structural and performance design, fabrication and installation of curtain wall in compliance with requirements of the Contract Documents, applicable codes at time of award and ordinance and requirement of local officials.
- 1.1.3. Curtain wall design is based on mutually agreed upon design of extrusions and details as submitted by Subcontractor for final review by Consultant. Architectural Drawings covering work of this Section show design intent and profiles that are diagrammatic in nature. Drawings also show some general building standards for tying into adjacent building trades, which are to be completed and coordinated by this Section. In addition to Specification requirements, final design and performance of curtain wall and approval by authorities having jurisdiction is responsibility of this Section.
- 1.1.4. Identify locations where system design proposed varies from Consultant's design Drawings.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide glazed aluminum curtain wall system including but not limited to following:
 - 1.2.1.1. unitized and stick built double and triple glazed pre-finished aluminum curtain wall cladding system(s) as required and/or specified herein and indicated on Drawings.
 - 1.2.1.2. compartmentalized spandrel panels, including cavity wall insulation and galvanized metal air/vapour barrier work as required and/or specified herein and indicated on Drawings.
 - 1.2.1.3. aluminum fixed windows.
 - 1.2.1.4. aluminum plate fins.
 - 1.2.1.5. expansion joints within curtain wall system.
 - 1.2.1.6. removable sections of curtain wall.
 - 1.2.1.7. out-of-sequence infill areas such as "leave outs".
 - 1.2.1.8. fixing plates, brackets and assemblies required for complete installation including embeds. Coordinate embed installation.
 - 1.2.1.9. mullion reinforcement and bracing to floors.
 - 1.2.1.10. pre-finished aluminum formed components at termination and closure points as indicated and required to meet design requirements. Include extruded aluminum sills, end dams, clips and supports for sills.
 - 1.2.1.11. flat galvanized metal back pans at isolated areas over curtain wall head where pre-finished metal panels, insulation and flexible transition membranes contact curtain wall, complete with necessary anchors and clips.
 - 1.2.1.12. parapets including related flashings related to curtain wall with necessary anchors and clips.
 - 1.2.1.13. protective film on stainless steel components and removal of same film.
 - 1.2.1.14. separation of dissimilar metals with dielectric separator.
 - 1.2.1.15. membrane tie-ins to adjacent envelope assemblies ensuring full compatibility and insulation continuity.

- 1.2.1.16. sealing joints within work of this Section, at abutting joints of this work and interface work of adjacent trades.
- 1.2.1.17. coordination with electrical, security and pneumatic trades for installation of their respective work within work of this Section.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Casting-in insert anchors at perimeter slab conditions: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Firestopping between back of curtain wall and walls: Section 07 84 00, Firestopping and Smoke Seals.
 - 1.2.2.3. Sealant between aluminum framing and adjacent construction: Section 07 92 00, Joint Sealants.
 - 1.2.2.4. Provision of glazing types: Section 08 06 80, Glazing Schedule.
 - 1.2.2.5. Provision of glass and glazing of exterior aluminum windows: Section 08 51 13, Aluminum Windows.
 - 1.2.2.6. Provision of lock cylinders: Section 08 71 00, Door Hardware.
 - 1.2.2.7. Pre-finished louvres not part of curtain wall assembly: Section 08 91 00, Louvres.
 - 1.2.2.8. Provision of gypsum board finish on interior side of curtain wall: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.9. Provision of door contacts: Division 28, Electronic Safety and Security.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AAMA: American Architectural Manufacturers Association; www.fgiaonline.org.
 - 1.3.1.2. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; www.ashrae.org.
 - 1.3.1.3. CISC: Canadian Institute of Steel Construction; www.cisc-icca.ca.
 - 1.3.1.4. EPDM: Ethylene Propylene Diene Monomer.
 - 1.3.1.5. FGIA: Fenestration & Glazing Industry Alliance; www.fgiaonline.org.
 - 1.3.1.6. GANA: Glass Association of North America; www.glass.org.
 - 1.3.1.7. IG: Insulated Glass.
 - 1.3.1.8. IPA: Isopropyl Alcohol.
 - 1.3.1.9. LBNL: Lawrence Berkeley National Laboratory; www.lbl.gov.
 - 1.3.1.10. OBC: Ontario Building Code.
 - 1.3.1.11. PVDF: Polyvinylidene Fluoride.
 - 1.3.1.12. RH: Relative Humidity.
 - 1.3.1.13. SHGC: Solar Heat Gain Coefficient.
 - 1.3.1.14. STC: Sound Transmission Class.
 - 1.3.1.15. SWRI: Sealant Waterproofing & Restoration Institute; www.swrionline.org.
- 1.3.2. Definitions:
 - 1.3.2.1. Air/Vapour Barrier: A continuous membrane including joints of membrane to adjacent construction which seals or prevents rate of penetration of moisture laden air and diffusion of water vapour through it at air infiltration/exfiltration rates given.

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| 1.3.2.2. | Glass Terminology: Conform to ASTM C162 for glossary of terms and definitions of glazing terminology. | |
| 1.3.3. | Reference Standards: | |
| 1.3.3.1. | AAMA TIR-A9-14 | - Metal Curtain Wall Fasteners |
| 1.3.3.2. | AAMA 503-14 | - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems |
| 1.3.3.3. | ANSI/IES/ASHRAE 90.1-20 | - Energy Code for Commercial and High-Rise Residential Buildings |
| 1.3.3.4. | ANSI/NFRC 100-14 | - Procedure for Determining Fenestration Product U-factors |
| 1.3.3.5. | ASTM A653/A653M-23 | - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| 1.3.3.6. | ASTM B117-19 | - Standard Practice for Operating Salt Spray (Fog) Apparatus |
| 1.3.3.7. | ASTM B209/B209M-21 | - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate |
| 1.3.3.8. | ASTM B221M-21 | - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) |
| 1.3.3.9. | ASTM B244-09(21) | - Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments |
| 1.3.3.10. | ASTM C162-05(15) | - Standard Terminology of Glass and Glass Products |
| 1.3.3.11. | ASTM C165-07(17) | - Standard Test Method for Measuring Compressive Properties of Thermal Insulations |
| 1.3.3.12. | ASTM C542-05(17) | - Standard Specification for Lock-Strip Gaskets |
| 1.3.3.13. | ASTM C661-15 | - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer |
| 1.3.3.14. | ASTM C719-14(19) | - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle) |
| 1.3.3.15. | ASTM C794-18 | - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants |
| 1.3.3.16. | ASTM C920-18 | - Standard Specification for Elastomeric Joint Sealants |
| 1.3.3.17. | ASTM C1036-21 | - Standard Specification for Flat Glass |
| 1.3.3.18. | ASTM C1048-18 | - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass |
| 1.3.3.19. | ASTM C1184-23 | - Standard Specification for Structural Silicone Sealants |
| 1.3.3.20. | ASTM C1401-23 | - Standard Guide for Structural Sealant Glazing |
| 1.3.3.21. | ASTM D523-14(18) | - Standard Test Method for Specular Gloss |
| 1.3.3.22. | ASTM D714-02(17) | - Standard Test Method for Evaluating Degree of Blistering of Paints |
| 1.3.3.23. | ASTM D968-22 | - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive |

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| 1.3.3.24. | ASTM D2244-23 | - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates |
| 1.3.3.25. | ASTM D2247-15(20)e1 | - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity |
| 1.3.3.26. | ASTM D3363-22 | - Standard Test Method for Film Hardness by Pencil Test |
| 1.3.3.27. | ASTM D4214-23 | - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films |
| 1.3.3.28. | ASTM E330/E330M-14 | - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference |
| 1.3.3.29. | ASTM E1105-15(23) | - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference |
| 1.3.3.30. | BS EN 14179-1:2016 | - Glass in building - heat soaked thermally toughened soda lime silicate safety glass. Definition and description |
| 1.3.3.31. | CAN/CGSB-12.1-17 | - Safety glazing |
| 1.3.3.32. | CAN/CGSB-12.20-M89 | - Structural Design of Glass for Buildings |
| 1.3.3.33. | CAN/CSA-A440.2:22 | - Fenestration energy performance |
| 1.3.3.34. | CSA G40.21-13(23) | - Structural quality steel |
| 1.3.3.35. | CSA S16:19 | - Design of steel structures |
| 1.3.3.36. | CSA S136-16(21) | - North American specification for the design of cold-formed steel structural members |
| 1.3.3.37. | CSA S157-17(22) | - Strength design in aluminum |
| 1.3.3.38. | CSA W47.1:19 | - Certification of companies for fusion welding of steel |
| 1.3.3.39. | CSA W47.2-11(20) | - Certification of companies for fusion welding of aluminum |
| 1.3.3.40. | CSA W59:24 | - Welded steel construction |
| 1.3.3.41. | GANA 01-0300 | - Glass Information Bulletin – Proper Procedures for Cleaning Architectural Glass Products |
| 1.3.3.42. | ISO 9001:2015 | - Quality management systems - Requirements |
| 1.3.3.43. | CAN/ULC-S702.1-21 | - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Coordination:
 - 1.4.1.1. Notify concerned trades of items required to be incorporated into work of separate Sections. Certain components specified under this Section includes items which are closely integrated with air/vapour barrier transitions, entrances, glazing components, flashing pieces and architectural metalwork specified under separate Sections and consequently requires close coordination with such allied trades. Perform total coordination required to ensure correct installation procedures and results.
 - 1.4.1.2. Coordinate and cooperate with metal panel system trades by installing panel system closures and trim supplied by such trades and installed directly into curtain wall system.

1.4.2. Preinstallation Meetings:

- 1.4.2.1. Arrange preinstallation meeting 1 week prior to commencing work with parties associated with this trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
- 1.4.2.2. Review installation methods, procedures, time schedule and conditions under which work shall proceed including manufacturer's written instructions and coordination required with related work.
- 1.4.2.3. Review and finalize construction schedule, verify availability of materials, experienced installer, equipment and facilities needed to make progress and avoid delays.

1.5. SUBMITTALS

1.5.1. Shop Drawings:

- 1.5.1.1. Submit Shop Drawings for work of this Section in accordance with Section 01 30 00 for Consultant's review before any work is fabricated. In addition to minimum requirements indicate following:
 - 1.5.1.1.1. Indicate with plans, sections, elevations and sufficient full size details to indicate components and methods of assembly, materials, finishes, colour and their characteristics relative to their purpose and other fabrication information.
 - 1.5.1.1.2. Identify and describe material types and components being supplied, their manufacturers, wall thicknesses of extrusions and shapes including connections and grades, attachments, reinforcing, anchorage and locations of fastenings.
 - 1.5.1.1.3. allowances for thermal and structural movement between components and thermal isolation materials.
 - 1.5.1.1.4. line of airseal, water drainage, venting and water shed continuous, clearly shown and defined, including continuity of air seal and membrane flashing with adjacent trades.
- 1.5.1.2. Include description of materials, metal finishing specifications and other pertinent information.
- 1.5.1.3. Ensure a licensed engineer specified herein is responsible for:
 - 1.5.1.3.1. production and review of Shop Drawings.
 - 1.5.1.3.2. sealing and signing each Shop Drawing and any associated calculations performed.
 - 1.5.1.3.3. Submit a signed letter from manufacturer of system being provided on manufacturer's letterhead. Ensure letter states Project name and lists Products incorporated in the Project. Include Product names, types and series numbers applicable. Include manufacturer's contact person and their contact information.
- 1.5.1.4. Provide copies of final reviewed Shop Drawings as required for submission to authorities having jurisdiction.
- 1.5.1.5. Verify on site and coordinate dimensions and modules related to the work with other trades and other trade Shop Drawings. Include a complete layout of modular and referenced dimensions for curtain wall assemblies and aluminum panels.
- 1.5.1.6. Properly identify showing overall construction and detailed design of all parts of the installation and materials, including intersections of adjacent trades.

- 1.5.1.7. Final comment on Shop Drawings are contingent upon complete submission of structural calculations, documentation, certifications, approvals of anchoring and firestop assemblies, samples, mock-up and test reports. Samples, technical material and pre-test results to be submitted for review prior to submission of Shop Drawings.
- 1.5.1.8. Consultant's review of Shop Drawings does not relieve Contractor from its responsibility for errors, or for providing components and materials in full compliance with Contract Documents.
- 1.5.2. Samples:
 - 1.5.2.1. Submit samples in accordance with Section 01 30 00.
 - 1.5.2.2. Submit 300 mm (12") long or square samples of 4-way panel-to-panel intersections at curtain wall sill, head and mullions at various intersections, mullion at typical vertical glazing intersection with spandrel panels, parapet cap detail (at corner) and sill profiles.
 - 1.5.2.3. Submit 3 samples, minimum 300 mm (12") square of each curtain wall and aluminum panel type, with each specified glass type or metal panel colour and edge seals.
 - 1.5.2.4. Samples of colour and finish prepared as specified on respective aluminum components for both extrusion and sheet. Indicate range within which colour and sheen and metallic disbursement of fluoropolymer on building shall adhere. Submit samples as many times as required to obtain review with no objections recorded of range. Mark direction of metal grain and rolling and paint application on back of control samples.
 - 1.5.2.5. Submit full-sized samples demonstrating methods of sealing both primary and secondary seals of expansion joints within wall system as well as where they meet surrounding dissimilar systems and joints.
 - 1.5.2.6. Provide sealant manufacturer, production run samples of metal, glass, gasketing and setting blocks to be used to perform adhesion and compatibility tests both prior to sitework, and progressively as construction proceeds.
- 1.5.3. Record Documents and "As-Built" Drawings:
 - 1.5.3.1. As Work progresses, clearly mark changes and deviations from Shop Drawings onto a bound set of white prints.
 - 1.5.3.2. Keep prints available at site for periodic inspection throughout duration of work. Pay particular attention to accurately dimensioning the exact location of concealed work, noting work concealed in inaccessible locations.
 - 1.5.3.3. When work is complete and ready for inspection, neatly transfer as-built information from marked-up prints mentioned above and on to a set of Contract Drawings on the most recent revision and submit to Consultant.
- 1.5.4. Delegated Design Submittals:
 - 1.5.4.1. Design Calculations:
 - 1.5.4.1.1. Submit under seal, calculations prepared by a licensed engineer registered in Province of Ontario, providing design assumptions regarding loadings related to OBC, applicable Standards and authorities having jurisdiction. Submit detailed designs of all curtain wall elements. Detailed designs of anchorage hardware including but not limited to, clip angles, washers, anchor bolts, welds and torque pressures. State materials proposed and their allowable shear and bending stresses, ensuring failure load is substantiated by previous tests and in accordance with AAMA TIR-A9.
 - 1.5.4.1.2. Submit calculations verifying conformity with specified wind pressure parameters.
 - 1.5.4.1.3. Submit design calculations and tabular data for design of members, including methods of attachment to supporting structure with design loads and maximum support reactions. Prepare calculations in a clear and comprehensive manner so they can be easily reviewed and cross-referenced to applicable Shop Drawing detail.

- 1.5.4.1.4. Submit for review, type and location of fixing with regard to load applied to building structure. Deflection summary for anticipated primary structural deflections, as shown on Structural Drawings.
- 1.5.5. Test and Evaluation Reports:
 - 1.5.5.1. Submit in accordance with Section 01 30 00.
 - 1.5.5.2. Prior to fabrication of curtain wall, submit certified test data performed by an independent Standards Council of Canada approved laboratory displaying results of testing program carried out on typical curtain wall systems proposed for this Project.
 - 1.5.5.3. Provide test report on adhesion to production samples of metal and glass testing in accordance with ASTM C794.
 - 1.5.5.4. Ensure test results show compliance with standards specified under this Section.
 - 1.5.5.5. Thermal Reports: Submit thermal simulations, bearing seal of a licensed engineer experienced in thermal analysis of wall systems to verify and substantiate thermal performance of the curtain wall assembly prior to commencing fabrication:
 - 1.5.5.5.1. Ensure simulations are in general accordance with ANSI/NFRC 100 using LBNL's "THERM" IG unit performance based on LBNL's "WINDOW" software. Base 'U' value calculations on CAN/CSA-A440.2 methods.
 - 1.5.5.5.2. Base simulations on Project geometry and match system details in every aspect. Submissions based on non-specific geometries will be rejected.
 - 1.5.5.5.3. Thermal simulation submissions include a summary report including following:
 - 1.5.5.5.3.1. identification of design parameters and environmental conditions.
 - 1.5.5.5.3.2. Elevation Drawings indicating area divisions and curtain wall framing configurations used in overall simulation.
 - 1.5.5.5.3.3. Elevation Drawings indicating how modeled areas are assigned to elevations of building.
 - 1.5.5.5.3.4. area calculations of frame, edge and centre of panel.
 - 1.5.5.5.3.5. 'U' value results and weighting for individual models.
 - 1.5.5.5.3.6. screen shots of "THERM" output models used showing isotherms.
 - 1.5.5.5.3.7. conductivity/emissivity values of components and cavities.
 - 1.5.5.5.3.8. IG unit compositions of units used cross referenced to glazing types.
 - 1.5.5.5.3.9. 'U' values for spandrel, vision and overall assembly of each identified wall types.
 - 1.5.5.5.3.10. summary statement of compliance with codes and Specifications.
 - 1.5.5.5.4. Submit summary report with relevant LBNL's "THERM" and "WINDOW" data files.
 - 1.5.5.6. Glazing Thermal Stress Analysis:
 - 1.5.5.6.1. Submit results of a thermal stress analysis for glazing, including any stresses developing from solar radiation or other causes - prior to or during installation of glass - and allow for protection or method of handling and storage of glass to avoid such stresses and conform to safety requirements for glass application in accordance with ASTM C1036.
 - 1.5.5.6.2. Identify glazing which can be expected to fail under service conditions and submit recommendations for resolution of problem to avoid glazing failure.
 - 1.5.5.7. Thermal performance calculations per ANSI/IES/ASHRAE 90.1.

- 1.5.6. Source Quality Control Submittals:
 - 1.5.6.1. Develop a quality control manual encompassing wall design, material procurement, factory fabrication and assembly and field installation. Ensure manual format is reviewed by Consultant and forms minimum level of quality for the Project. Ensure manual documents quality control practices of Contractor, Subcontractors and major material suppliers. Manual includes but is not limited to specific criteria related to:
 - 1.5.6.1.1. complete responsibility matrix identifying roles and responsibilities of Quality Control (QC) team.
 - 1.5.6.1.2. supplier identification and QC verification procedures.
 - 1.5.6.1.3. component/element traceability procedures similar to ISO 9001.
 - 1.5.6.1.4. details of material tagging process.
 - 1.5.6.1.5. copies of inspection forms and checklists in English, where international standards are relied on equivalence to Canadian standards must be demonstrated.
 - 1.5.6.1.6. details of material sampling and testing programmes to an acceptable statistical sampling procedure, minimum sampling of critical attributes to be 20%.
 - 1.5.6.1.7. physical testing equipment, process and staff allocation, definition and storage of rejected material.
 - 1.5.6.1.8. parameters for 100% glass review prior to glazing for dimensions, primary and secondary seal continuity and thickness, scratches, colour and surface condition; minimum 20% sampling for surface compression and argon fill at 0 defects rate.
 - 1.5.6.1.9. assembly review protocol.
 - 1.5.6.1.10. procedures for response and rectification of issues noted in Consultant's shop and field reviews.
 - 1.5.6.1.11. surface preparation and structural silicone sealant application in accordance with sealant suppliers procedures, SSG bondline verification at minimum rate of 20% with 0 defects.
 - 1.5.6.1.12. sealant mixing, tack time, set time and butterfly tests.
 - 1.5.6.1.13. paint adhesion testing.
 - 1.5.6.1.14. sealant adhesion testing.
 - 1.5.6.1.15. material compatibility testing.
 - 1.5.6.1.16. assembly testing of frames in shop to include backpan watertightness and overall glazing assembly watertightness sampled at minimum rate of 1/50 frames.
 - 1.5.6.1.17. shipping.
 - 1.5.6.1.18. field installation including safety program, method statement, material storage and handling, deglazing procedure, hoist bay completion procedure.
 - 1.5.6.1.19. closeout QC documentation summary.
 - 1.5.6.2. Maintain a logbook (copies provided to Consultant and Owner at completion of fabrication) documenting date, time, results and significance of in-plant testing carried out linked to daily panel production. Ensure format of logbook is reviewed until no objections are recorded by Consultant.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00. Include in Maintenance Manual; printed copies of maintenance instructions for glazed curtain wall, proper care and maintenance of curtain wall and hardware, recommended inspection schedule, copy of each duly reviewed Shop Drawing in its most recent amended form, complete explanation of operation principles and sequences, complete parts and materials list with numbers and glass sizes, method statement of re-glazing and replacement of component parts of installation, instructions for proper cleaning and routine maintenance of curtain wall including recommended frequency.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:

- 1.7.1.1. Fabricators:

- 1.7.1.1.1. Curtain Wall: Be responsible for quality control of the Work including quality control of Subcontractors and material suppliers. Organize plant fabrication and assembly processes to allow prompt and efficient quality control review of both incoming source materials and work in process.

- 1.7.1.1.2. IG Units: Ensure insulating glass unit fabricators have membership and certification in FGIA. Ensure FGIA members participate in certification program and successfully pass a Compliance Audit within last 6 months.

- 1.7.1.2. Installers: Provide work of this Section executed by competent installers with minimum 10 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

- 1.7.1.3. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario having minimum 5 years' experience in design of curtain wall and aluminum panels.

- 1.7.2. Certifications:

- 1.7.2.1. Sealant Certification:

- 1.7.2.1.1. Submit written certification from sealant manufacturer that sealant applications in specified systems have been reviewed and approved as completely appropriate for its intended uses in systems as shown and detailed on Shop Drawings, designating drawing number, date and revision, with regards to design criteria and other requirements of the Contract Documents and compatibility with components and adjacent materials together with life expectancy of sealant materials detailed and specified. Ensure specific reference is made to compatibility of glass edge seal with adjacent materials, together with life expectancy of sealant materials detailed and specified.

- 1.7.2.1.2. Submit Product information on the sealant to be used, complete with recommendations and installation instructions.

- 1.7.2.1.3. Structural Silicone Design: Provide statement and test data from silicone sealant manufacturer indicating stresses on silicone sealant, per dimensions shown on Shop Drawing details are in accordance with ASTM C1184 and ASTM C1401.

- 1.7.2.1.4. Ensure weather seal sealants are verified by SWRI in accordance with ASTM C719 and ASTM C661.

- 1.7.2.1.5. Provide to sealant manufacturer, Shop Drawings showing size of lites, design loads and sealant dimensions for evaluation and statement on stress.

- 1.7.2.2. Sealed Glazed Units:
 - 1.7.2.2.1. Submit to Consultant a written certification from sealed unit manufacturer that sealed units of curtain wall assemblies have been reviewed as completely appropriate for their intended use in system shown. They are to be detailed on Shop Drawings, designating drawing number, date and requirements of the Contract Documents, compatibility with components and adjacent materials and thermal safety of glass constructions together with life expectancy of glazing materials detailed and specified in the glazing system.
 - 1.7.2.2.2. Take into account any stresses developing from solar radiation or other causes (prior to or during installation of the glass) and allow for protection or methods of handling and storage of glass to avoid such stresses and conform to safety requirements for glass application as set out in ASTM C1036.
 - 1.7.2.2.3. Ensure sealed units are capable of being removed and replaced from exterior. Submit to Consultant detail drawing indicating procedure for removal and replacement of any damaged sealed unit of glass.
- 1.7.2.3. Corrosion Analysis:
 - 1.7.2.3.1. Engage a licensed engineer who is an expert in corrosion, to conduct a component-by-component analysis of potential corrosion resulting from galvanic action between materials, for components of curtain wall and aluminum panels and provide report.
 - 1.7.2.3.2. Submit Engineering Report to Consultant, for review prior to submission of Shop Drawings. Ensure sample and test results are available upon request.
 - 1.7.2.3.3. Separate dissimilar metals to prevent electrolytic action. Provide letter of confirmation from licensed engineer specified herein that infill components, accompanying trims and flashings and attachments to adjacent construction are designed to eliminate potential for galvanic action between components.
- 1.7.3. Visual Mock-Ups:
 - 1.7.3.1. Erect visual mock-up at designated location for Consultant's review, minimum 1 bay in width and include height sufficient to include 2 vision panels and 1 spandrel panel above and below such vision panels. Ensure mock-up is complete including but not necessarily limited to correct glass, spandrel glass panels, insulated metal air/vapour barrier, connections, firestopping, sealants, air seal gaskets and anchorage systems.
 - 1.7.3.2. Adjust mock-up at no extra cost to Owner as directed.
 - 1.7.3.3. Mock-up when reviewed with no objections recorded becomes part of completed work and minimum standard in matching balance of work, subject to passing of tests.
- 1.8. DELIVERY, STORAGE AND HANDLING**
 - 1.8.1. Storage and Handling Requirements: Store material as per manufacturer's directions and to maintain material in good condition.
- 1.9. SITE CONDITIONS**
 - 1.9.1. Ambient Conditions: Maintain surface of substrates free of moisture, dust, dirt, oils or other residues or contaminants which may adversely affect adhesion and curing of sealant and ambient temperatures constantly between 5 deg C (41 deg F) and 38 deg C (100 deg F) during application and curing of sealants and adhesives and during installation of glazing.

1.10. WARRANTY

1.10.1. Manufacturer Warranty:

- 1.10.1.1. Warrant work of this Section for a period of 5 years against defects and/or deficiencies in accordance with General Conditions of Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to weathertightness of curtain wall, structurally sound and free from distortion, deflection, misalignment, excessive noise, continuity of air/vapour barrier, loosening of glazing and anchorage buckling, water penetration beyond air/vapour seal, fading, discolouration of finish, failure of glazing, joint sealant against staining, adhesion and cohesion, bond failure and extensive colour fading.
- 1.10.1.2. Warrant factory sealed insulating units against defects for a period of 10 years. Warrant factory sealed insulating units free from condensation, fogging of material, obstruction of vision as result of dust or film formation on internal glass surfaces by any cause, under normal conditions anticipated under this Project, other extrinsic glass breakage, but including breakage due to thermal shock and temperature differential due to inherent glass or glazing fault.
- 1.10.1.3. Provide sealant manufacturer's 10 year materials warranty and limited labour warranty, including statement that sealants used in the Work will not cause porous substrates to become discoloured or change its appearance due to fluid migration.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List for Curtain Wall: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Alumicor Limited; www.alumicor.com
- 2.1.1.2. Kawneer Co. Canada, Ltd.; www.kawneer.com
- 2.1.1.3. Oldcastle Building Envelope; www.obe.com
- 2.1.2. Manufacturer List for Insulated Glass Units: Refer to Section 08 06 80.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Drawings and details are diagrammatic and are intended to show design concept, configuration, components and arrangements; they are not intended to identify nor solve completely problems of thermal, deflection and structural movements, air pressure equalization, air/vapour barriers, assembly framing, fixings and anchorages, moisture disposal, water penetration and problems at the glass line associated with glazing installation, movements, pressure fracture or thermal shock and weather seal. Final engineering design of curtain wall is responsibility of this trade. Material types, sizes and/or thicknesses shown on Drawings are diagrammatic and must be engineered to suit intended sizes and profiles.
- 2.2.1.2. Include cladding, glazing, insulation, air/vapour barriers, system components, metal trims, expansion joints, thermal breaks, firestopping, smoke seals, closures, fascias, parapet fins, flashings, vents, anchorage, fixings, reinforcing and related items of work to provide a complete curtain wall system to meet design criteria.
- 2.2.1.3. Comply with requirements of OBC and regulations of authorities having jurisdiction, which shall be minimum, except where more stringent requirements are specified herein.
- 2.2.1.4. Design glazing systems and framing to prevent thermal shock and pressure fracture damage to glass.

- 2.2.1.5. Design aluminum work as shown to provide free and noiseless movement of components of assembly due to structural erection or dead loads, without buckling, oil canning of any component and/or transmitting of stresses to any members.
- 2.2.1.6. Coordinate maximum allowable reaction loads with Structural Drawings.
- 2.2.1.7. Ensure metal faces of panels, flashings, caps and bases are visually flat under all lighting conditions to limitations specified hereinafter. Ensure finish on aluminum is uniform and consistent within each component and from component to component.
- 2.2.1.8. Locate sealants, gaskets, air/vapour seals, thermal separations, drainage slots and holes as shown or specified in this Section as required to obtain design requirements. Ensure components and assemblies exterior to air barrier drain to building exterior.
- 2.2.1.9. Design, assemble and secure Work in a manner that will keep any stresses on sealants within sealant manufacturer's recommended working range within factors of safety specified.
- 2.2.1.10. Ensure vertical and horizontal mullion caps are continuous full height and length of window units and horizontal caps shall butt to vertical mullion caps and trims.
- 2.2.1.11. Extrude pressure plates to dimensions of glass panes. Design pressure plates and glass retainers to place uniform pressure on glass, to prevent distortion of glass. Jointing of pressure plates need not necessarily follow snap-on cap jointing locations.
- 2.2.1.12. Ensure grain and extruding or rolling direction of horizontal mullion caps, trims, flashings, bases and sills are horizontal and in same direction. Where applicable apply paint finish in same direction as grain and extruding direction of metal.
- 2.2.1.13. Ensure grain and extruding or rolling direction of vertical mullion caps and trims are in "up" direction. Where applicable apply paint finish in same direction as grain and extruding direction of metal and vertical grain direction.
- 2.2.1.14. Accurately shape mullion and cover caps at intersecting joints to obtain hairline joints, just wide enough to permit thermal expansion and contraction.
- 2.2.1.15. Design and assemble curtain wall and aluminum panels to permit re-glazing without removal of structural mullion sections.
- 2.2.1.16. Ensure fasteners within curtain wall system are concealed.
- 2.2.1.17. Design attachments that permit replacement of individual units during construction or in subsequent usage of building without dismantling or disturbance to adjoining components or units. In addition, accomplish such replacement without use of extra exposed fasteners, splices, covers and like that alter original design features.
- 2.2.1.18. Provide accessories, closures and trims required and necessary to complete work.
- 2.2.1.19. Provide parapet cap flashings to roofs where curtain wall extends to roof.
- 2.2.1.20. Thermal Design/Movement Requirements:
 - 2.2.1.20.1. Vision Glass:
 - 2.2.1.20.1.1. Maximum centre of panel thermal transmittance ('U' value) at 15 mph wind velocity and when tested in accordance with CAN/CSA-A440.2:
 - 2.2.1.20.1.1.1. 0.68 w/(m²•°C) (0.12 Btu/(ft²•h•°F)) winter nighttime for vision panels.
 - 2.2.1.20.1.1.2. SHGC: 0.35 maximum.
 - 2.2.1.20.1.1.3. Visible transmittance of sealed unit: 56% minimum.
 - 2.2.1.20.2. Thermally break frame members, except where structural glazing is employed. Provide thermal breaks between exterior and interior components and sufficient metal on interior side of glass to provide total absence of condensation on interior metal surfaces under maintained design conditions at specified relative humidity.

- 2.2.1.20.3. Thermal Movement: Design components of installation to allow for thermal movement resulting from a exterior surface temperature differential of 92 deg C (165 deg F) (-18 deg C (0 deg F) to 74 deg C (165 deg F)).
- 2.2.1.20.4. Design frames so edges of inner pane of insulating glass units do not fall more than 8 deg C (14.4 deg F) below temperature of centre of inner pane.
- 2.2.1.20.5. Winter Design Conditions:
 - 2.2.1.20.5.1. Temperature: 22 deg C (72 deg F) interior and -20 deg C (-4 deg F) exterior.
 - 2.2.1.20.5.2. Relative Humidity: 35% RH.
- 2.2.1.20.6. Summer Design Conditions:
 - 2.2.1.20.6.1. Temperature: 24 deg C (75 deg F) interior and 31 deg C (89 deg F) exterior.
 - 2.2.1.20.6.2. Relative Humidity: 35% RH.
- 2.2.1.21. Structural Building Movement and Tolerances:
 - 2.2.1.21.1. Dead and Live Loads: Design curtain wall system and fixing to accommodate differential structural movements; 9 mm (3/8") typical live load deflection (13 mm (1/2") at Mechanical/Electrical floors), 1.6 mm (1/16") subsidence of columns, creep and thermal movement of the structure and other elements. Coordinate final calculations.
 - 2.2.1.21.2. Allow for a differential deflection of floor slabs, beams and wall framing after curtain wall and aluminum panel installation for anticipated primary structural deflections, as required by structural design.
 - 2.2.1.21.3. Design curtain wall system so failure of any 1 element (eg. bolt, anchor or embed) will not result in progressive failure of the wall.
 - 2.2.1.21.4. Ensure design of curtain wall and aluminum framing and panels, with fixing devices to structure, accommodates building construction tolerances in accordance with those specified in CISC and Structural Drawings.
 - 2.2.1.21.5. Be responsible for agreeing to tolerances of other trades affecting work of this Section prior to start of Shop Drawings.
- 2.2.1.22. Structural Design Requirements:
 - 2.2.1.22.1. Design work to withstand within specified deflection limitations, its own weight, forces applied by movements of building structure and attached adjacent components and maximum design loads due to pressure and suction of wind, snow, ice, rain and hail.
 - 2.2.1.22.2. Design curtain wall and aluminum panels to permit 150% of design loads without failure or permanent deformation in excess of L/1000.
 - 2.2.1.22.3. Design work to accommodate within its components, expansion and contraction due to cyclic temperature changes, shrinkage, moisture changes, creep in component materials, movement due to differential hoisting, distortions, misalignment, joint seal failures, noise, undue stress on securement devices and components and any other damage.
 - 2.2.1.22.4. Design work to accommodate expansion and contraction between this work, work of other Sections and building structure due to cyclic temperature changes, to prevent damages, twisting, distortion, misalignment, buckling, noise, undue stress on components and securement devices to work of this Section, work of other Sections and building structure.
 - 2.2.1.22.5. Ensure work accommodates, by means of expansion/contraction provisions, any movements within building structure and adjacent construction caused by short and long term structural movements, creep, column shortening, deflection, torsion, sway and racking.

- 2.2.1.22.6. Expansion/contraction provisions shall ensure no damages, distortion, misalignment of work of this Section, building structure, adjacent construction and connections occur and shall ensure thermal, vapour barrier, air infiltration/exfiltration and water and weathertightness requirements are maintained.
- 2.2.1.22.7. Design curtain wall connections to building structure and to adjacent construction to take into account peculiarities as may be found on this Project; to ensure no possibility of weakening, loosening or fracturing occurring due to vibrations from any source.
- 2.2.1.22.8. Examine As-Built documents provided by others for structural steel and concrete work and make field observations and measurements of these works, verifying As-Built information. Start of fabrication and installation of curtain wall and aluminum panel work implies acceptance of As-Built condition.
- 2.2.1.22.9. Design wall and base panels and their connections so they remain flat and free of distortion from forces imposed by building movement, cladding movement and movement induced by temperature change. Ensure such forces do not cause distortions, bow, twist and racking of panels and system alignment is maintained. Determine elastic deflection of panels by visual flatness requirements specified herein.
- 2.2.1.22.10. Design sill assemblies to sustain a concentrated load of 1112 N (250 lbs) at any point.
- 2.2.1.22.11. Design light gauge steel structural members in accordance with CSA S136.
- 2.2.1.22.12. Design light gauge aluminum structural members in accordance with CSA S157.
- 2.2.1.22.13. Design curtain wall and glazing systems (including accessories) to resist minimum wind pressure as required to meet design criteria and designated in OBC for this specific location of Project.
- 2.2.1.22.14. Design systems supported by structural building frame system to compensate for tolerances and deflection limitations stipulated in Contract Documents. Design special components, brackets and saddles to allow for connection to framing members.
- 2.2.1.22.15. Ensure deflection limitations for span distributions as directly related to exterior wall system and related cladding whether positive or negative (pressure or suction) comply with following:
 - 2.2.1.22.15.1. In all cases, limit deflection of any member, in direction parallel to wall plane, when member carries its full design load, not to exceed 75% of design clearance dimension between that member and panel, glass, or other part immediately below it.
 - 2.2.1.22.15.2. Deflection of any framing member in a direction normal or perpendicular to the plane of the wall when subjected to a uniform and/or concentrated load deflection test in accordance with ASTM E330/E330M, loads shall not:
 - 2.2.1.22.15.2.1. exceed $L/240$ of its clear span or 19 mm (3/4") whichever is less.
 - 2.2.1.22.15.2.2. exceed $2L/175$ of its cantilevered length or 19 mm (3/4") whichever is less.
 - 2.2.1.22.15.3. Deflection criteria for any vertical mullion shall not:
 - 2.2.1.22.15.3.1. exceed $L/175$ if its clear span is 4115 mm (13' - 6") or less.
 - 2.2.1.22.15.3.2. exceed $L/240 + 6$ mm (1/4") if its clear span greater than 4115 mm (13' - 6").
- 2.2.1.22.15.4. Jamb mullions' deflection not to exceed dynamic movement capacity of the tie-in.
- 2.2.1.22.15.5. For horizontal rails and members, deflection measured parallel to face of glass; a maximum of $L/175$ or an amount which allows reduction of glass bite to not exceed 3 mm (1/8") at mid-height of any glass light due to member deflection.
- 2.2.1.22.15.6. Ensure aluminum panels, when carrying a full design load do not deflect more than $L/60$ of its clear span of the short dimension.
- 2.2.1.22.15.7. For horizontal and vertical members retaining glass panels; deflection limits shall be such that integrity of glass and air seals are maintained at design loading. Permanent deformation of members due to applied loads is not permitted.

- 2.2.1.22.15.8. Design assemblies to resist window washing equipment applied load of 2.67 kN (600 lbs) in any direction.
- 2.2.1.22.16. Unless otherwise noted, design curtain wall to resist pressure due to stack effect in tower, excluding affects of wind and mechanical systems, of 0.2 KPa (5 lbs/sq ft) pressure on curtain wall. Confirm with Mechanical Engineer of Record.
- 2.2.1.22.17. Ensure sheet metal air/vapour barriers do not deflect more than 6 mm (1/4") under design loads or sufficient to cause noise, breaking joint seals or to cause them to touch other components of Work of this Section and building structure and so compression of firestopping is not less than 25% at any time. Design, fabricate and erect supplementary framing as required to support air/vapour barriers such that completed installation meets specified design requirements.
- 2.2.1.22.18. Design anchors, fasteners, bracing and framing fastened directly to structure, structurally adequate in accordance with requirements of CSA S16 using Limit States Design. Where extra bracing and/or supports are required to stabilize curtain wall assembly, provide such structural members whether shown on Drawings or not. Provide reinforcement in mullions as required, without increasing sight lines of aluminum members.
- 2.2.1.22.19. Utilize Limit States Design in sizing of glass and employ a safety factor for glass to statistical probability of failure of 8 glass lites per 1000. Comply with requirements of CAN/CGSB-12.20-M for design of glass. Replace broken or damaged sealed units prior to application of Substantial Performance of the Work.
- 2.2.1.22.20. In addition, ensure design of glazing takes into consideration characteristics of mullions and effects of connections and sealants at frame junctions. Ensure glass is heat strengthened or tempered as required in order to meet wind load, failure probability specified and accommodate thermal stresses as required to meet building codes and/or standards.
- 2.2.1.22.21. Design work to accommodate tolerance requirements permitted of building structure and thermal, seismic and live load movements of building structure as stipulated in Contract Documents.
- 2.2.1.23. Seismic Loads: In accordance with OBC.
- 2.2.1.24. Water and Moisture Design Requirements: In designing and engineering the Work, use following principles:
 - 2.2.1.24.1. Design curtain wall system to rain screen principle. Make provision to drain to exterior face of assembly at every floor level to create horizontal compartmentalization and provide vertical compartmentalization at each vertical mullion to control any water, air and condensation occurring within curtain wall construction while maintaining air seal between interior and exterior. Ensure drain holes are adequate to drain water.
 - 2.2.1.24.2. Design, fabricate and install assembly to be watertight under design conditions in combination with movements occurring due to loads imposed.
 - 2.2.1.24.3. Ensure frames provide pressure equalization to glazing pockets at vision and spandrel panels and reveal base and sill panels, column covers to have pressure equalization provided to spaces behind and not fully depend upon sealants and gaskets to achieve watertight and air/vapour barrier seals. Ensure curtain wall system is self-draining with framing components to curtain wall assembly profiled to drain off any moisture to exterior. Screen drainage ports to exterior.
- 2.2.1.25. Air/Vapour Design Requirements:
 - 2.2.1.25.1. Ensure an air/vapour barrier consistent with rain screen principle is continuously installed at inner frame perimeter as an integral part of curtain wall system design to provide a complete and impervious air/vapour barrier. No detectable drafts are permitted.
 - 2.2.1.25.2. It is Contractor's responsibility to design and provide air/vapour seal between curtain wall, aluminum panels, trim and expansion joints at roof, base structure, masonry and other components of building.
 - 2.2.1.25.3. Ensure maximum water vapour transmission including joints is 57 ng/Pa•sm² (1 US perm).

- 2.2.1.25.4. Design and reinforce rigid air/vapour barriers to withstand specified load deflection limitations, their own weight, insulation weight and design loads.
- 2.2.1.26. Firestopping/Smoke Seals: Coordinate with Section 07 84 00 for firestopping/smoke seal assemblies at floor levels where indicated and where required by local building authorities.
- 2.2.1.27. Sound Attenuation Requirements:
 - 2.2.1.27.1. Ensure curtain wall assembly has an exterior to interior sound attenuation average of not less than STC 34 when tested after installation.
 - 2.2.1.27.2. Ensure curtain wall assembly effectively insulates interior areas from exterior noise transmission.
 - 2.2.1.27.3. Provide completed installation free from noise, rattles, wind whistles, or noise due to thermal and structural movement.
- 2.2.2. Aluminum Extrusions: ASTM B221M, minimum 3 mm (1/8") wall thickness, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T6 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.
- 2.2.3. Aluminum Sheet: ASTM B209/B209M, minimum thickness 3 mm (1/8") of type and characteristics to match finished extrusions; ensure sheet which is not exposed is Utility Aluminum mill finished; for intricate forming with decorative finishes use AA-1100 and for siding and exposed panels use AA-3003 with specified finish.
- 2.2.4. Screws, Bolts and Fasteners: At exterior to air seal and/or penetrating air seal, use Type 304 Series stainless steel or hardened aluminum. Fully to interior of air seal, use zinc chromate plated or Series 400 stainless steel is permitted.
- 2.2.5. Structural Silicone Sealant: Non-sag type, multi-component, high-modulus, pre-pigmented, neutral cure elastomeric silicone sealant conforming to ASTM C1184, Type M, Use G and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.5.1. "DOWSIL™ 983 Structural Glazing Sealant" by The Dow Chemical Company; www.consumer.dow.com.
 - 2.2.5.2. "Sikasil® SG-500 CN" by Sika Canada Inc.; www.sika.ca.
 - 2.2.5.3. "Proglaze® II" by Tremco Canada; www.tremcosealants.com.
- 2.2.6. Backpan Sealant: Non-sag type, 1 component medium-modulus, pre-pigmented, elastomeric silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 25, Use NT, G, M, A and O. Supply in White. Supply 1 of following:
 - 2.2.6.1. "DOWSIL™ 791 Silicone Weatherproofing Sealant" by The Dow Chemical Company.
 - 2.2.6.2. "Tremsil® 600 Single-Component, Neutral-Cure Silicone Sealant for Glazing" by Tremco Canada.
- 2.2.7. Thermal Break Component: Glassfibre impregnated nylon, "Polymide" by Ensinger Ltd.; www.ensinger.ltd.uk.
- 2.2.8. Light Gauge Sheet Metal: Commercial quality galvanized sheet steel to ASTM A653/A653M, Designation Z275 (G90) unless otherwise specified.
- 2.2.9. Miscellaneous and Sub-Frame Steel: CSA G40.21, Grade 300W, prime painted.
- 2.2.10. Shims: Aluminum utility sheet when not in contact with concrete; stainless steel when in contact with concrete or cementitious substances of thickness required, or hot dip galvanized steel.

- 2.2.11. Insulation for Spandrels and Firestopping: Stone wool, rigid or semi-rigid board insulation, "ROCKWOOL™ CURTAINROCK®" by ROCKWOOL™ International A/S. Ensure insulation has a thermal resistance value of not less than RSI=0.704 per 25 mm (R=4 per inch) thickness at a mean temperature of 24 deg C (75 deg F) and a minimum nominal density of 64 kg/m³ (4 pcf). Ensure deformation of insulation does not exceed 10% when tested at 1.2 kPa (25 psf) in accordance with CAN/ULC-S702.1, Type 1 and ASTM C165. Thickness as indicated.
- 2.2.12. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.
- 2.2.13. Adhesive for Insulation: Compatible, permanent type recommended by insulation manufacturer and suitable when fully coated to hold metal back-up panels and insulation totally bonded for life of building.
- 2.2.14. Metal Air/Vapour Barriers: Galvanized sheet metal for metal/air vapour barriers, backpans and air seals minimum 0.912 mm (20 ga) thick, sheet steel galvanized to requirements specified herein and Designation Z275 (G90).
- 2.2.15. Insulation Retainers: Aluminum bars spaced no greater than 400 mm (16") oc.
- 2.2.16. Gun Welded Pins: 3 mm (1/8") dia. galvanized steel pins with cup heads of length to suit insulation thickness and suitable for gun shot welding to metal air/vapour barriers.
- 2.2.17. Stick Clips: Consisting of 25 mm (1") diameter perforated disc base with integral 3 mm (1/8") square sharpened pin of moulded polyvinyl chloride or galvanized steel. Ensure pin lengths suit insulation thickness and clips have 25 mm x 25 mm (1" x 1") galvanized sheet steel retainers punched to lock on pins. Adhere with structural silicone sealant in accordance with insulation manufacturer's recommendations.
- 2.2.18. Adhesive for Stick Clips: High-strength, resilient adhesive having a drying time of 1 to 30 minutes (rapid initial set) and 24 hour final set. Ensure adhesive is compatible with specified insulation adhesive, insulation, galvanized steel and polyvinyl chloride.
- 2.2.19. Primer for Adhesives: As recommended by adhesive manufacturer for particular materials to be adhered.
- 2.2.20. Seal Closure/Spandrel Back Panel: 0.912 mm (20 ga) nominal core thickness steel sheet.
- 2.2.21. Coping and Parapet Counter Flashing: Provide 2.5 mm (3/32") thick aluminum, reinforced as required.
- 2.2.22. Stack Joint Flashing: Provide aluminum or stainless steel embedded in silicone sealant. Pre-seal as required.
- 2.2.23. Touch-Up Paint: As recommended by aluminum finish manufacturer. Touch-up paint for welded galvanized areas; "METALHIDE® ONE PAC | 97-676" by PPG Architectural Coatings; www.ppg.com, "Zinc Clad® 5 Organic Zinc-Rich Primer" by The Sherwin-Williams Company; www.sherwin-williams.com or "ZRC® Cold Galvanizing Repair Compound" by ZRC Worldwide; www.zrcworldwide.com in accordance with manufacturer's printed directions.
- 2.2.24. Air/Vapour Transition Membrane System: Provide following:
 - 2.2.24.1. Flexible Membrane: SBS modified bitumen or rubberized asphalt membrane, minimum 0.56 mm (22 mils) thick with polyethylene or polypropylene film membrane on 1 side and siliconized release paper on the other, cut to suit design and lap requirements, "Perm-A-Barrier Wall Membrane" by GCP Applied Technologies, Inc., "Blueskin SA/Blueskin SA LT" by Henry Company, "IKO AquaBarrier AVB" by IKO Industries Ltd., "Air Shield" by W. R. Meadows of Canada, "ExoAir 110/110AT Self-Adhered" by Tremco Canada or "SOPRASEAL STICK 1100T" by Soprema Inc. Primer as recommended by membrane manufacturer.

- 2.2.25. Glazing Materials:
- 2.2.25.1. Ensure selected glazing accessories for each condition are fully compatible with contact surfaces of frames, other accessories used in glazing system and contact surfaces of compounds used on insulated glass units. Wood or other organic materials are not permitted for use in glazing systems, including spacer blocks.
- 2.2.25.2. Edge Blocking for Glass: 60 - 70 Durometer neoprene, silicone or EPDM, channel shaped, 100 mm - 150 mm (4" - 6") long.
- 2.2.25.3. Spacers: Low conductance black stainless steel warm edge spacer of adequate rigidity, continuous with bent corners and welded joints (non-metallic spacers for exterior conditions, refer to Section 08 06 80). Design spacer to accommodate seals and desiccant.
- 2.2.25.4. Setting Blocks, Void Filler Blocks Under Pressure Bars, Anti-Walk Blocks: Neoprene ASTM C542, or silicone or EPDM, having 80 to 90 Durometer Shore 'A' hardness.
- 2.2.25.5. Glazing Tape: Preformed, 100% solids polyisobutylene butyl, paper release, reinforced centre. Permitted Products: "Polyshim 2" by Tremco Canada or equivalent by Protective Treatments Incorporated. Test to ensure compatibility with edge-seal.
- 2.2.25.6. Neoprene Gaskets: Black, closed cell neoprene of approximately 5 to 15 Durometer Shore 'A' hardness suitable for 50% compression when installed.
- 2.2.25.7. Exterior Glazing Gaskets: Silicone of sufficient thickness having 13.8 MPa (2000 psi) tensile strength, 60 +/-5 Durometer Shore 'A' hardness, resistance to permanent set 30% maximum, minimum elongation at break of 300% and resistance to ozone showing no cracks.
- 2.2.25.8. Silicone Compatible Rubber Extrusions: Gaskets and accessories such as wedges, pre-set spacers and shims for use in glazing applications and other building joint applications. "SCR-900 Rubber Extrusions" by Tremco Canada for standard design or profile size and configuration to suit design requirements.
- 2.2.25.9. Preshim Glazing Tape: Preformed, ribbon-shaped, non-skinning, 100% solids, non-oxidizing polyisobutylene: butyl, paper release, EPDM Shim with continuous synthetic rubber spacer rod of 60 Durometer hardness. Permitted Products: "Polyshim II Tape" by Tremco Canada, or "PTI-606" by Protective Treatments Inc. Ensure tape is sufficiently wide and thick to completely cover bite area of glazing unit when unit is pushed into place.
- 2.2.25.10. Sealant for Heel Bead Airseal: One component, medium modulus silicone sealant conforming to ASTM C920, Type S, Grade NS. Permitted Products: "DOWSIL™ 795 Silicone Building Sealant" by The Dow Chemical Company, "Sikasil® WS-295 Neutral Cure, Weather Sealing Silicone Sealant" by Sika Canada Inc. or "Spectrum® 2" by Tremco Canada in accordance with Section 07 92 00. Ensure compatibility with edge seal of glazing unit.
- 2.2.26. Glass:
- 2.2.26.1. Glass thicknesses given in this Section are minima. Validate glass thicknesses specified in Section 08 06 80 in accordance with CAN/CSGB-12.20-M.
- 2.2.26.2. Ensure glass (particularly heat-strengthened, tempered and laminated) bears manufacturer's labels on bottom inner right hand corner indicating quality.
- 2.2.26.3. Ensure heat-strengthened and tempered glass meets following roller wave distortion criteria:
- 2.2.26.3.1. maximum peak to valley measurement of 0.127 mm (0.005") for every 300 mm (12") in any direction.
- 2.2.26.3.2. roller distortion and/or ripples runs in same direction for entire Project.
- 2.2.26.3.3. unless precluded by manufacturing process, orient roller-wave in the horizontal direction. Ensure glass is heat-treated through the horizontal tempering process.

- 2.2.26.4. Ensure glass coatings do not have pinholes greater than 1.6 mm (1/16") in diameter, nor have pinholes clustered together. Ensure scratches on coatings only occur within 75 mm (3") of glass edge and does not exceed 75 mm (3") in length.
- 2.2.26.5. Tempered Glass (TGL):
 - 2.2.26.5.1. Clear transparent and/or low iron tempered glass conforming to ASTM C1048, Kind FT and meeting requirements of CAN/CGSB-12.1. Ensure surface compression is equal to or greater than 68.9 MPa (10 000 psi). Ensure tempered glass is heat-soaked in accordance with BS EN 14179-1.
 - 2.2.26.5.2. Ensure heat soaking records are kept in accordance with Section 01 70 00 and glass remains traceable.
 - 2.2.26.5.3. Retest heat soak batches with breakage greater than 1 in 100 units. Batches with additional breakages will be rejected and not used on this Project.
 - 2.2.26.5.4. "Statistical Heat Soak", "Partial Batch" and "On-Line" heat soaking are not permitted.
 - 2.2.26.5.5. Tempered glass at a height greater than 3 m (10') above a trafficable walkway and has 1 or more unframed edges or is point-fixed will be treated as inclined glazing with requirements for secondary retention in case of breakage.
- 2.2.26.6. Heat-Strengthened Glass (HSGL): Clear transparent and/or low iron heat-strengthened glass conforming to ASTM C1048, Kind HS. Perform heat-strengthening using horizontal tong free method and ensure surface compression is between 27.6 MPa (4000 psi) and 48.3 MPa (7000 psi).
- 2.2.27. Factory Sealed Insulating Vision Glass Units (GL): For factory sealed insulating vision glass unit types, refer to Section 08 06 80.
- 2.2.28. Fabrication:
 - 2.2.28.1. Curtain Wall:
 - 2.2.28.1.1. Drawing details of curtain wall are based on "ThermaWall 2600" for CW-1 and "VersaWall 2500" for CW-2 by Alumicor Limited as well design performance requirements and criteria specified herein, frame depth and back section, cap depths and configuration as shown.
 - 2.2.28.1.2. Ensure extrusion thickness is adequate to satisfy loading and deflection, as required and indicated.
 - 2.2.28.1.3. Form accurate extrusions with clean, straight, sharply defined profiles free from any defects.
 - 2.2.28.1.4. Insofar as practical, execute fitting and assembly of unitized components in shop with various parts or assemblies ready for erection on site.
 - 2.2.28.1.5. Take field measurements and levels required to verify or supplement those shown for proper layout and installation of Work. Coordinate dimensional tolerances in adjacent building elements and confirm prior to commencement of Work. Commencement of installation floor by floor implies acceptance of building conditions. Ensure curtain wall does not deviate from tolerances specified.
 - 2.2.28.1.6. Maintain dimensional tolerances from vertical and horizontal planes with closest possible accuracy.
 - 2.2.28.1.7. Where curtain wall occurs in curved plane, machine butt joints of horizontal members to accurately follow a segmented line along curve of building wall.
 - 2.2.28.1.8. Ensure means of anchoring curtain wall has sufficient adjustment to permit correct and accurate alignment. After adjustment, positively lock anchorage devices in manner to preclude movement, once alignment is achieved.
 - 2.2.28.1.9. Isolate aluminum bearing contact with dissimilar materials. Ensure method of isolation is reviewed by Consultant.

- 2.2.28.1.10. Make allowances for deflection of structure above when making connection thereto and ensure no structural load is transmitted to aluminum curtain wall.
- 2.2.28.1.11. Ensure grain of sheet and direction of finish for flashings and panels on building are in the same direction. Make panels free of machine marks.
- 2.2.28.1.12. Conceal nuts, bolts, screws, clips and other means of fastening in finished Work, except where shown or specified. Countersink and conceal fixing screws. Ensure screws are oval head, Phillips or Robertson head, set flush with adjacent surfaces.
- 2.2.28.1.13. Weld aluminum where required with inert metal arc equipment by methods recommended by manufacturer. Ensure welders qualify according to CSA W47.2. Make exposed welds continuous and flush with adjacent surface. Do not mar surface finishes with welds in back of exposed aluminum. Do not deform exposed metal and finish in any way by welding.
- 2.2.28.1.14. Weld steel, where required, in accordance with CSA W59. Ensure welded joints are of adequate strength and durability with jointing tight and flush. Ensure welder is fully approved by Canadian Welding Bureau and fabricator certified to CSA W47.1, Division 3. Where it is necessary to weld components already galvanized, remove galvanizing for 50 mm (2") around weld and paint over welds where galvanizing is removed as specified hereinafter.
- 2.2.28.1.15. Insert concealed galvanized and zinc chromate coated steel reinforcement into frame members and any other units as required, sized to adequately withstand snow and wind pressure requirements of OBC.
- 2.2.28.1.16. Curtain wall closures thickness for exposed or concealed locations: Minimum 3 mm (1/8").
- 2.2.28.1.17. At junction of mullions and adjoining structure, notch extrusion stem at head and/or sill as required too allow for correct, uninterrupted installation of flashings and air seals integrated into system as indicated. Provide smoke seal closure within mullion section at stack joint to prevent floor to floor smoke migration.
- 2.2.28.1.18. Include thermal barriers and miscellaneous EPDM pads, shims and washers.
- 2.2.28.1.19. Glass Rabbet: Ensure rabbet depth is no less than 25 mm (1") deep to allow adequate engagement of variables such as temperature, manufacturing tolerances and site installation.
- 2.2.28.1.20. Provide weepholes in glazing cavity to drain water leakage to exterior. Provide drainage tubes as necessary to conduct water safely through isolated insulated areas to direct exterior discharge. Seal around tubes.
- 2.2.28.1.21. Fabricate frame systems complete with mullions, head and sill frames, spigots and plugs for horizontals, spline gaskets, thermal break pressure plates, filler pieces, snap-on caps, and other necessary components. Where horizontal and/or vertical mullions terminate or are interrupted and would otherwise expose an open end of tube, provide plug consisting of colour matching aluminum finished to fit with hair-line joint and either welded or mechanically fixed in position with totally concealed stainless steel fasteners.
- 2.2.28.2. Assembly Glazing:
 - 2.2.28.2.1. Clean rabbets, stops and glass edges of dust, dirt, moisture, oil and other foreign matter detrimental to glazing material adhesion. Ensure drainage holes are not blocked.
 - 2.2.28.2.2. Accurately size glass to fit openings allowing clearances following trade practices. Cut glass cleanly and carefully; nicks, damaged edge conditions will not be permitted. Replace glass which has nicked or damaged edges.
 - 2.2.28.2.3. Use shims, spacers and setting blocks of proper size to support and hold glass in position independent of glazing tape and gaskets. Place 2 setting blocks under each unit at 1/4 points. Arrange setting blocks so as to avoid blocking water transfer inside frames.
 - 2.2.28.2.4. Install glazing tapes or gaskets to ensure complete contact on surface of glass and frame. Make joints only at corners of sash or frame and seal joints. Fit tape accurately with tight joints, free from tension, without gaps and cracks.

- 2.2.28.2.5. Set glass properly centred with uniform bite and face and edge clearance, free from twist or warp.
- 2.2.28.2.6. Handle and install glass in accordance with manufacturer's directions. Prevent nicks, abrasion and other damage likely to develop stress on edges
- 2.2.28.3. Assembly Structural Silicone Glazing:
 - 2.2.28.3.1. Apply structural silicone sealant between glass-to-metal joints in accordance with sealant manufacturer's written directions and reviewed Shop Drawings. Utilize 2-part, high modulus silicone sealants for structural glazing.
 - 2.2.28.3.2. Do not use structural sealant for primary deadload.
 - 2.2.28.3.3. Before proceeding with total application of structural silicone sealant, complete a factory application of a typical 4-sided structural glazing application to indicate quality of sealant. Ensure application is witnessed by sealant manufacturer. Allow sealant application to cure for 24 hours and then test for adhesion prior to any further application of structural sealant taking place. Ensure structural sealant manufacturer renders technical assistance prior to application of any sealant.
 - 2.2.28.3.4. Submit a letter of recognition from proposed silicone manufacturer stating silicone manufacturer has examined proposed 4-sided structural glazing system and recognizes a proper application.
 - 2.2.28.3.5. Apply structural silicone in a temperature controlled environment free of dust and moisture. Ensure ambient and surface temperatures and joint conditions are suitable for materials being installed.
 - 2.2.28.3.6. Clean and prepare surfaces receiving structural silicone in accordance with silicone manufacturer's instructions. If recommended by sealant manufacturer, prime joints to prevent staining, or to assist in bonding.
 - 2.2.28.3.7. Ensure glass edges and joint surfaces are sound, free of dirt, water, frost, loose scale, corrosion, or other contaminants which may adversely affect performance of sealant materials prior to silicone application. Remove protective oil coatings and other oil or grease films. Tape and mask surfaces as required. Tool sealant material to achieve smooth and flush appearance.
 - 2.2.28.3.8. Ensure structural silicone, exterior weatherseal and any exposed sealants, gaskets or glazing tapes are Black in colour.
 - 2.2.28.3.9. Provide test samples of substrate materials to sealant manufacturer for peel adhesion and accelerated weathering testing and submit results of tests to Consultant. Ensure testing is with materials and finishes identical in every respect to reviewed production materials and finishes.
 - 2.2.28.3.10. Prior to undertaking any structural glazing, submit to Consultant complete structural glazing procedures, including permissible conditions, temperatures, cure times, temporary restraint design, surface preparation and other procedures, including quality control inspection program being employed to properly undertake aluminum curtain wall construction.
- 2.2.28.4. Metal/Air Vapour Barriers:
 - 2.2.28.4.1. Brake form barriers from sheet metal to permit assembly using self-tapping screws and attachment using powder-activated or pneumatic fixings or other means of secure fastening.
 - 2.2.28.4.2. Make provision in barrier design to accommodate movement resulting from thermal change and from structural deflection. Where largest dimension of back-pan exceeds 500 mm (18"), internally reinforce pans to maintain deflection limitations.
 - 2.2.28.4.3. Form edges in contact with building substrate to 45° to permit peripheral and joint sealing. Form edges making contact with aluminum framing sections similarly to flanged and stepped back pans.
 - 2.2.28.4.4. Cut, fit and form metal air/vapour barriers as required to accommodate conflicting framing connections, mechanical and electrical appurtenances and other obstructions.
 - 2.2.28.4.5. Supply metal furring and reinforcing as required to support radiant heating equipment shown. Fastener penetrations are not permitted through air barrier; weld all such Work.

- 2.2.28.4.6. Where air/vapour barrier is mechanically connected to aluminum curtain wall framing, ensure fasteners used are specially designed to be non-corrosive and to maintain air tightness throughout life of building.
- 2.2.28.4.7. As part of work of this Section, include where required custom formed metal back pans integrated at head of curtain wall. Make sealed connections to back-up steel framing and to rebate line on curtain wall head member, separating dissimilar metals. Make allowances in aluminum framing to receive sealed cap flashing between metal wall panels and curtain wall furnished under separate Section.
- 2.2.28.5. Flashing and Trim:
- 2.2.28.5.1. Furnish metal flashing members, trim and accessories in contact with framing members under this Section. Fabricate exposed, concealed or semi-concealed flashing and closure sections from finish-matching 2.5 mm (3/32") thick aluminum from stock as previously specified.
- 2.2.28.5.2. Be responsible for accurate cutting, drilling and fitting of dissimilar and aluminum components which penetrate this work.
- 2.2.28.5.3. Provide matching custom formed or brake shape trim sections at capped peak, sill section to overlap separate counter flashing and end rafter edge trim to interface with metal cladding.
- 2.2.29. Finishes: Provide 1 of following systems:
- 2.2.29.1. Exterior Superior Performance Coating Finish Process: (3 Coat Wet System (primer/colour coat/clear coat)) including thermal setting application of 70% fluoropolymer resin minimum, PVDF with added colour pigment finish exceeding or meeting AAMA 2605 requirements. Ensure fluoropolymer baked resins form a continuous physically locked finish during manufacturing process. Apply fluoropolymer finish after multistage chemical treatment cleaning providing corrosion resistance surface ready to receive primer. During baking process apply primer in accordance with manufacturer's recommendations followed by a flash process whereby evaporating solvent and then fluoropolymer finish sprayed on to aluminum; apply another flash procedure and then bake for approximately 10 minutes when aluminum surface reaches a temperature of 232 deg C (450 deg F). Permitted Products: "Duranar XL" by PPG Industries; www.ppgideascape.com or "Fluoropon® Classic" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

| Description | Performance Characteristics |
|--|--|
| 2.2.29.1.1. Coating Thickness: | 0.0063 mm +/-0.0013 mm (0.25 +/-0.05 mils) primer 0.025 mm (1.0 mil) min barrier coat (if applicable) 0.025 mm (1.0 mil) min colour coat 0.015 mm +/-0.0005 mm (0.6 +/-0.02 mil) clear top coat |
| 2.2.29.1.2. Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.29.1.3. Gloss (ASTM D523 @ 60°): | Medium gloss |
| 2.2.29.1.4. Pencil Hardness (ASTM D3363): | F minimum |
| 2.2.29.1.5. Abrasion Resistance Falling Sand (ASTM D968): | 50 l/ml |
| 2.2.29.1.6. Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.29.1.7. Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.29.1.8. Colour Retention 10 yrs, 45° South Florida (ASTM D2244): | ΔE <5.0 |

- 2.2.29.1.9. Humidity Resistance:
ASTM D714, ASTM D2247,
4000 hrs, 100% R.H. @ 100°F: Few #8 blisters maximum
- 2.2.29.1.10. Salt Spray Resistance:
ASTM B117, 4000 hrs
5% NaCl @ 100°F: 1/16" maximum undercutting
- 2.2.29.1.11. Chalking Resistance
10 yrs, 45° South Florida
(ASTM D4214): No more than #8 (#6 for Whites)
- 2.2.29.1.12. Erosion Resistance:
10 yrs, 45° South Florida
(ASTM B244): Maximum 5%
- 2.2.29.2. Exterior Superior Performance Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2605 with minimum 100% fluoropolymer resin. Permitted Product: "Interpon D3000 Fluoromax Powder Coating" by Akzo Nobel Coatings, Inc.; www.akzonobel.com with following characteristics:

Description

Performance Characteristics

- 2.2.29.2.1. Coating Thickness: 0.060 mm to 0.115 mm (2.4 mils to 4.5 mils) with no reading less than 0.045 mm (1.8 mils)
- 2.2.29.2.2. Pre-Treatment: Multi-Stage Cleaning with Chemical Conversion Coating
- 2.2.29.2.3. Gloss (ASTM D523 @ 60°): 20% - 40%
- 2.2.29.2.4. Pencil Hardness
(ASTM D3363): F minimum
- 2.2.29.2.5. Abrasion Resistance
Falling Sand (ASTM D968): 40 l/ml
- 2.2.29.2.6. Colour Retention
10 yrs, 45° South Florida
(ASTM D2244): $\Delta E < 5.0$
- 2.2.29.2.7. Humidity Resistance
ASTM D714, ASTM D2247,
4000 hrs, 100% R.H. @ 100°F: Few #8 blisters maximum
- 2.2.29.2.8. Salt Spray Resistance
ASTM B117, 4000 hrs
5% NaCl @ 100°F: 1/16" maximum undercutting
- 2.2.29.3. Interior Pigmented Organic Thermal Setting Finish Process: (1 Coat Wet System) meeting or exceeding AAMA 2603. Permitted Products: "Duracron" by PPG Industries; www.ppgideascape.com or "Acryliccoat™" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

Description

Performance Characteristics

- 2.2.29.3.1. Colours Available: White, Black and full range of colours including metallics and pearlescents
- 2.2.29.3.2. Dry Film Thickness: 0.025 mm +/-0.005 mm (1.0 mil +/-0.2 mils) - 0.02 mm (0.8 mil) minimum
- 2.2.29.3.3. Pre-Treatment: Multi-Stage Cleaning with Chemical Conversion Coating
- 2.2.29.3.4. Gloss (ASTM D523 @ 60°): Colours: Low, medium and high gloss
Polychromatics: Low and medium gloss

- | | | |
|--------------|--|---|
| 2.2.29.3.5. | Pencil Hardness (ASTM D3363): | H minimum |
| 2.2.29.3.6. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.29.3.7. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.29.3.8. | Detergent Resistance (3%) immersion @ 100°F: | 72 hours - no attack |
| 2.2.29.3.9. | Humidity Resistance ASTM D714, ASTM D2247, 1500 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.2.29.3.10. | Salt Spray Resistance ASTM B117, 1500 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.2.29.3.11. | Exterior Exposure 1 yr @ 45° South Florida: | No loss of adhesion, maximum 8 fade and maximum 6 chalk |
| 2.2.29.4. | Interior Pigmented Thermal Setting Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2603. Permitted Product: "Interpon D1010 Powder Coating" by Akzo Nobel Coatings, Inc. with following characteristics: | |
| | Description | Performance Characteristics |
| 2.2.29.4.1. | Coating Thickness: | 0.051 mm to 0.080 mm (2.0 mils to 3.2 mils) |
| 2.2.29.4.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.29.4.3. | Gloss (ASTM D523 @ 60°): | 10% - 90% |
| 2.2.29.4.4. | Pencil Hardness (ASTM D3363): | H minimum |
| 2.2.29.4.5. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.29.4.6. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.29.4.7. | Detergent Resistance (3%) immersion @ 100°F: | 72 hours - no attack |
| 2.2.29.4.8. | Humidity Resistance ASTM D714, ASTM D2247, 1500 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.2.29.4.9. | Salt Spray Resistance ASTM B117, 1500 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.2.29.4.10. | Exterior Exposure 1 yr @ 45° South Florida: | No loss of adhesion, maximum 8 fade and maximum 6 chalk |
| 2.2.29.5. | Colours and Sheens: To be selected by Consultant. Include for texture and specialty finishes. | |
| 2.2.29.6. | SSG Bondline: | |
| 2.2.29.6.1. | Aluminum surfaces to receive structural silicone sealant. | |
| 2.2.29.6.2. | Structural Silicone Bond Line: Alodine. | |

- 2.2.29.7. Apply to metal exposed on interior and exterior with finishes specified herein to suit design requirements. Ensure colour and sheen are uniform with no visible variations.
- 2.2.29.8. Painting:
 - 2.2.29.8.1. Prime steel at building interior and not exposed to view or to exterior environmental conditions with oil alkyd primer.
 - 2.2.29.8.2. Provide a dielectric separator to concealed surfaces of aluminum and galvanized steel which would otherwise come in direct contact with structural steel, concrete and masonry.
 - 2.2.29.8.3. Paint welded, galvanized items where galvanizing has been removed for welding. Make Good corrosion protection using 2 coats of touch-up primer for galvanized steel. Make Good protection on steel primed with oil alkyd primer using same primer.

2.3. SOURCE QUALITY CONTROL

- 2.3.1. Test and Inspections:
 - 2.3.1.1. Owner will designate an independent inspection and testing company to carry out inspection and testing of work of this Section.
 - 2.3.1.2. Ensure Owner or his independent inspection and testing company has free and ready access to shop production to conduct periodic/regular reviews of source materials, fabrication and assembly of wall systems. Immediately remove from production line materials or assemblies flagged as not in conformance with Specifications, reviewed Shop Drawings, QC manual or good practice. Render materials/assemblies not re-workable as unusable. Hold materials/assemblies re-workable for further review.
 - 2.3.1.3. Source material review includes but is not limited to visual review of glass edges for chips, crushes, spalls and of edge seals for lack of continuity, exposed or misaligned edges spacers, or mis-mixed sealants.
 - 2.3.1.4. Production line shop review includes but is not limited to:
 - 2.3.1.4.1. visual review of glass edges for chips, crushes, spalls and of edge seals for lack of continuity, exposed spacers or mis-mixed sealants.
 - 2.3.1.4.2. review of aluminum framing joinery for proper fit, frame sealing and fixing.
 - 2.3.1.4.3. review of backpan fabrication including corner welds, weld treatment and stick pin weld/adhesion.
 - 2.3.1.4.4. review of backpan sealing into frame and insulation placement.
 - 2.3.1.4.5. review of glass placement into frame including setting blocks, side blocks, edge clearance and gasket.
 - 2.3.1.4.6. seating and corner block placement.
 - 2.3.1.4.7. review of drain hole and vent hole during fabrication process.
 - 2.3.1.4.8. review of stiffener placement into frames, as per design.
 - 2.3.1.4.9. checks of gasket installation, crimping and sealant installation.
 - 2.3.1.4.10. review of shipping, crating and protection procedures.
 - 2.3.1.5. Cost of such inspection and testing, if required, will be paid by Owner.
- 2.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Ensure openings and recesses to receive work of this Section are within permitted tolerances.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Ensure masonry and concrete surfaces to receive adhesives and sealants are dry, firm, sound, smooth, suitable for bond, and free from loose material, projections, ice, frost, slick, grease, oil and other matter detrimental to bond.
 - 3.2.1.2. Remove dust and other loose material from openings.

3.3. INSTALLATION

- 3.3.1. Perform work of this Section in accordance with "GANA Glazing Manual, 50th Anniversary Edition" and "GANA Laminated Glazing Reference Manual, 2009" for laminated glazing installation methods.
- 3.3.2. Supply anchorage devices and inserts to appropriate trades where required for building in or casting-in-place and instruct as to proper location and position.
- 3.3.3. Erect work plumb and true and in proper alignment and relationship to established lines and grades.
- 3.3.4. Erection Tolerances: Maintain following tolerances:
 - 3.3.4.1. maximum variation from plane or location shown on Shop Drawings: 1.6 mm (1/16") in 4420 mm (14' - 6") of length.
 - 3.3.4.2. maximum offset from true alignment between 2 identical members abutting end-to-end in line: 0.8 mm (1/32").
 - 3.3.4.3. racking of face: 3 mm (1/8") maximum.
 - 3.3.4.4. racking in elevation: nil.
 - 3.3.4.5. Deviation from true plumb over full height of building: maximum 6 mm (1/4").
 - 3.3.4.6. Deviation from true straightness in plane over full length of each building face; maximum 6 mm (1/4").
 - 3.3.4.7. Maximum variation in any column-to-column space or 6 m (20' - 0") run: 3 mm (1/8").
 - 3.3.4.8. Ensure tolerances of relationship of individual components are as follows:
 - 3.3.4.8.1. member to member, maximum 0.4 mm (1/64").
 - 3.3.4.8.2. out of plane between faces of 2 halves of split mullions, 0.8 mm (1/32").
 - 3.3.4.9. Joint width, mullion snap-on cap to mullion snap-on cap; maximum 1.6 mm (1/16"). Ensure each joint is of uniform width.
 - 3.3.4.10. Joint width between soffits and base and sill panels; maximum 3 mm (1/8") and of uniform width within a 3 m (10') length. Do not apply sealants to joints between panels; use only "dry" gasket system of sealing.

- 3.3.4.11. Keep panel joints to a minimum and as shown. Ensure panel sizes are uniform and to direction of Consultant.
- 3.3.4.12. Tolerances are not cumulative.
- 3.3.4.13. Flatness of Panels Defined:
 - 3.3.4.13.1. Ensure exposed metal panels including exposed flashing components have a visual flatness permitted and in such manner that slope of any surface at any point does not exceed 0.5% from nominal plane of surface when measured in any direction at 25 mm (1") intervals when ambient temperature is at 22 deg C (72 deg F) and under any combination of performance conditions. This requirement is also applicable to conditions and jointing of components in same plane and to transition from 1 component to another or similar component in same plane.
 - 3.3.4.13.2. Short length distortion ripples, edge distortions, "oil canning", "telegraphing of fasteners" and like will not be permitted. Make provisions to allow for differential thermal expansion between stiffeners, recessed slots and exposed metal of curtain wall system to take place without noise and without buckling of surface.
- 3.3.4.14. Dimensional tolerances of outer dimensions of panels: +/-0.8 mm in 1220 mm (+/-1/32" in 4' - 0") measured at any point.
- 3.3.5. Ensure devices for anchoring frame assemblies have sufficient adjustment to permit correct and accurate alignment. After alignment, positively secure anchorage devices to prevent movement other than those designed for expansion and contraction. Take into consideration climatic conditions prevailing at time of installation.
- 3.3.6. Ensure site located fixings are subject to Consultant's review. Perform welding and drilling of steel and drilling of concrete as required to install fixings. Repair concrete chipped by drilling or fixing operations.
- 3.3.7. Installed adjacent to each other, group components with shop applied finishes which relate most closely to 1 another, with regard to colour and appearance.
- 3.3.8. Coordinate work of this Section with and provide connection for compartmentalization of air spaces provided under other Sections. Cooperate and coordinate work of this Section with Section executing fire stopping and smoke seal work.
- 3.3.9. Provide thermal insulation and air/vapour barriers compatible and continuous with adjacent thermal and air/vapour barrier systems.
- 3.3.10. Ensure a uniform, continuous thermal and vapour barrier effect. Where adjacent insulation and vapour barriers are to be provided under other Sections, coordinate work such that thermal and vapour barrier continuity is achieved.
- 3.3.11. Locate vapour barrier on warm-in-winter side of insulation.
- 3.3.12. Isolate metal air/vapour barriers with thermal breaks and spacers.
- 3.3.13. Gun-apply a continuous bead of sealant to joints and air/vapour barrier junctions with adjacent construction. Liberally butter screw fastenings with sealant.
- 3.3.14. Supply and install flexible, continuous membrane and gasket air/vapour barrier seals between work of this Section and adjacent construction and at deflection and expansion connections, where required. Apply membrane to concrete and masonry with adhesive and retain with continuous aluminum or galvanized steel plates or bars and non-corrosive mechanical fasteners. Vulcanize or overlap joints to ensure a continuous seal.
- 3.3.15. Provide air tight seals at penetrations in air/vapour barriers.
- 3.3.16. Apply insulation to cold-in-winter side of air/vapour barriers.

- 3.3.17. Adhere stick clips for insulation to metal air/vapour barriers at 300 mm (12") oc both ways. As an alternative, gun weld apply pins to metal substrates in lieu of stick clips, provided clips do not easily break off and weld burn-through does not occur. Ensure other methods of retaining insulation tight to metal air/barrier are subject to Consultant's review and following instructions by insulation manufacturer.
- 3.3.18. Support adhesive-applied clips in place until adhesive has set.
- 3.3.19. Cut insulation as required and fit snugly to penetrations, obstructions, openings and corners. Butt insulation boards tightly. Cut out back of board insulation as required to accommodate substrate irregularities and build up over cut out areas on other side as required to ensure thermal barrier uniformity unless otherwise indicated or permitted.
- 3.3.20. Install insulation to thicknesses shown on Drawings.
- 3.3.21. Press insulation boards firmly and tightly to barrier or substrate impaling them on clips without bending clips. Butt insulation boards tightly at joints. Install retainers to clips.
- 3.3.22. Fill irregular shaped voids within assemblies with fibrous packing insulation to maintain continuity of thermal barrier.
- 3.3.23. Protect exterior finished surfaces by installing snap-on caps only when building is closed in and when possibility of damage due to construction has been minimized, to Consultant's review.
- 3.3.24. Supply and install flexible sheet waterproofing membrane at copings and parapets. Lap, adhere and seal joints in membrane in accordance with recommendations of membrane manufacturer to provide a watertight, continuous membrane.
- 3.3.25. Field Glazing:
 - 3.3.25.1. Clean rabbets, stops and glass edges of dust, dirt, moisture, oil and other foreign matter detrimental to glazing material adhesion. Ensure drainage holes are not blocked.
 - 3.3.25.2. Mask surfaces subject to staining and wherever necessary to ensure neat appearance of glazing bead. Remove masking as work progresses.
 - 3.3.25.3. Accurately size glass to fit openings allowing clearances following trade practices. Cut glass cleanly and carefully; nicks, damaged edge conditions will not be permitted. Replace glass which has nicked or otherwise damaged edges.
 - 3.3.25.4. Replace defective materials and materials damaged due to faulty installation, careless handling or other causes resulting from work of this Section.
 - 3.3.25.5. Remove glazing stops and replace in original locations, using original fasteners, securely set and accurately aligned.
 - 3.3.25.6. Use shims, spacers and setting blocks of proper size to support and hold glass in position independent of glazing tape and gaskets. Place 2 setting blocks under each unit at quarter points. Place spacers located directly opposite each other on both sides of glass, at maximum 610 mm (24") centres and maximum 300 mm (12") from corners and uniformly spaced. Arrange shims, spacers, setting blocks and shims so as to avoid blocking water transfer inside frames.
 - 3.3.25.7. Install preformed tapes to ensure complete contact on surface of glass, pressure plates and stops. Make joints only at corners of sash or frame. Fit tape accurately with tight joints, free from tension, without gaps and cracks.
 - 3.3.25.8. Install glazing gaskets in continuous lengths between corners, not stretched and seal joints at corners to prevent entry of water and air movement.
 - 3.3.25.9. Set glass properly centred with uniform bite and face and edge clearance, free from twist, warp or other distortion likely to develop stress. Ensure bite is minimum 19 mm (3/4").
 - 3.3.25.10. Handle and install glass in accordance with manufacturer's directions. Prevent nicks, abrasion and other damage likely to develop stress on edges.

- 3.3.25.11. Install glazing materials to obtain complete adhesion over full bite area of unit and to be free from gaps, air bubbles and embedded foreign matter. Use primer for elastomeric compounds. Use sufficient bedding compound so that when glass is pressed into place excess compound is forced well out around entire margin.
- 3.3.25.12. Ensure a weathertight and rattle-free seal for glass cushioning.
- 3.3.25.13. Ensure a continuous seal between glazed element and frame flush with sight line.
- 3.3.26. Field Structural Glazing:
 - 3.3.26.1. Perform structural glazing in accordance with details shown on Drawings, sealant manufacturer's printed instructions and review by Consultant.
 - 3.3.26.2. Ensure structural silicone sealant manufacturer tests and certifies compatibility of structural and weather sealants with adjacent materials, adhesion of sealant to chromate conversion finish suitable for structural glazing and other details in accordance with performance/design criteria specified herein.
 - 3.3.26.3. Temporarily clamp glass during cure of structural silicone. After sufficient cure, remove clamps and fill any gaps with silicone.
 - 3.3.26.4. Mask glass and aluminum during application of structural silicone. Remove masking immediately after tooling sealant.
 - 3.3.26.5. Do not apply structural silicone to edges of insulating glass units, or to edges of laminated glass units. Do not place sealants used as weather seals against edge of laminated glass interlayer. Protect laminated glass edges from silicone contact with plastic separation tape.
- 3.3.27. Louvres:
 - 3.3.27.1. Secure support frames to openings. Install louvres plumb or true to slope and at correct location in openings, with bird screens on inside. Use concealed method of attachment.
 - 3.3.27.2. Provide dielectric separator between dissimilar metals, where required.
 - 3.3.27.3. Ensure louvres are provided with shop cut-outs and flanges for duct connections. Coordinate locations of ductwork and ensure ducts are able to drain through louvres and to outside.
 - 3.3.27.4. At sides of louvred sections, return insulated blank-off panels (complete with framing) to outside wall and seal weather tight.
 - 3.3.27.5. Include removable sections in sandwich panel assembly, to provide access above and below spandrel beam to plenum between louvres.
 - 3.3.27.6. Provide thru-wall continuous flashing around louvres for waterproofing and drainage to exterior at the sill.
 - 3.3.27.7. Use carbon steel fasteners and aluminum clips to anchor louvres.
- 3.3.28. Sealants: Seal joints between frame assemblies and adjacent construction except where specified to be done under other Sections and within glazed assemblies where required to maintain weathertightness and integrity of air/vapour barrier. Seal junctions in sheet metal air/vapour barriers and between air/vapour barriers and adjacent construction. Conform to requirements of Section 07 92 00.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections:
 - 3.4.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
 - 3.4.1.2. Curtain Wall:
 - 3.4.1.2.1. Submit in accordance with Section 01 30 00.

- 3.4.1.2.2. Ensure an AAMA accredited independent laboratory conducts 1 field test of full scale section of curtain wall immediately after commencement of installation of curtain wall at designated location in accordance with requirements of AAMA 503 for following performance values of water resistance:
- 3.4.1.2.2.1. Conduct field water penetration tests at an uniform static are pressure difference of 580 Pa (12 psf) in accordance with ASTM E1105, procedure A.
- 3.4.1.2.3. Include cost of field testing described above in Contract Price.
- 3.4.1.2.4. If failure occurs, retest failed unit and test 1 additional unit to verify effectiveness of any remedial repairs.
- 3.4.1.2.5. Modify and alter test area as necessary to obtain required test results at no cost to Owner. Pay cost of re-testing including time and cost for Owner and Consultants to attend re-testing. Pay costs for modification and re-fabrication of rejected test units or portion thereof until tests are completed with no objections recorded.
- 3.4.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Clean work of this Section in accordance with "Cleaning Procedure" as recommended by Aluminum Company of Canada in publication D.I. 650, 1962 "Care During Construction" and as recommended by finish applicator.
- 3.5.2. Clean and polish glass in accordance with GANA 01-0300 including removal of markings indicating presence of glass.

3.6. PROTECTION

- 3.6.1. Protect finishes with strippable coating that will not mar, nor deface finish on removal, or a similar method designed to afford an equivalent amount of protection. Leave protected coating intact until damage risk is past or immediately prior to final cleaning.
- 3.6.2. In addition to foregoing, ensure finish surfaces are protected by adequate covering to ensure no detrimental effect on any and contaminants or other effects or elements.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide aluminum windows including but not limited to following:
 - 1.2.1.1. fixed and operable thermally broken aluminum windows.
 - 1.2.1.2. aluminum window framing.
 - 1.2.1.3. aluminum louvres within window framing.
 - 1.2.1.4. glass and factory glazing work of this Section.
 - 1.2.1.5. integral seals at perimeters.
 - 1.2.1.6. hardware for operating windows.
 - 1.2.1.7. aluminum sills and trims.
 - 1.2.1.8. aluminum sill flashings.
 - 1.2.1.9. aluminum closures and cover plates.
 - 1.2.1.10. back painting.
 - 1.2.1.11. joint sealants.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Preparing openings, building in treated wood blocking inserts and cooperating in installation of work of this Section: Section 04 20 00, Masonry Units and Section 06 10 00, Rough Carpentry.
 - 1.2.2.2. Sealant between aluminum framing and adjacent construction: Section 07 92 00, Joint Sealants.
 - 1.2.2.3. Provision of glazing types: Section 08 06 80, Glazing Schedule.
 - 1.2.2.4. Provision of curtain walls: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.5. Glass and glazing other than for work of this Section: Section 08 80 00, Glass and Glazing.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AAMA: American Architectural Manufacturers Association; www.fgiaonline.org.
 - 1.3.1.2. EPDM: Ethylene Propylene Diene Monomer.
 - 1.3.1.3. FGIA: Fenestration & Glazing Industry Alliance; www.fgiaonline.org.
 - 1.3.1.4. GANA: Glass Association of North America; www.glass.org.
 - 1.3.1.5. NFRC: National Fenestration Rating Council; www.nfrccommunity.org.
 - 1.3.1.6. OBC: Ontario Building Code.
 - 1.3.1.7. PVC: Polyvinyl Chloride.
 - 1.3.1.8. RH: Relative Humidity.
 - 1.3.1.9. STC: Sound Transmission Class.

- 1.3.2. Definitions:
- 1.3.2.1. Glass Terminology: Conform to ASTM C162 for glossary of terms and definitions of glazing terminology.
- 1.3.3. Reference Standards:
- 1.3.3.1. AAMA 502-12 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products
- 1.3.3.2. AAMA/WDMA/CSA 101/I.S.2/A440-22 - North American Fenestration Standard/Specification for windows, doors, and skylights
- 1.3.3.3. ASTM A653/A653M-23 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- 1.3.3.4. ASTM B117-19 - Standard Practice for Operating Salt Spray (Fog) Apparatus
- 1.3.3.5. ASTM B209/B209M-21 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- 1.3.3.6. ASTM B221M-21 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
- 1.3.3.7. ASTM B244-09(21) - Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
- 1.3.3.8. ASTM C162-05(15) - Standard Terminology of Glass and Glass Products
- 1.3.3.9. ASTM C165-23 - Standard Test Method for Measuring Compressive Properties of Thermal Insulations
- 1.3.3.10. ASTM C509-06(21) - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
- 1.3.3.11. ASTM C864-05(19) - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers
- 1.3.3.12. ASTM C920-18 - Standard Specification for Elastomeric Joint Sealants
- 1.3.3.13. ASTM C1048-18 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
- 1.3.3.14. ASTM D523-14(18) - Standard Test Method for Specular Gloss
- 1.3.3.15. ASTM D714-02(17) - Standard Test Method for Elevating Degree of Blistering of Paints
- 1.3.3.16. ASTM D968-22 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
- 1.3.3.17. ASTM D2244-23 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
- 1.3.3.18. ASTM D2247-15(20)e1 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
- 1.3.3.19. ASTM D3363-22 - Standard Test Method for Film Hardness by Pencil Test
- 1.3.3.20. ASTM D4214-23 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

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| 1.3.3.21. | ASTM E90-09(16) | - Standard Test Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements |
| 1.3.3.22. | ASTM E283/E283M-19 | - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |
| 1.3.3.23. | ASTM E413-22 | - Classification for Rating Sound Insulation |
| 1.3.3.24. | ASTM E547-00(16) | - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Cyclic Static Air Pressure Difference |
| 1.3.3.25. | ASTM F588-17 | - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact |
| 1.3.3.26. | CAN/CGSB-12.1-17 | - Safety glazing |
| 1.3.3.27. | CAN/CGSB-12.20-M89 | - Structural Design of Glass for Buildings |
| 1.3.3.28. | CAN/CGSB-79.1-M91 | - Insect Screens |
| 1.3.3.29. | CSA A440.4-07(12) | - Window, Door, and Skylight Installation |
| 1.3.3.30. | CSA G40.21-13(23) | - Structural quality steels |
| 1.3.3.31. | CSA S157-17(22) | - Strength design in aluminum |
| 1.3.3.32. | NFRC 501-2023 | - User Guide to the Procedure for Determining Fenestration Product Condensation Index Rating |
| 1.3.3.33. | CAN/ULC-S702.1-21 | - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week before commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings:
- 1.5.1.1. Submit Shop Drawings of aluminum windows, components and accessories in accordance with Section 01 30 00.
- 1.5.1.2. Indicate head, jamb and sill, profiles of components, (interior and exterior trim), junction between combination units, elevations of unit and description of related components. Indicate relation to adjoining work and location, construction and back-up, joint sealant, location of isolation coating, interior structure and/or details of reinforcements, glazing modules, head and frame details, mullions, extrusion sections (in 1/2 size, if not of the manufacture specified and drawn), glazing and glass stop details, thermal break sections and vinyl or neoprene mouldings (in 1/2 size), details of connections, anchorage, interfacing with adjacent work and assembly fixings. Clearly indicate materials used for every component on Shop Drawings. Clearly indicate drainage path including location of weeps.

- 1.5.1.3. Clearly indicate how thermal expansion and contraction are to be accommodated and to what degree. Show connections to adjacent construction and provision made for structural deflections, contractions, expansion and other normal movement.
- 1.5.1.4. Submit Shop Drawings showing where anchors and shims are placed, type of anchors, shim thicknesses, widths, number of fasteners and edge clearances for fasteners. Ensure Shop Drawings indicate allowance for deflection of structure at head of window.
- 1.5.1.5. Ensure a licensed engineer specified herein is responsible for:
 - 1.5.1.5.1. production and review of Shop Drawings.
 - 1.5.1.5.2. sealing and signing each Shop Drawing and any associated calculations performed.
 - 1.5.1.5.3. Submit a signed letter from manufacturer of system being provided on manufacturer's letterhead. Ensure letter states Project name and lists Products incorporated in the Project. Include Product names, types and series numbers applicable. Include manufacturer's contact person and their contact information.
- 1.5.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in the sizes indicated:
 - 1.5.2.1. Supply 1 - 450 mm x 450 mm (18" x18") sized operating sample of each window type to Consultant for review of general appearance and quality of work within 30 Days after Contract award. Reclaim reviewed sample after review with no objections recorded is obtained and incorporate in the Work. Ensure remainder of work equals or exceeds standard of reviewed sample.
 - 1.5.2.2. Submit sample sections of component parts of windows including frame, sash, sill, glazing and waterproofing method, insect screens, surface and finish hardware and glass finished in specified colours. Provide 300 mm (12") long samples of extruded shapes and other linear type components and 300 mm (12") square samples of each type of glass and other sheet type components.
- 1.5.3. Test Reports:
 - 1.5.3.1. Submit report from an independent testing laboratory, indicating aluminum windows meet or exceed performance requirements of AAMA/WDMA/CSA 101/I.S.2/A440 with respect to air tightness, load resistance, water tightness, ease of operation, load tests on screens, forced entry resistance and mullion deflection (for combined and composite windows).
 - 1.5.3.2. Submit a report from an independent testing laboratory, verifying metal construction and insulating glass units used meet design requirements specified.
 - 1.5.3.3. Ensure aluminum windows complying with applicable requirements of AAMA/WDMA/CSA 101/I.S.2/A440 bear permanent marking of manufacturer's identity on each window, visibly located after installation of window. Window classification label showing air tightness, water tightness and load resistance. Label need not be permanent.
- 1.6. CLOSEOUT SUBMITTALS**
 - 1.6.1. Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00. Provide a demonstration with window manufacturer for building maintenance staff dealing with operation of windows, insert, removal, re-glazing, cleaning and general maintenance.
- 1.7. QUALITY ASSURANCE**
 - 1.7.1. Qualifications:
 - 1.7.1.1. Designers, Fabricators and Installers for Work of this Section: Minimum of 10 years' experience in application of Products, systems and assemblies specified. Ensure installer is acceptable to aluminum window manufacturer for installation of units required for this Project.
 - 1.7.1.2. An independent testing agency, acceptable to authorities having jurisdiction, with experience and capability to conduct testing indicated.

- 1.7.1.3. Insulating Glass Unit Fabricators: Ensure insulating glass unit fabricators have membership and certification in the FGIA. Ensure FGIA members participate in the certification program and successfully pass a Compliance Audit within the last 6 months.
- 1.7.1.4. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.7.1.5. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
- 1.7.2. Mock-Ups:
 - 1.7.2.1. Conform to requirements of Section 01 40 00. Submit transportable mock-ups in accordance with following requirements:
 - 1.7.2.1.1. Build mock-up in building envelope wall in locations indicated on Drawings:
 - 1.7.2.1.1.1. minimum size: 450 mm x 450 mm (18" x 18").
 - 1.7.2.1.1.2. maximum size: 600 mm x 600 mm (24" x 24").
 - 1.7.2.1.1.3. include glazing and demonstrate airseal and anchorage systems.
 - 1.7.2.2. Construct 1 typical mock-up of aluminum windows in location as directed by Consultant for Consultant's review. Demonstrate installation procedures, finished look and quality of workmanship including but not limited to; framing members, glazing units, anchorage, operational units and transition to adjoining assemblies and material. Once reviewed with no objections recorded, sample may remain part of finished work and used as a quality reference standard for balance of Project. Remove and dispose of mock-ups which do not form part of final work.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Transport materials to site storage in a manner to prevent in-transit damage. These measures include, but are not limited to, crating, polyethylene wrapping system, etc.
- 1.8.2. Storage and Handling Requirements:
 - 1.8.2.1. Store in a dry, protected area on site, in original undamaged containers with manufacturer's labels and seals intact.
 - 1.8.2.2. Brace frames to maintain squareness and rigidity during shipment and installation.
 - 1.8.2.3. Provide glass units with interlayer protection between lites. Keep glass and interleaving dry and store cases in clean, cool, dry areas with temperatures above dewpoint. Circulation of cool, dry air in storage areas is essential. Open cases and inspect units periodically for moisture accumulation. Do not store glass in direct sunlight without an opaque protective covering over same.
 - 1.8.2.4. Remove damaged or unsatisfactory materials from site and replace with new materials to satisfaction of Consultant at no cost to Owner.
 - 1.8.2.5. Provide at factory, strippable coatings on exposed surfaces of aluminum. Ensure coating and protective wrappings remain on surfaces through period other trades' works proceed on building and remove by this trade on completion of building.
 - 1.8.2.6. Comply with unpacking procedures as recommended by framing and glass manufacturers.

1.9. WARRANTY

1.9.1. Manufacturer Warranty:

- 1.9.1.1. Warrant work of this Section for a period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Include cost of warranties in Contract Price. Promptly correct any defects or deficiencies that become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner at Owner's convenience. Repair leaks into building within 48 hours of notification. Defects include but are not limited to; loosening of glazing and anchorage, water penetration beyond air/vapour seal, air tightness, condensation, deformation of members, failure of insulated glass units, glass breakage, fading, discolouration of finish, failure of glazing, joint sealant against staining, adhesion and cohesion and interstitial condensation, argon gas leakage or spacer delamination of insulating glass units.
- 1.9.1.2. Warrant factory sealed insulating units against defects for a period of 10 years. Warrant factory sealed insulating units free from condensation, fogging of material, obstruction of vision as result of dust or film formation on internal glass surfaces by any cause, under normal conditions anticipated under this Project, other extrinsic glass breakage, but including breakage due to thermal shock and temperature differential due to inherent glass or glazing fault.
- 1.9.1.3. Provide sealant manufacturer's 10 year materials warranty and limited labour warranty, including statement that sealants used in the Work will not cause porous substrates to become discoloured or change its appearance due to fluid migration.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Substitution Limitations: No further substitutions will be permitted.
- 2.1.2. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.2.1. "148 Punch Window System (fixed), 78 Push Out [Awing] [Casement] (operable)" by Alsta Architectural Systems; www.alstasystems.com
- 2.1.2.2. "RainBlade 1900 (fixed), Univent 1375AW (operable)" by Alumicor Limited; www.alumicor.com
- 2.1.2.3. "AWD 4500 Series" by Aluminum Window Designs; www.aluminumwindowdesigns.com
- 2.1.2.4. "Series 425, 525, 625 (Fixed), Series 225 (Operable)" by Commdoor Aluminum; www.commdooraluminum.com
- 2.1.2.5. "AA® 6000 (fixed and operable)" by Kawneer Co. Canada, Ltd.; www.kawneer.com
- 2.1.2.6. "Series 127 (fixed and operable)" by NORSTAR Window; www.norstarwindows.com
- 2.1.2.7. "1200 Arctic (fixed), 3250 Signature Series (operable)" by Oldcastle Building Envelope; www.obe.com
- 2.1.2.8. "Schüco Window System AWS 75.SI+" by Schüco; www.schueco.com
- 2.1.3. Substitution Limitations: No further substitutions will be permitted.

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

- 2.2.1.1. Aluminum window design is established in details on Drawings and performance requirements in Specifications. Design requirements are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines, to one another and to adjoining construction. Performance characteristics and design criteria specified are subject to verification by 1 or more methods including preconstruction testing, field testing and in-service performance. Do not modify intended architectural design effects without Consultant's direction. If modifications are proposed, submit comprehensive explanatory data to Consultant for review.

- 2.2.1.2. Comply with requirements of OBC and regulations of authorities having jurisdiction, which shall be minimum, except where more stringent requirements are specified herein.
- 2.2.1.3. Design glazing systems and framing to prevent thermal shock and pressure fracture damage to glass. Design glass and glazing to meet CAN/CGSB-12.20-M. Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.
- 2.2.1.4. Design aluminum work as shown to provide free and noiseless movement of components of assembly without buckling of any component and/or transmitting of stresses to any members.
- 2.2.1.5. Design aluminum window system to accommodate and interface with work of other Sections as applicable.
- 2.2.1.6. Ensure metal faces of panels, flashings, caps, bases and soffits are visually flat under all lighting conditions. Ensure finish on aluminum is uniform and consistent within each component and from component to component.
- 2.2.1.7. Ensure glazing gaskets and sealants on inside of glass units are conductive type and installed in a manner to ensure interior building heat is conducted through metal framing, mullions and sills, through gaskets and sealants to glass edge while maintaining air seal. Ensure no voids occur between glass edges, gaskets and sealants. Use non-conductive glazing gaskets and sealants on building exterior side of glass units.
- 2.2.1.8. Locate sealants, gaskets, air/vapour seals, thermal separations, drainage slots and holes as shown or specified in this Section, as required to obtain design requirements. Ensure components and assemblies exterior to air barrier drain to building exterior.
- 2.2.1.9. Design, assemble and secure Work in a manner that will keep any stresses on sealants within sealant manufacturer's recommended working range within factors of safety specified.
- 2.2.1.10. Accurately shape members at intersecting joints to obtain hairline joints, just wide enough to permit thermal expansion and contraction.
- 2.2.1.11. Conceal securement devices unless otherwise specified.
- 2.2.1.12. Design attachments that will permit replacement of individual units during construction or in subsequent usage of building without dismantling or disturbance to adjoining components or units. In addition, accomplish such replacement without use of extra fasteners, splices, covers and like that alter original design features.
- 2.2.1.13. Provide accessories, closures and trims required and necessary to complete work.
- 2.2.1.14. Performance Requirements:
 - 2.2.1.14.1. Ensure windows meet following AAMA/WDMA/CSA 101/I.S.2/A440 window classification ratings provided, however, ensure thickness of extruded aluminum components are not less than 1.6 mm (0.062").
 - 2.2.1.14.2. Performance Class: HC.
 - 2.2.1.14.3. Condensation Index: Provide a Condensation Index rating of 60 based on Table 7-1 of NFRC 501 using a RH of 50% and a Winter Design Temperature of -20 deg C (-4 deg F) for Toronto.
 - 2.2.1.14.4. Air Tightness: Window rating for "A3 level" is 0.5 l/s/m² (0.1 cfm/sq ft) max and for "fixed level" is 0.2 l/s/m² (0.04 cfm/sq ft) max when tested at 300 Pa (6.24 psf) in accordance with ASTM E283/E283M.
 - 2.2.1.14.5. Water Tightness: Zero leakage at 400 Pa (test pressure differential) when tested in accordance with ASTM E547.
 - 2.2.1.14.6. Load Resistance: Deflection at sash, not more than L/125 when tested at 1200 Pa (test pressure) and deflection of mullions, not more than L/175 when tested at 2000 Pa (test pressure).

- 2.2.1.14.7. Resistance to Forced Entry: Comply with F20 for Ground Floor units with access from terrace levels and F10 requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440 when tested according to ASTM F588 for other units.
- 2.2.1.14.8. Provide aluminum windows, including anchorage that accommodates thermal movements of units resulting from temperature change range of 67 deg C (120 deg F), ambient 100 deg C (180 deg F) material surfaces without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections and other detrimental effects. Base engineering calculations on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.
- 2.2.1.14.9. Provide aluminum windows rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.
- 2.2.1.14.10. Design of components not complying with above requirements will not be reviewed.
- 2.2.1.14.11. Overall Effective Thermal Performance:
 - 2.2.1.14.11.1. Double Glazed Option:
 - 2.2.1.14.11.1.1. Fixed Window: Provide a total window system thermal resistance (Total Fenestration Product U-Factor) of not more than 1.75 W/(m²•°K) (0.31 Btu/(ft²•h•°F) winter nighttime, this value is an effective performance taking into effect frame, edge, seal and glass resistance per NFRC requirements.
 - 2.2.1.14.11.1.2. Casement - Single Window: Provide a total window system thermal resistance (Total Fenestration Product U-Factor) of not more than 2.28 W/(m²•°K) (0.40 Btu/(ft²•h•°F) winter nighttime, this value is an effective performance taking into effect frame, edge, seal and glass resistance per NFRC requirements.
 - 2.2.1.14.11.1.3. Awning or Hopper - Single Window: Provide a total window system thermal resistance (Total Fenestration Product U-Factor) of not more than 2.28 W/(m²•°K) (0.40 Btu/(ft²•h•°F) winter nighttime, this value is an effective performance taking into effect frame, edge, seal and glass resistance per NFRC requirements.
- 2.2.1.14.12. Design of components not complying with above requirement will not be reviewed.
- 2.2.1.15. Design Calculations:
 - 2.2.1.15.1. Be responsible for the design of components and accessories thereof and connections in accordance with the OBC.
 - 2.2.1.15.2. Make thorough examination of Drawings and details, check interfacing with work of other Contracts and other factors influencing engineering design and performance of the Work and be fully cognizant of requirements.
 - 2.2.1.15.3. Design to withstand without failure the positive and negative forces imposed by wind, earthquake, temperature and shrinkage stress, deflections of supporting or adjacent structures, within deflection limitations governed by design of supporting structure. Calculate external pressure of suction due to wind on part or the entire surface of the units in accordance with the OBC.
- 2.2.1.16. Structural Design: Employ a licensed engineer specified herein to:
 - 2.2.1.16.1. design components for work of this Section requiring structural performance.
 - 2.2.1.16.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.2.2. Aluminum Sections: ASTM B221M, sized accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T5 for aluminum except surfaces receiving anodizing which shall be AA-6061-T6. Ensure surfaces are free from defects impairing appearance, strength and durability.

- 2.2.3. Aluminum Sheet: ASTM B209/B209M, minimum thickness of 3 mm (1/8"), type and characteristics to match finished extrusions; sheet which is not exposed shall be AA-3003-14 mill finished.
- 2.2.4. Screws, Bolts and Fasteners: Exposed stainless steel, Type 304 or Type 300 or hardened aluminum. At interior locations, cadmium plated Series 400 stainless steel are not permitted.
- 2.2.5. Anchors, Clips and Accessories: Exposed stainless steel, Series Type 304 or Type 300 or hardened aluminum. At interior locations, cadmium plated Series 400 stainless steel are not permitted. Provide suitable strength to withstand design pressure required.
- 2.2.6. Light Gauge Sheet Metal: Commercial quality galvanized sheet steel to ASTM A653/A653M, Designation Z275 (G90) unless otherwise specified.
- 2.2.7. Miscellaneous and Sub-Frame Steel: CSA G40.21, Grade 300W, hot dipped galvanized after fabrication, with additional zinc chromate coating after fabrication. Ensure steel reinforcements and anchors conform to Section 05 50 00 requirements.
- 2.2.8. Shims: Aluminum sheet, EPDM, rubber, nylon or other material recommended by window manufacturer.
- 2.2.9. Stools, Sills and Cover Plates: Extruded aluminum and sheet stock minimum 1.6 mm (1/16") nominal thickness formed or brake shaped to profiles shown on Drawings.
- 2.2.10. Operable Windows:
 - 2.2.10.1. Window Hardware:
 - 2.2.10.1.1. Manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide nonmagnetic stainless steel.
 - 2.2.10.1.2. Provide concealed window opening control device to limit permitted opening of 100 mm (4") when device is engaged in accordance with OBC requirements.
 - 2.2.11. Removable Screen for Operating Units:
 - 2.2.11.1. Design windows and hardware to accommodate screens in tight fitting, removable arrangement from interior, assembly to resist 330 N force. Attach screen to framing with prefinished Allen head fastener or other permitted method with minimum of exposed fasteners and latches.
 - 2.2.11.2. Aluminum coated wire fabric or glass fibre fabric mesh of PVC coated woven into 14 x 18 or 16 x 18 mesh screen cloth, CAN/CGSB-79.1-M in prefinished extruded aluminum frame.
- 2.2.12. Insulation for Application to Sheet Metal and Steel Air/Vapour Barriers: Fibrous glass or stone wool rigid or semi-rigid board insulation, "Fiberglas® 703" by Owens Corning or "ROCKWOOL™ CURTAINROCK®" by ROCKWOOL™ International A/S. Ensure insulation has a thermal resistance value of not less than RSI=0.704 per 25 mm (R=4 per inch) thickness at a mean temperature of 24 deg C (75 deg F) and a minimum nominal density of 48 kg/m³ (3 pcf). Ensure deformation of fibrous glass rigid board does not exceed 10% when tested at 1.2 kPa (25 psf) in accordance with CAN/ULC-S702.1 and ASTM C165. Thickness as indicated.
- 2.2.13. Backer Rod: Preformed, compressible, resilient, non-waxing, non-extruding, non-staining strips of closed cell polyethylene or urethane foam, compatible with joint substrates and are approved by sealant manufacturer based on field experience and laboratory test. Sizes and shapes to suit various conditions, diameter 25% greater than joint width. Ensure backer rod is compatible with sealant, primer and substrate.
- 2.2.14. Glass Materials:
 - 2.2.14.1. Glass thicknesses given in this Section are minima.

- 2.2.14.2. Ensure glass (particularly heat-strengthened, tempered and laminated) bears manufacturer's labels on bottom inner right hand corner indicating quality.
- 2.2.14.3. Ensure glass coatings do not have pinholes greater than 1.6 mm (1/16") in diameter, nor have pinholes clustered together. Ensure scratches on coatings only occur within 75 mm (3") of glass edge and does not exceed 75 mm (3") in length.
- 2.2.14.4. Tempered Glass (TGL): Clear transparent and/or low iron tempered glass conforming to ASTM C1048, Kind FT and meeting requirements of CAN/CGSB-12.1. Ensure surface compression is equal to or greater than 68.9 MPa (10 000 psi).
- 2.2.14.5. Heat-Strengthened Glass (HSGL): Clear transparent and/or low iron heat-strengthened glass conforming to ASTM C1048, Kind HS. Perform heat-strengthening using horizontal tong free method and ensure surface compression is between 27.6 MPa (4000 psi) and 48.3 MPa (7000 psi).
- 2.2.15. Factory Sealed Insulating Vision Glass Units (GL): For factory sealed insulating vision glass unit types, refer to Section 08 06 80.
- 2.2.16. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing and completely concealed when aluminum window is closed. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C509. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C864.
- 2.2.17. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Provide weather stripping with integral barrier fin or fins of semi rigid, polypropylene sheet or polypropylene-coated material.
- 2.2.18. Internal Frame Sealant: Non-sag type, either 1 or 2 component ultra low-modulus, pre-pigmented, neutral cure elastomeric silicone sealant conforming to ASTM C920, Type S or M, Grade NS, Class 50, Use NT, G, M, A and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.18.1. "DOWSIL™ 983 Structural Glazing Sealant" by The Dow Chemical Company.
 - 2.2.18.2. "GE UltraGlaze SSG4400" by Momentive Performance Materials.
- 2.2.19. Dielectric Separator: Provide best grade, quick drying, non-staining, acid and alkali resistant bituminous paint or epoxy resin solution or membrane type to provide dielectric separation and which will dry to be tack-free and able to withstand high temperatures.
- 2.2.20. Flexible Membrane and Air Seal: 1 mm (40 mils) thick EPDM, or Neoprene.
- 2.2.21. Metal Air Seal: 0.912 mm (20 ga), Z275 galvanized sheet steel conforming to ASTM A653/A653M.
- 2.2.22. Thermal Break Material: Foamed polyvinyl chloride, of semi-rigid durometer hardness of 80, +/- 5, located on external side of glass pane.
- 2.2.23. Weathering and Glazing Gaskets: Extruded, black, closed cell or dense elastomer of durometer hardness to suit their intended function.
- 2.2.24. Preshim Glazing Tape: Preformed, ribbon-shaped, non-skinning, 100% solids, non-oxidizing polyisobutylene: butyl, paper release, EPDM Shim with continuous synthetic rubber spacer rod of 60 Durometer hardness. Permitted Products: "Polyshim II Tape" by Tremco Canada, or "PTI-606" by Protective Treatments Inc. Ensure tape is sufficiently wide and thick to completely cover bite area of glazing unit when unit is pushed into place. Test to ensure compatibility with edge-seal.
- 2.2.25. Exterior Glazing System: EPDM rubber interior and exterior gaskets, "VISIONstrip®", manufactured by Tremco Canada.
- 2.2.26. Compressible Filler: Supply "Unifoam R1009" by Goodco Limited.
- 2.2.27. Temporary Strips and Safety Markings: Supply 25 mm (1") wide, light reflecting, easily removable, pressure sensitive tape applied over glass lites in windows. Ensure windows have corner to corner cross stripes from aluminum frames.

- 2.2.28. Fabrication:
- 2.2.28.1. Aluminum frame design sections are based on fixed insulated thermally broken window framing system complete with rain screen capability, vented and drained glazed cavity, minimum 1.6 mm (1/16") thickness and sill extrusion shall be 1.95 mm (5/64") nominal thickness. Ensure Products of other permitted manufacturers provide minimum extrusion thicknesses and that overall dimensions do not vary design requirements.
- 2.2.28.2. Do not fabricate aluminum windows until laboratory test reports demonstrate compliance with requirements of Contract Documents. Where independent laboratory test reports do not demonstrate compliance with Contract Documents, include cost of necessary testing in Contract Price.
- 2.2.28.3. Provide integral window components such as glazing perimeter airseal, frame perimeter air seal, metal clip anchors, sills and closures.
- 2.2.28.4. Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements and manufacturer's written instructions.
- 2.2.28.5. Fabricate units square and true to detail with maximum tolerance of +/-1.6 mm (1/16") for units with diagonal measurement of 1800 mm (6' - 0") or less than 3 mm (1/8") for units with diagonal measurement over 1800 mm (6' - 0"), free from defects impairing appearance, strength and durability. Overall assembled profiles are detailed on Drawings.
- 2.2.28.6. Fabricate frames with continuous thermal breaks located on exterior side of glazing as detailed on Drawings and must be held by [snap-in] [rolled-in] methods without use of metallic fasteners which could reduce the effectiveness of thermal barrier. Fill frame extrusion on warm side of thermal break with rigid insulation.
- 2.2.28.7. Ensure mullions are tubular extruded shapes with sharp, well defined corners. Design mullions and framing members to accommodate insulating glass units.
- 2.2.28.8. Make provision at sealed horizontal members to lead moisture accumulation to exterior.
- 2.2.28.9. Provide internal drainage weep holes and channels to migrate moisture to exterior. Also provide internal drainage of glazing spaces to exterior through weep holes.
- 2.2.28.10. Provide aluminum backdam angle to accommodate shimming and flashing membrane. Fabricate aluminum angle in accordance with reviewed Shop Drawings, size and thickness as required suit wind loading requirements.
- 2.2.28.11. Shop assemble extruded or formed continuous sills, stools and flashings to profile to meet design requirements complete with intermediate clips, anchorages and reinforcing. Supply filler and closure pieces as required. Fill corners and other open areas within construction with loose or low expanding foam insulation. Ensure aluminum sill profile suits wall conditions, complete with drip deflectors at ends and at abutting vertical surfaces. Fit open end of sills with neatly applied closure plates.
- 2.2.28.12. Make provision in the work for vertical and horizontal expansion and contraction and structural deflections.
- 2.2.28.13. Butt and cope and closely fit corners of formed work. Fabricate framing joints accurately machined, assembled and sealed to provide tight, neat weathertight joints. Apply back-up sealants designed for this purpose on the inside of joints in aluminum work by this trade. Provide drainage towards exterior at bottom of glazing rebates.
- 2.2.28.14. Attach anchorages to warm side.
- 2.2.28.15. Carry out welding with argon shielded electric arcs to ensure complete fusion of the metal.
- 2.2.28.16. Fabricate louvres at windows, chevron style, extruded aluminum construction, complete with prefinished insulated blank-off panels.
- 2.2.28.17. Manufacture factory sealed insulating glass units in accordance with FGIA's "IGMAC Certification Program Manual".

2.2.29. Finishes: Provide 1 of following systems:

2.2.29.1. Exterior Superior Performance Coating Finish Process: (3 Coat Wet System (primer/colour coat/clear coat)) including thermal setting application of 70% fluoropolymer resin minimum, PVDF with added colour pigment finish exceeding or meeting AAMA 2605 requirements. Ensure fluoropolymer baked resins form a continuous physically locked finish during manufacturing process. Apply fluoropolymer finish after multistage chemical treatment cleaning providing corrosion resistance surface ready to receive primer. During baking process apply primer in accordance with manufacturer's recommendations followed by a flash process whereby evaporating solvent and then fluoropolymer finish sprayed on to aluminum; apply another flash procedure and then bake for approximately 10 minutes when aluminum surface reaches a temperature of 232 deg C (450 deg F). Permitted Product: "Duranar XL" by PPG Industries; www.ppgideascape.com or "Fluoropon® Classic" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

| | Description | Performance Characteristics |
|--------------|--|--|
| 2.2.29.1.1. | Coating Thickness: | 0.0063 mm +/-0.0013 mm (0.25 +/-0.05 mils) primer 0.025 mm (1.0 mil) min barrier coat (if applicable) 0.025 mm (1.0 mil) min colour coat 0.015 mm +/-0.0005 mm (0.6 +/-0.02 mil) clear top coat |
| 2.2.29.1.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.29.1.3. | Gloss (ASTM D523 @ 60°): | Medium gloss |
| 2.2.29.1.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.2.29.1.5. | Abrasion Resistance Falling Sand (ASTM D968): | 50 t/ml |
| 2.2.29.1.6. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.29.1.7. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.29.1.8. | Colour Retention 10 yrs, 45° South Florida (ASTM D2244): | ΔE <5.0 |
| 2.2.29.1.9. | Humidity Resistance: ASTM D714, ASTM D2247, 4000 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.2.29.1.10. | Salt Spray Resistance: ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.2.29.1.11. | Chalking Resistance 10 yrs, 45° South Florida (ASTM D4214): | No more than #8 (#6 for Whites) |
| 2.2.29.1.12. | Erosion Resistance: 10 yrs, 45° South Florida (ASTM B244): | Maximum 5% |

2.2.29.2. Exterior Superior Performance Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2605 with minimum 100% fluoropolymer resin. Permitted Product: "Interpon D3000 Fluoromax Powder Coating" by Akzo Nobel Coatings, Inc.; www.akzonobel.com with following characteristics:

Description

Performance Characteristics

| | | |
|-------------|---|---|
| 2.2.29.2.1. | Coating Thickness: | 0.060 mm to 0.115 mm (2.4 mils to 4.5 mils) with no reading less than 0.045 mm (1.8 mils) |
| 2.2.29.2.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.29.2.3. | Gloss (ASTM D523 @ 60°): | 20% - 40% |
| 2.2.29.2.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.2.29.2.5. | Abrasion Resistance Falling Sand (ASTM D968): | 40 t/ml |
| 2.2.29.2.6. | Colour Retention 10 yrs, 45° South Florida (ASTM D2244): | ΔE <5.0 |
| 2.2.29.2.7. | Humidity Resistance ASTM D714, ASTM D2247, 4000 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.2.29.2.8. | Salt Spray Resistance ASTM B117, 4000 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |

2.2.29.3. Interior Pigmented Organic Thermal Setting Finish Process: (1 Coat Wet System) meeting or exceeding AAMA 2603. Permitted Product: "Duracron" by PPG Industries; www.ppgideascape.com or "Acryliccoat™" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

Description

Performance Characteristics

| | | |
|-------------|---|---|
| 2.2.29.3.1. | Colours Available: | White, Black and full range of colours including metallics and pearlescents |
| 2.2.29.3.2. | Dry Film Thickness: | 0.025 mm +/-0.005 mm (1.0 mil +/-0.2 mils) - 0.02 mm (0.8 mil) minimum |
| 2.2.29.3.3. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.29.3.4. | Gloss (ASTM D523 @ 60°): | Colours: Low, medium and high gloss Polychromatics: Low and medium gloss |
| 2.2.29.3.5. | Pencil Hardness (ASTM D3363): | H minimum |
| 2.2.29.3.6. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.29.3.7. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.29.3.8. | Detergent Resistance (3%) immersion @ 100°F: | 72 hours - no attack |
| 2.2.29.3.9. | Humidity Resistance ASTM D714, ASTM D2247, 1500 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |

- 2.2.29.3.10. Salt Spray Resistance
ASTM B117, 1500 hrs
5% NaCl @ 100°F: 1/16" maximum undercutting
- 2.2.29.3.11. Exterior Exposure
1 yr @ 45° South Florida: No loss of adhesion, maximum 8 fade and maximum 6 chalk
- 2.2.29.4. Interior Pigmented Thermal Setting Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2603. Permitted Product: "Interpon D1010 Powder Coating" by Akzo Nobel Coatings, Inc.; www.akzonobel.com with following characteristics:
- | Description | Performance Characteristics |
|---|---|
| 2.2.29.4.1. Coating Thickness: | 0.051 mm to 0.080 mm (2.0 mils to 3.2 mils) |
| 2.2.29.4.2. Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.2.29.4.3. Gloss (ASTM D523 @ 60°): | 10% - 90% |
| 2.2.29.4.4. Pencil Hardness (ASTM D3363): | H minimum |
| 2.2.29.4.5. Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.2.29.4.6. Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |
| 2.2.29.4.7. Detergent Resistance (3%) immersion @ 100°F: | 72 hours - no attack |
| 2.2.29.4.8. Humidity Resistance ASTM D714, ASTM D2247, 1500 hrs, 100% R.H. @ 100°F: | Few #8 blisters maximum |
| 2.2.29.4.9. Salt Spray Resistance ASTM B117, 1500 hrs 5% NaCl @ 100°F: | 1/16" maximum undercutting |
| 2.2.29.4.10. Exterior Exposure 1 yr @ 45° South Florida: | No loss of adhesion, maximum 8 fade and maximum 6 chalk |
- 2.2.29.5. Colours and Sheens: To be selected by Consultant. Include for texture and specialty finishes.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Set window framing in its correct location, level, square and plumb and at proper elevations, with nominal face of framing aligned in a single vertical plane. Fasten and anchor framing in place in accordance with CSA A440.4. Install in accordance with reviewed Shop Drawings.
- 3.2.2. Anchor component parts securely in place as shown, by bolting, welding or other permanent mechanical attachment system, which will comply with performance requirements and permit movement as intended or necessary. Install slip-joint linings where required to ensure movement as per design.

- 3.2.3. Apply a bituminous coating of approximately 0.76 mm (30 mil) dry film thickness, or other suitable permanent separator on concealed contact surfaces of dissimilar materials, before assembly or installation where there is possibility of corrosive or electrolytic action (i.e. aluminum to concrete, mortar, plaster or steel).
- 3.2.4. Erection Tolerances:
 - 3.2.4.1. Limit variations from plumb, level or dimensioned angle to the following:
 - 3.2.4.1.1. 3 mm (1/8") maximum deviation in storey height, or in 3 m (10') vertical run, or in 6 m (20') horizontal run.
 - 3.2.4.1.2. 6 mm (1/4") maximum deviation in 12 m (40') in any direction.
 - 3.2.4.2. Limit variations from location (theoretical calculated positions in plan or elevation based on established floor lines and column lines), including variations from plumb and level, to following:
 - 3.2.4.2.1. 9 mm (3/8") total maximum deviation for member at any location.
 - 3.2.4.2.2. 3 mm (1/8") maximum change in deviation for member for 3 m (10') run, any direction.
 - 3.2.4.3. Limit offsets in end-to-end and edge-to-edge alignment of adjoining and consecutive members, which form planes, continuous runs and profiles to 1.6 mm (1/16") maximum offset in flush alignment, including those which are to be 13 mm (1/2") or less out-of-flush, and including those which are separated 50 mm (2") or less by a reveal or protrusion in plane or wall.
- 3.2.5. Glazing:
 - 3.2.5.1. Use glazing and bedding compounds of type compatible with secondary sealant in insulating glass unit.
 - 3.2.5.2. Thoroughly wipe surfaces receiving glazing materials with a cloth dampened in xylol to assure a clean surface.
 - 3.2.5.3. Windows to be inside glazed using exterior butyl tape with integral spacer. Provide heal bead at bottom of interior edge of sealed units and up the lower 75 mm (3") of each vertical to provide a vented glazing cavity. Provide punched louvres or holes through exterior glazing flange for venting and drainage. Snap-in glazing stop to be complete with elastomeric roll-in wedge to hold glass tight and separate glass from aluminum frame.
- 3.2.6. Sealant: At interior and exterior joints between aluminum framing and adjacent work of others:
 - 3.2.6.1. Install backer rod over compressible filler material or perimeter blocking to provide sealant joints of proper form, thickness to width ratios and to provide bond break at backside of sealant. Where backer rod cannot be used or is not shown provide bond breaker tape to back side of sealant joint substrate.
 - 3.2.6.2. Clean substrate surfaces to which sealant is to bond and apply sealant primers as recommended by sealant manufacturer.
 - 3.2.6.3. Caulk joints continuous to produce weatherproof and aesthetically pleasing joint installation.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Tests and Inspections:
 - 3.3.1.1. Submit field test results for following components in accordance with AAMA 502.
 - 3.3.1.2. Submit test results from an independent testing organization accredited by the Standards Council of Canada.
 - 3.3.1.3. Arrange for testing of following typical assemblies forming part of the Work as directed by Consultant:
 - 3.3.1.3.1. One Window: 1800 mm x 1200 mm (6' x 4').

- 3.3.1.4. Pay costs for modification, re-fabrication and reinstallation of rejected test units or portion thereof until tests are completed satisfactorily.
- 3.3.1.5. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
- 3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. ADJUSTING

- 3.4.1. Adjust windows to operate smoothly and fit tightly when closed and locked.
- 3.4.2. Adjust hardware to operate smoothly with proper tension and lubricate as required.
- 3.4.3. Ensure weatherstripping does not cause binding to prevent closing and locking and it makes weathertight contact.

3.5. CLEANING

- 3.5.1. Remove as work progresses all corrosive and foreign materials which may set or become difficult to remove at time of final cleaning or which may damage components of glazing system. Examine surface as often as required to ensure cleanliness.
- 3.5.2. Maintain window framing in a clean condition throughout construction period, so it will be without deterioration or damage at time of review. Select methods of cleaning which will promote achievement of uniform appearance and stabilized colours and textures for materials that weather or age with exposure.
- 3.5.3. Immediately before time of Ready-for-Takeover, clean windows thoroughly, inside and out. Demonstrate proper cleaning methods to Owner during this final cleaning. Prepare a "Cleaning and Maintenance Manual" listing types of cleaning compounds, cleaning methods, sealants and glazing materials of the work and submit 2 copies to Owner.

3.6. PROTECTION

- 3.6.1. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.
- 3.6.2. Remove protective covering and coating from aluminum surfaces, inside and out, and clean surfaces, remove labels, stripes and protective devices and polish glass surfaces, immediately prior to final review of the Work by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section includes:
 - 1.2.1.1. Supply and off-load to place in a clean, dry, and secure room at the Place of the Work, which has been designated for storage of all finish hardware specified including necessary fastening devices.
 - 1.2.1.2. Supply all finish hardware required and not supplied under other Sections.
 - 1.2.1.3. Check and verify hardware information on door and frame shop drawings, prior to fabrication.
 - 1.2.1.4. Packaging, labelling, provision of installation instructions, templates, fixings and similar items, and delivery to the Work site.
 - 1.2.1.5. Give assistance at the Place of the Work to organize hardware storeroom and supply qualified staff to correctly categorize, mark, and arrange each item in groups to enable efficient dispensing in specified hardware groups for each door to installation trades.
 - 1.2.1.6. Upon completion of installation of hardware, hardware Supplier shall arrange and conduct, in company of Consultant and Contractor, inspections to verify that all hardware is installed and functioning satisfactorily, and where necessary shall recommend adjustments of such items as closer arms, valves, door holders and latch and locksets. Report comments in writing to Consultant and Contractor.
 - 1.2.1.7. Supply temporary locking cylinders and keys for construction purposes. Locks used for Contractor security shall be keyed as required to conform to building operations' security requirements.

1.3. ADMINISTRATIVE REQUIREMENTS

- 1.3.1. Coordination:
 - 1.3.1.1. Coordinate work of this section to ensure information and material is promptly provided, to ensure orderly and expeditious progress of the Work, and to comply with schedule for completion.
 - 1.3.1.2. Within 3 weeks of Contract Award, submit confirmed orders to manufacturers/Suppliers to Consultant.
 - 1.3.1.3. Assist Contractor to organize hardware storeroom and supply qualified staff to correctly categorize, mark, and arrange each item in groups to enable efficient dispensing in specified hardware groups for each door to installation trades.
 - 1.3.1.4. Coordinate the work of this section to ensure supplied hardware can function as required and can be installed within the particular details of the door and frame assemblies. Hardware that cannot be installed or will not function as intended will be replaced at no cost to the Owner.
- 1.3.2. Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.4. SUBMITTALS

- 1.4.1. Product data sheets:
 - 1.4.1.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.

- 1.4.2. Schedules and samples:
 - 1.4.2.1. Prepare and submit for review, a finish hardware schedule with technical product data sheets for use in the Work. List type, selected manufacturer's name and number, location, mounting heights and finish of hardware and complete cross reference to door schedule.
 - 1.4.2.2. The indication or omission of a hardware component on the hardware schedule does not remove the responsibility of this section to ensure that all hardware can be installed and will function as intended.
 - 1.4.2.3. Submit samples of complete line of hardware and finishes. Identify samples indicating hardware item numbers used in the Finish Hardware Schedule, manufacturer's numbers, names, types, finishes, sizes and indication of door location(s).
 - 1.4.2.3.1. Approved samples will be sent to hardware supplier, to be used on final applications, prior to the beginning of Work.
 - 1.4.2.4. Prepare and submit for review, a keying schedule recognizing Owner requirements which shall be determined after award of Contract.
- 1.4.3. Templates:
 - 1.4.3.1. Submit for distribution, 3 copies of templates, template information, installation instructions and details necessary to enable preparation for, and installation of finish hardware in accordance with Door Hardware Institute recommended procedures. Submit templates arranged and marked coincident with specified hardware designations.
 - 1.4.3.2. Submit promptly when requested, the foregoing information in 3-ring plastic hard covered binders suitably identified.
- 1.4.4. Jigs:
 - 1.4.4.1. Submit template jigs for each component to be recessed to enable installation trades to prepare doors to preclude misalignment and improper fit.
- 1.4.5. Sustainability submittals:
 - 1.4.5.1. Submit documentation to verify compliance with sustainability objectives and requirements.
- 1.5. CLOSEOUT SUBMITTALS**
 - 1.5.1. Operation and maintenance data:
 - 1.5.1.1. Instruct the Owner's designated representative in proper care and preventative maintenance of hardware to assure longevity of operation.
 - 1.5.1.2. Submit maintenance data for cleaning and maintenance of finish hardware.
 - 1.5.1.3. Submit to building maintenance staff prior to date of Substantial Performance of the Work, two sets of wrenches for door closers, locksets and fire exit hardware.
- 1.6. QUALITY ASSURANCE**
 - 1.6.1. Qualifications: Supply and install work of this section, executed by competent Supplier with minimum 5 years' experience in Products, systems and assemblies specified and with approval of Product manufacturers.
 - 1.6.1.1. Finish Hardware Supplier's project manager shall be directed involved in the day to day management of the project and shall be a member in good standing with the Door and Hardware Institute (DHI).
- 1.7. DELIVERY, STORAGE, AND HANDLING**
 - 1.7.1. Package each item of hardware individually, complete with trim and necessary fastenings, and accessories, including wrenches, keys, and other appurtenances required to ensure correct installation. Mark each item as to contents and appropriate use in specified groups.

- 1.7.2. All items of hardware subject to handling when installed shall be submitted with an easily removable covering to protect against scratches, abrasions, coating with dissimilar finish materials on adjacent surfaces, and tarnishing.

1.8. EXTENDED WARRANTY

- 1.8.1. Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.
- 1.8.1.1. Provide supplementary warranties listed:
- 1.8.1.1.1. Closers: 10 years.
- 1.8.1.1.2. Operators: 2 years.
- 1.8.1.1.3. Pulls: 5 years.
- 1.8.1.1.4. Electric strikes: 5 years.
- 1.8.1.1.5. Electric panic devices: 5 years.
- 1.8.1.1.6. Hinges (full mortise): 10 years.
- 1.8.1.1.7. Hinges (continuous): 10 years.
- 1.8.1.2. Provide manufacturer's standard extended warranties for hardware items not listed above.

PART 2 - PRODUCTS

2.1. SUSTAINABILITY REQUIREMENTS

- 2.1.1. Comply with the requirements of Section 01 81 13 as applicable.

2.2. PERFORMANCE/DESIGN REQUIREMENTS

- 2.2.1. Comply with codes and requirements of governing authorities, and as specified.
- 2.2.2. Supply and install hardware items with characteristics to meet specified fire ratings, and conform to exit requirements of governing authorities.

2.3. MANUFACTURERS

- 2.3.1. While certain manufacturer's catalogue numbers are used in the schedule of finishing hardware, it is not the intent that these items are specified exclusively. The manufacturer's numbers are used to denote minimum quality, style, design function, finish. Submit catalogue cut sheets for approval of substitutions, based on approved manufacturers. See List of Approved Manufacturers for acceptable manufacturer substitutions to finish hardware in accordance with Finish Hardware Schedule.
- 2.3.2. List of Approved Manufacturers
- 2.3.2.1. Hinges, Full Mortise
- 2.3.2.1.1. McKinney
- 2.3.2.1.2. Hager
- 2.3.2.2. Hinges, Continuous
- 2.3.2.2.1. Markar
- 2.3.2.2.2. McKinney
- 2.3.2.2.3. Gallery Specialty Hardware
- 2.3.2.3. Flush Bolts
- 2.3.2.3.1. Ives
- 2.3.2.3.2. Rockwood

- 2.3.2.4. Mortise Locksets (Mechanical)
 - 2.3.2.4.1. Schlage
 - 2.3.2.4.2. Sargent
 - 2.3.2.4.3. Corbin Russwin
- 2.3.2.5. Mortise Locksets (Electric)
 - 2.3.2.5.1. Schlage
 - 2.3.2.5.2. Sargent
- 2.3.2.6. Cylinders and Keying
 - 2.3.2.6.1. Supplied and Installed by University of Toronto
- 2.3.2.7. Exit Devices
 - 2.3.2.7.1. Von Duprin
 - 2.3.2.7.2. Sargent
 - 2.3.2.7.3. Corbin Russwin
- 2.3.2.8. Exit Devices (Electric Latch Retraction)
 - 2.3.2.8.1. Sargent
- 2.3.2.9. Electric Strikes
 - 2.3.2.9.1. HES
 - 2.3.2.9.2. Von Duprin
 - 2.3.2.9.3. Folger Adams
- 2.3.2.10. Door Closers
 - 2.3.2.10.1. LCN
 - 2.3.2.10.2. Sargent
 - 2.3.2.10.3. Norton Rixson
- 2.3.2.11. Door Operators
 - 2.3.2.11.1. Horton
- 2.3.2.12. Overhead Stops
 - 2.3.2.12.1. Glynn-Johnson
 - 2.3.2.12.2. Rixson
- 2.3.2.13. Door Seals
 - 2.3.2.13.1. K.N. Crowder
 - 2.3.2.13.2. Pemko
 - 2.3.2.13.3. National Guard Products
- 2.3.2.14. Key Switches
 - 2.3.2.14.1. RCI
 - 2.3.2.14.2. Camden Door Controls

- 2.3.3. Butt Hinges:
 - 2.3.3.1. Provide 3 knuckle, concealed bearing butt hinges, except where continuous hinges are specified. Provide heavy duty hinges for high traffic doors, doors over 900 mm (3' - 0"), stair doors, corridor doors and doors where specified in Finish Hardware Schedule to have heavy duty hinges. Provide stainless steel hinges for exterior doors, tub rooms, showers, or doors in high humidity areas. Exterior doors shall have non-removable pins (NRP).
- 2.3.4. Continuous Hinges:
 - 2.3.4.1. Prior to ordering verify compatibility with door thicknesses, specifically related to thermally broken doors. Provide continuous hinges on interior doors. Provide extruded heavy duty geared continuous hinges on exterior aluminum doors and any door that requires integral hinge guard. Hinges shall have no more than 13 mm (1/2") clearance at top and bottom of hinge in relation to door. Ensure full height hinges are knuckle type with nylon bearings between each knuckle.
- 2.3.5. Flush Bolts:
 - 2.3.5.1. Provide 12 inch rod, manual flush bolt. Top and Bottom, where specified in Finish Hardware Schedule. Include 12 inch rod for hollow metal doors up to 84 inches. Increase rods by 12 inches for every 12 inches over 84 inch height doors.
- 2.3.6. Mortise Locksets and Latchsets
 - 2.3.6.1. Locks and latches shall be mortise lever sets. Latch bolts shall have ULC labels for all fire rated doors and 19 mm (3/4") throw. Auxiliary dead bolts are to have hardened steel pin inserts. Where lever trim is required, trim shall have concealed through bolt mounting and lever shall be solid cast or forged material with return to door face.
 - 2.3.6.2. Privacy Sets shall have occupancy indicators.
 - 2.3.6.3. Electric Mortise Locksets: Provide 24 volt DC, Fail Secure Electrified Mortise, low current, with build-in Latchbolt Monitor and Request to Exit Feature.
- 2.3.7. Wireless Locks
 - 2.3.7.1. Wireless locks shall be Grade 1 mortise locks with auxiliary latch (anti card system) and an electronic wide body escutcheon. Provide electronic half escutcheon for doors with rim exit devices and requires a wireless lock.
 - 2.3.7.2. ID technology for wireless locks shall be contactless BLE HID iClass
 - 2.3.7.3. There are no substitutions.
- 2.3.8. Exit Devices
 - 2.3.8.1. Provide exit devices sized for height and width of door. Include shim kits, extended rods and accessories to ensure properly functioning openings. Provide rim exit devices for single door applications, concealed vertical rod (CVR) devices for pairs of door in new applications, and surface vertical rod (SVR) devices for pairs of door in existing applications. Electrified exit devices to be 24VDC
 - 2.3.8.2. Provide manufacturer recommended fasteners for each application, and materials.
 - 2.3.8.3. Screws to be manufacturer sized and finished to match hardware
- 2.3.9. Electric Strike
 - 2.3.9.1. Provide UL Listed Burglar Resistant for fire rated applications. Provide 24VDC, fail secure electric strike, with dual switch. To suit frame application and latch requirements. Provide mortar box.
 - 2.3.9.2. No electric strikes shall be used with the exception of:
 - 2.3.9.2.1. Barrier free washrooms
 - 2.3.9.2.2. Where there is no other possible way of using electric locks.

- 2.3.10. Maglocks
- 2.3.10.1. Maglocks shall be a minimum 1200 lbs holding force units, provided with 24VDC 2 amp ULC rated power supplies from same manufacturer where applicable. Provide holding force sensor (dry contact version) to indicate proper door locking to security system (by others). Provide separate door contacts where specified to indicate door position. Provide maglock filler bars or angle brackets as required and determined by frame details. Coordinate these parts with aluminum or hollow metal shop drawings as required. Provide acceptable signage for door to indicate "DOOR UNLOCKED BY FIRE ALARM" as local building codes dictate. Coordinate signs with Owner and/or Consultant before ordering. Maglock permits shall be provided by the security division.
- 2.3.11. Door Closers
- 2.3.11.1. Provide heavy duty surface mounted closers, with cast iron body, heavy forged steel arm and full plastic covers. Handed closers for opening and sized for door width and application. Closers include adjustment screws for latch speed, general speed and back check. Arm length, brackets, drop plates, spacers, supports and special templates required to ensure proper function and for mounting closers inside of rooms, the interior of building for exterior doors, and stairwells.
- 2.3.12. Power Door Operator
- 2.3.12.1. Provide heavy duty low energy surface mounted devices used for "slow" traffic wheelchair access. Provide medium duty low energy surface mounted devices for single stall barrier free washrooms. Provide also where specified, heavy duty "high energy" power door operators. Provide presence sensors on "pull" side of each door to protect people standing in path of travel of a door on "pull" side. One per leaf shall be provided on double egress doors and 1 per pair on pairs swinging in same direction. Sensors shall be active when door is in closed position, de-activate during opening and activate again when door is in 90 degree position as indicated by sensors in power door operator. Provide 150 mm (6") diameter heavy duty stainless steel push buttons where specified. Logo (handicap symbol) or wording (push to open) as specified. All units shall be ULC, cUL, or CSA approved as required.
- 2.3.13. Overhead Stops
- 2.3.13.1. Provide channel type, stainless steel, heavy duty, concealed or surface mount as noted in Hardware Sets. Size to suit door width or not to obstruct with hardware mounted in or on top rail of door. Allow for maximum 110 degree swing, where wall conditions allow. Dead stop for openings butting against walls
- 2.3.14. Protective Plates
- 2.3.14.1. Provide .050 gauge stainless steel, bevel 4 edges (B4E). Factory mounted 3M adhesive. Provide 10 inch height, mounted at the bottom edge of the door. 1-1/2 inch LDW on singles. 1 inch LDW on Pairs.
- 2.3.15. Wall Stop:
- 2.3.15.1. Provide heavy duty, cast or wrought brass, 2-1/2 inch diameter, 1 inch projection, in brushed chrome wall stop with convex grey, rubber bumper.
- 2.3.16. Gasketing/Smoke Seal
- 2.3.16.1. Provide for full width head and jambs at door in continuous length.
- 2.3.16.2. Perimeter Seal
- 2.3.16.2.1. Provide ridged, heavy duty, aluminum weather-strip with silicon type insert
- 2.3.16.3. Smoke Seal
- 2.3.16.3.1. Provide black, bulb type, smoke rated, self-adhesive gasket

- 2.3.17. Door Bottom/Sweep:
- 2.3.17.1. Auto Door Bottoms
- 2.3.17.1.1. Provide heavy duty, concealed auto door bottom with neoprene seal. To match architectural details.
- 2.3.17.2. Door Sweep
- 2.3.17.2.1. Provide surface mounted, brush type sweep for interior doors.
- 2.3.17.2.2. Provide surface mounted, brush type sweep with a drip cap for exterior doors.
- 2.3.18. Threshold
- 2.3.18.1. Provide thermally broken thresholds for exterior doors.

2.4. MATERIALS

- 2.4.1. Finish hardware: in accordance with Finish Hardware Schedule.
- 2.4.2. Refer to 'Finish Hardware Schedule'.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Before furnishing any hardware, carefully check Contract Documents, verify door swings, door and frame materials and operating conditions, and assure that hardware will fit work to be attached.
- 3.1.2. Check shop drawings and frame and door lists affecting hardware type and installation, and verify to correctness thereof, or advise of required revisions. Check that doors, frames and panels requiring additional support are reinforced.
- 3.1.3. Point out special requirements to installer. Make final adjustment of hardware, in particular closer arms, valves and locksets, to work properly.

3.2. INSTALLATION

- 3.2.1. Install in accordance with manufacturer's written installation instructions. Refer also to installation requirements indicated, and specified in other sections of specifications.
- 3.2.2. Accurately locate and adjust hardware to meet manufacturer's instructions. Use special tools and jigs as recommended.
- 3.2.3. Locate door stops to contact doors 75 mm (3") from latch edge.
- 3.2.4. Refer to Section 08 14 00 with respect to factory preparation for hardware for wood doors. Install wood doors and applicable hardware, including hinges.
- 3.2.5. Take delivery of finishing hardware and install, except hardware specified as part of work of another section. Check each item as received.
- 3.2.6. Set, fit and adjust hardware according to manufacturer's directions, at heights later directed by Consultant. Hardware shall operate freely. Protect installed hardware from damage and paint spotting.
- 3.2.7. Sound and weather seals:
- 3.2.7.1. Install seals to continuously seal entire perimeter of doors. Secure in place with non-ferrous screws, in accurate alignment.
- 3.2.7.2. Maintain integrity of seal at head of doors fitted with closers. Adapt seals as required to achieve specified performance.

3.2.8. Set thresholds on two continuous beads of polyurethane caulking fastened with a minimum of 4 countersunk screws.

3.2.9. At wood doors, use screw attachment for exit devices and closers except as follows:

3.2.9.1. Use through-bolt attachment for exit devices and closers at mineral core doors.

3.3. ELECTRIFIED HARDWARE

3.3.1. Install electronic components, security components such as magnetic locks, card readers, processors, transformers, and other electric devices.

3.3.2. Power wiring will be supplied and installed by Electrical Divisions 26, 27, and 28 including conduit, boxes and other electrical appurtenances, including connections and terminations. Be responsible for ensuring that all wiring work is done in accordance with the Suppliers wiring diagrams and directions.

3.3.3. Arrange for testing and commissioning of system by the distributor of the system. Submit a copy of reports to the Consultant.

3.4. KEYING

3.4.1. Supply temporary locking cylinders and keys for construction purposes. Locks used for Contractor security shall be keyed as required to conform to building operations' security requirements.

3.4.2. Supply '0' bitted permanent cores with 2 blank keys each, to match UofT building keying requirements.

3.4.2.1. Include keying through UofT Lock Shop

3.4.3. Submit Construction Master Keying (CMK) and Grand Master Keying (GMK) upon completion of the work of this section.

3.5. FIELD QUALITY CONTROL

3.5.1. Field tests and inspections:

3.5.1.1. Inspect the installation of finish hardware on an agreed frequency.

3.5.1.2. Advise in writing of work being performed that will prejudice the installation or correct operation of items of hardware.

3.5.1.3. Ensure items have been installed complete with required trim and accessories, and fastenings are adequately secured and approved. Ensure closer arms, valves, holder devices, locksets and latchsets are correctly adjusted.

3.5.1.4. Inspections shall be performed by Finish Hardware Supplier's project manager involved in the day to day management of the project and shall be a member in good standing with the Door and Hardware Institute (DHI).

3.6. ADJUSTING AND CLEANING

3.6.1. Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.

3.6.2. Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by Supplier's instructions.

3.6.3. Ensure that doors equipped with closers operate to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location and traffic.

3.6.4. Clean hardware after installation in accordance with Supplier's instructions.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide automatic door operators including but not limited to following:
 - 1.2.1.1. operator housing.
 - 1.2.1.2. swing power operator.
 - 1.2.1.3. electronic control.
 - 1.2.1.4. connecting hardware.
 - 1.2.1.5. presence sensor.
 - 1.2.1.6. low voltage wiring and raceways associated with door operators and controls.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Finish Hardware Schedule: Section 00 01 20, List of Schedules.
 - 1.2.2.2. Provision of hardware for cabinetry work: Section 06 40 00, Architectural Woodwork.
 - 1.2.2.3. Installation of door hardware: Section 06 90 00, General Installations.
 - 1.2.2.4. Supply of hollow metal doors and frames: Section 08 11 13, Steel Doors and Frames.
 - 1.2.2.5. Supply of aluminum doors: Section 08 11 16, Aluminum Doors and Frames.
 - 1.2.2.6. Supply of wood doors: Section 08 14 00, Wood Doors.
 - 1.2.2.7. Supply of aluminum doors and entrances: Section 08 44 13, Glazed Aluminum Curtain Wall
 - 1.2.2.8. Provision of 120 volt wiring and power source from building power panel to operator housing equipment: Division 26, Electrical.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CSA: Canadian Standards Association; www.csagroup.org.
 - 1.3.1.2. DC: Direct Current.
 - 1.3.1.3. OBC: Ontario Building Code.
 - 1.3.1.4. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ANSI/BHMA A156.10-17 - Power Operated Pedestrian Doors
 - 1.3.2.2. ANSI/BHMA A156.19-19 - Power Assist and Low Energy Power Operated Doors
 - 1.3.2.3. ASME B46.1-2019 - Surface Texture (Surface Roughness, Waviness, and Lay)
 - 1.3.2.4. ASTM A653/A653M-23 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

- 1.3.2.5. ASTM A666-23 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- 1.3.2.6. CAN/CGSB-69.26-96 - Power Operated Pedestrian Doors

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week before commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
- 1.4.2. Scheduling:
- 1.4.2.1. Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work is to be preformed. Inspect surfaces to determine adequacy of existing and proposed conditions.
- 1.4.2.2. Cooperate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.
- 1.4.2.3. Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location thereof.
- 1.4.2.4. Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit manufacturer's literature, data sheets for each type of material provided under this Section for Project. Ensure data sheets provide required information. Submit 3 copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials. Submit manufacturer's installation instructions.
- 1.5.2. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Submit Shop Drawings and manufacturer's catalogue cuts complete with activating controls for Consultant's review.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00. Submit automatic operators and accessories schedule and parts manual as part of Project closeout documents. Submit 2 sets of following items of manufacturer's literature:
- 1.6.1.1. Technical Data Sheets of each item used for the Project.
- 1.6.1.2. Service and Parts Manuals.
- 1.6.1.3. Name of local representative to be contacted in event of need of field service of consultation.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
- 1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver materials in sealed cartons and containers with manufacturer's name and Product description clearly marked thereon.

1.9. WARRANTY

- 1.9.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Horton Automatics; www.hortondoors.com
- 2.1.1.2. Rhinotek Entrance Solutions; www.rhinoteksolutions.com
- 2.1.2. Substitution Limitations: No further substitutions will be permitted.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Design swinging doors system to operate, open and close under design wind and suction loads, as calculated in accordance with OBC and other requirements of authorities having jurisdiction.
- 2.2.1.2. Design operation of automatic entrance doors as power assisted entrances and exits, as required means of egress from the building, and to comply with applicable codes.
- 2.2.1.3. Design automatic entrances to comply with applicable requirements of CAN/CGSB-69.26/ANSI/BHMA A156.10.
- 2.2.1.4. Design equipment to operate at ambient temperatures between 34 deg C and 71 deg C (29 deg F and 160 deg F).
- 2.2.1.5. Automatic Door Equipment: Electro/mechanical operated with manual switching control.
- 2.2.1.6. Type of Door Operations: Manual push button or push plate operation as indicated on Drawings.
- 2.2.1.7. Traffic Movement: Disabled person access.
- 2.2.1.8. Operator Equipment: CSA and ULC or cUL certified.
- 2.2.1.9. Provide manual operation for opening and closing of doors during electrical power failure and when power is manually switched off.
- 2.2.1.10. Provide fully adjustable operators for opening and closing speeds, checking speeds and hold open time.
- 2.2.1.11. Make provision to eliminate the possibility of water accumulating and freezing in door power units.
- 2.2.2. Ensure automatic door operators are stainless steel, Type 304 or Type 302, of 1 type throughout, "No. 4 Finish" typically having a surface roughness average (Ra) ranging from 20 - 25 micro inches when measured in accordance with ASME B46.1, of contemporary design, with minimum material thicknesses of components as specified herein. Arrange stainless steel sheet so grain of brushed finish runs vertically in finished installation:
- 2.2.2.1. Minimum thickness, any location or component: 0.645 mm (24 ga).
- 2.2.2.2. Reinforcement: 1.27 mm (18 ga).

- 2.2.3. Concealed Sheet Steel Reinforcing: Commercial quality cold rolled galvanized sheet steel to ASTM A635/A653M with zinc coating designation of ASTM A653/A653M, Z275 in minimum thickness of 0.912 mm (20 ga); or ASTM A666, Type 304 sheet stainless steel.

2.3. MANUFACTURED UNITS

- 2.3.1. Automatic Operators: Electro-mechanical swing door operators, completely self-contained units consisting of DC motor, high strength mechanical drive unit, solid state electro-control system, adjustable opening speed and adjustable hold-open time. Provide CSA listing and Provide ULC, cUL listing for fire rated openings. Automatic operators shall be complete with a fire door package consisting of an electric latch mechanism to co-ordinate with door panic devices and a control panel for connecting to the life safety system provided under Division 26.
- 2.3.2. Swing Automatic Door Operator: Design is based on low energy power operated door equipment:
- 2.3.2.1. "HD-Swing® LE, Series 4100LE" by Horton Automatics.
- 2.3.2.2. "Rhino ADO 4000" by Rhinotek Entrance Solutions.
- 2.3.2.3. Single Stall Barrier Free Washroom: "EasyAccess®, Series 7100" by Horton Automatics.

2.4. FUNCTIONAL REQUIREMENTS

- 2.4.1. Design equipment to operate swing doors up to weight of 102 kg (225 lbs).
- 2.4.1.1. Opening Speed:
- 2.4.1.1.1. Field adjust door to back check as required in Table 1 of ANSI/BHMA A156.19.
- 2.4.1.1.2. Opening speed to fully open shall be 4 seconds or longer.
- 2.4.1.2. Hold Open: Field adjust door to remain fully open for not less than 5 seconds or more than 30 seconds.
- 2.4.1.3. Closing Speed:
- 2.4.1.3.1. Field adjust doors to close 90° to 10° in 3 seconds or longer as required in Table 1 of ANSI/BHMA A156.19.
- 2.4.1.3.2. Ensure doors close from 10° to fully closed in not less than 1.5 seconds.
- 2.4.1.3.3. Force required to prevent door from opening or closing shall not exceed 7 kg (15 lbs) applied 25 mm (1") from latch edge of door at any point in opening or closing cycle.
- 2.4.1.3.4. During power failure, doors shall open with manual pressure not exceeding 11 kg (24 lbs) at point 25 mm (1") from latch edge of door.
- 2.4.1.3.5. Equip doors with signs visible from either side, instructing user as to operation and function of door.
- 2.4.2. System Operation: Where 1 of push buttons on either side of door is actuated door shall open slowly to back check (80°) in 3 to 6 seconds and to full open position in 4 to 7 seconds. Door shall remain open for period set to suit requirements (period of 5 to 30 seconds). After time delay door shall close by spring in door operator from 90° to 10° in 3 to 6 seconds from 10° to fully closed in 1-1/2 to 2 seconds.
- 2.4.3. Requirements:
- 2.4.3.1. Provide header complete with full housing, finish shall match door frame finish.
- 2.4.3.2. Operator shall be activated by push button switches on either sides as indicated. Switches shall be located no more than 1000 mm (39") from floor. Switches shall bear universal handicap logo visible to all types of traffic.

- 2.4.4. Door Operator Control Systems - Wall Mounted Push Plate Switch:
 - 2.4.4.1. Provide stainless steel push plate switch in safe location for ease of operation of sizes and quantities to suit Project requirements in accordance with ANSI/BHMA A156.10.
 - 2.4.4.2. Manufacturer's standard hard wired stainless steel push plate switch 100 mm (4"), 150 mm (6") diameter or square on weatherproof junction box complete with socket cap screws for wall mounting near door opening, concealed wire connection to operator on both sides of opening with international symbol of access pictogram and operating instructions engraved into surface. Surface mounted or recessed with "Press to Operate", plus handicap "logo" control shall cause door to open instantly when press wall switch is pushed.
 - 2.4.4.3. Door shall operate as a manual door when press switch is not activated with no damage to operator.
- 2.4.5. Door Operator Control System - Jamb Mounted Push Button:
 - 2.4.5.1. Jamb mounted push button switch: Recessed door frame mounted 25 mm (1") diameter red push button as indicated on both sides of opening, for wired connection to operator with handicapped logo and "Push to Open" engraved into surface.
 - 2.4.5.2. Door shall operate as a manual door when press switch is not activated with no damage to operator.
- 2.4.6. Door Operator Control System - Jamb Mounted Narrow Stainless Steel Plate:
 - 2.4.6.1. Jamb mounted narrow stainless steel plate switch: Flush mounted on exterior and interior narrow stainless steel push plate on jamb shall have handicap logo.
 - 2.4.6.2. Door shall operate as a manual door when press switch is not activated with no damage to operator.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Drawings and Schedules indicate location of existing doors to be installed with automatic door operators and location of push buttons. Minor deviations will be permitted in order to utilize manufacturer's standard Products when deviations do not materially detract from design concept or intended performance.
- 3.2.2. Provide automatic door operators and controls for automatic operation of doors indicated.
- 3.2.3. Provide surface mounted overhead automatic operators at door head.
- 3.2.4. Coordinate door closing and astragal alignment by delaying closing of door leaf with astragal.
- 3.2.5. Provide a fire door electrical device and control panel assembly for operation of doors during activation of life safety system to operate in conjunction with door hardware provided under other Sections. Electrical device shall cause door panic devices, normally not engaged at top and bottom during automatic mode of operation, to become engaged upon signal from life safety sensors provided under Division 26. Doors shall become manually operated and automatic operators shut down after activation by life safety system.

- 3.2.6. Doors shall operate manually as though equipped with manual door closers, without damage to automatic door components, in event of power failure or in event of power termination by life safety system.
- 3.2.7. Power supply to each door operator, life safety sensor devices, and wiring from life safety sensor devices to fire door package control panel shall be provided under Division 26. Make connections at operators and at control panel and Supply and Install all electrical work between operators and activating controls. Comply with requirements of Division 26. Conceal wiring or, where exposed, run in conduit. Location of exposed wiring shall be subject to Consultant's review.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Remove protective coatings and paper including adhesives.
- 3.4.2. Test and adjust operators and controls for smooth, proper operation.
- 3.4.3. Upon completion of work of this Section, remove from site all debris, equipment and excess material resulting from work of this Section.
- 3.4.4. Clean and polish stainless steel surfaces.

3.5. CLOSEOUT ACTIVITIES

- 3.5.1. Demonstration: Demonstrate operation, operating components, adjustable features and lubrication requirements to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide glass and glazing including but not limited to following:
 - 1.2.1.1. glazing hollow metal doors.
 - 1.2.1.2. glazing borrowed lights and screens.
 - 1.2.1.3. glazing borrowed lights and screens with fire-rated ceramic glass.
 - 1.2.1.4. glazing plastic laminate wood doors.
 - 1.2.1.5. mirrors.
 - 1.2.1.6. window film.
 - 1.2.1.7. miscellaneous specialty glass, gaskets, tapes and glazing materials.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of architectural woodwork: Section 06 40 00, Architectural Woodwork.
 - 1.2.2.2. Provision of glazing types: Section 08 06 80, Glazing Schedule.
 - 1.2.2.3. Supply of hollow steel doors and frames: Section 08 11 13, Hollow Metal Doors and Frames.
 - 1.2.2.4. Provision of glass and glazing for aluminum doors: Section 08 11 16, Aluminum Doors and Frames.
 - 1.2.2.5. Supply of wood doors [and frames]: Section 08 15 00, Plastic Laminate Wood Doors.
 - 1.2.2.6. Provision of glass and glazing in curtain walls: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.7. Provision of glass and glazing of exterior aluminum windows: Section 08 51 13, Aluminum Windows.
 - 1.2.2.8. Provision of unit mirrors: Section 10 28 00, Washroom Accessories.
 - 1.2.2.9. Glazed hose cabinets and valve directory: Division 21, Fire Suppression.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. EPDM: Ethylene Propylene Diene Monomer.
 - 1.3.1.2. GANA: Glass Association of North America; www.glass.org.
 - 1.3.1.3. OBC: Ontario Building Code.
 - 1.3.1.4. PVB: Polyvinyl Butyral.
 - 1.3.1.5. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Definitions:
 - 1.3.2.1. Glass Terminology: Conform to ASTM C162 for glossary of terms and definitions of glazing terminology.
 - 1.3.2.2. United Inches: Total of 1 width and 1 height of a lite of glass in inches.

- 1.3.3. Reference Standards:
- 1.3.3.1. ANSI/ASME B18.6.3-13 - Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)
 - 1.3.3.2. ASTM C162-05(15) - Standard Terminology of Glass and Glass Products
 - 1.3.3.3. ASTM C509-06(21) - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
 - 1.3.3.4. ASTM C864-05(15) - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
 - 1.3.3.5. ASTM C920-18 - Standard Specification for Elastomeric Joint Sealants
 - 1.3.3.6. ASTM C1036-21 - Standard Specification for Flat Glass
 - 1.3.3.7. ASTM C1048-18 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
 - 1.3.3.8. ASTM C1115-17(22) - Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories
 - 1.3.3.9. ASTM C1172-14 - Standard Specification for Laminated Architectural Flat Glass
 - 1.3.3.10. ASTM C1349-17 - Standard Specification for Architectural Flat Glass Clad Polycarbonate
 - 1.3.3.11. ASTM E1300-16 - Standard Practice for Determining Load Resistance of Glass in Buildings
 - 1.3.3.12. CAN/CGSB-12.1-17 - Safety glazing
 - 1.3.3.13. CAN/CGSB-12.20-M89 - Structural Design of Glass for Buildings
 - 1.3.3.14. CAN/ULC-S104-15 - Standard Method for Fire Tests of Door Assemblies
 - 1.3.3.15. CAN4-S106-M80(85) - Standard Method for Fire Tests of Window and Glass Block Assemblies
 - 1.3.3.16. GANA 01-0300 - Glass Information Bulletin – Proper Procedures for Cleaning Architectural Glass Products
 - 1.3.3.17. NFPA 80-22 - Standard for Fire Doors and Other Opening Protectives

1.4. ADMINSTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings:
- 1.4.1.1. Arrange pre-installation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
 - 1.4.1.2. Review installation methods, procedures, time schedule and conditions under which work shall proceed including manufacturer's written instructions and coordination required with related work.
 - 1.4.1.3. Review and finalize construction schedule, verify availability of materials, experienced installer, equipment and facilities needed to make progress and avoid delays.

1.5. SUBMITTALS

- 1.5.1. Samples:
 - 1.5.1.1. Submit samples of materials in accordance with Section 01 30 00 identifying quality and type of glass if required by Consultant before commencing work. Ensure samples are clearly labelled with manufacturer's name and type.
 - 1.5.1.2. Submit following samples:
 - 1.5.1.2.1. mirrors.
 - 1.5.1.2.2. fire-rated ceramic glass.
 - 1.5.1.2.3. window film.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operational and Maintenance Data: Provide maintenance data in accordance with Section 01 70 00 indicating cleaning instructions for inclusion into Maintenance Manual.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
 - 1.7.1.1. Installers: Provide experienced installer who is trained and experienced in glass and glazing requirements of this Section including familiarization with standards specified herein and capable to instruct installation requirements of this Section.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver glass and associated materials to site in original crates and containers with manufacturer's name and brand distinctly marked thereon and with glass labelled as to types. Do not remove labels on glass until after work is reviewed by Consultant.
- 1.8.2. Storage and Handling Requirements: Store materials within the building, in a clean, dry location, reviewed by Consultant. Fully protect materials from damage of any kind until ready for use.

1.9. SITE CONDITIONS

- 1.9.1. Ambient Conditions: Do not perform glazing when temperature is less than 7 deg C (44 deg F) or sash or frames are wet, damp or frosted.

1.10. WARRANTY

- 1.10.1. Manufacturer Warranty: Warrant mirrors for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to deterioration of silvering on mirrors.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. AGC Glass Company North America; www.yourglass.com
 - 2.1.1.2. Cardinal Glass Industries; www.cardinalcorp.com
 - 2.1.1.3. The Dow Chemical Company; www.consumer.dow.com
 - 2.1.1.4. Guardian Industries Corp.; www.guardian.com
 - 2.1.1.5. Momenive Performance Materials; www.momentive.com

- 2.1.1.6. Pilkington Special Glass Limited; www.pilkington.com
- 2.1.1.7. TGP Technical Glass Products; www.fireglass.com
- 2.1.1.8. Tremco Canada; www.tremcosealants.com
- 2.1.1.9. Vetrotech USA; www.vetrotechusa.com
- 2.1.1.10. Vitro Architectural Glass; www.vitro.com
- 2.1.2. Single Source Responsibility for Sealants, Gaskets and Other Glazing Accessories: Ensure consistent quality of performance by providing glazing sealant and seals from single manufacturer.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
 - 2.2.1.1. Design glass and glazing to CAN/CGSB-12.20-M complying to OBC design and fire rating requirements and regulations of authorities having jurisdiction, being the minimum, except where more stringent requirements are specified herein. In case of conflict of requirements comply with most stringent requirements.
 - 2.2.1.2. Validate glass thicknesses specified in Section 08 06 80 in accordance with ASTM E1300.
 - 2.2.1.3. Provide accessories, closures and trims required and necessary to complete work.
 - 2.2.1.4. Deflection: Limit glass deflection to flexural limit of glass with full recovery of glazing materials.
- 2.2.2. Glass:
 - 2.2.2.1. Free from bubbles, waves, discolouration and other defects. Ensure glass (particularly heat-strengthened, tempered and laminated) bears manufacturer's labels on bottom inner right hand corner indicating quality.
 - 2.2.2.2. Float Glass (CGL): Clear transparent float glass conforming to ASTM C1036, Type I, Class 1, Quality-Q3.
 - 2.2.2.3. Tempered Glass (TGL): Clear transparent tempered glass conforming to ASTM C1048, Kind FT and meeting requirements of CAN/CGSB-12.1. Ensure surface compression is equal to or greater than 69 MPa (10 000 psi).
 - 2.2.2.4. Laminated Glass (LGL): Clear transparent laminated float glass (CGL) conforming to ASTM C1172, Type I and meeting requirements of CAN/CGSB-12.1 with clear PVB interlayer. Ensure mismatch of glass lites after laminating process is +3.2 mm (1/8"), -1.6 mm (1/16") maximum for exposed edges after installation. Provide edge seal protection at exposed edges of glass.
 - 2.2.2.5. Heat-Strengthened Glass (HSGL): Clear transparent heat-strengthened glass conforming to ASTM C1048, Kind HS. Perform heat-strengthening using horizontal tong free method; surface compression less than 52 MPa (7500 psi).
 - 2.2.2.6. Glass Units (GL): For single glass unit types, refer to Section 08 06 80.
 - 2.2.2.7. Fire-Rated Ceramic Glass (FRCGL) (GL-20):
 - 2.2.2.7.1. Fire-rated ceramic glass clear and wireless glazing materials installed as transoms, borrowed lights and screens in fire-rated frames.
 - 2.2.2.7.2. Impact and safety rating conforming to CAN/CGSB-12.1; thickness to suit design, fire-rating requirements and in accordance with manufacturer's recommendations conforming to testing agencies acceptable to authorities having jurisdiction for respective performance criteria.
 - 2.2.2.7.3. Test fire-rating in accordance with CAN/ULC-S104 and CAN/ULC-S106 as applicable and acceptable to authorities having jurisdiction for specific application.

- 2.2.2.7.4. 5 mm (3/16") thick, (20 minute to 3 hour fire-rating), impact safety fire-rated ceramic glass with an approved surface-applied safety film; "FireLite® Premium NT" or "PYRAN® Platinum F" by TGP Technical Glass Products or "Keralite® Select Filmed" by Vetrotech USA.
- 2.2.2.7.5. 8 mm (5/16") total thickness, (20 minute to 3 hour fire-rating), impact safety laminated fire-rated ceramic glass; "FireLite Plus®" or "PYRAN® Platinum L" by TGP Technical Glass Products or "Keralite® Select Laminated" by Vetrotech USA.
- 2.2.2.7.6. Provide glazing tapes and setting blocks in accordance with applicable ULC Listing for approved fire-rated glazing Product. Butyl tapes and setting blocks are not permitted.
- 2.2.2.8. Mirrors: Size(s) as shown on Drawings, 6 mm (1/4") thick conforming to ASTM C1503 float glass with process deposit of 5 silver coats, 3 copper coats and final protective seal, warranted for 10 years against deterioration of silvering.
- 2.2.3. Mirror Adhesive: Compatible with silver coatings, copper coatings and protective seal applied to mirrors, recommended by manufacturer to hold mirrors permanently in position without visible signs of mirror deterioration thorough out warranty period. "Mirror-Mastic Bond" by Palmer Corporation.
- 2.2.4. Security Screws: Complying with ANSI/ASME B18.6.3; provide only tamper-resistant Torx-Plus® or break off type screws as specified and noted on Drawings. Provide flathead security screws where Torx-Plus® or breakoff is indicated to be counter sunk otherwise provide only trusshead or buttonhead for Torx-Plus® and only roundhead for breakoff type. Torx-Plus® Tamper resistant screws with heads having a deep hex-lobular recess with a solid post formed in the centre requiring a special metal driver to install or remove screw. Ensure fasteners and tools are of type produced by licensed manufacturer. Break-Off head security screws with drive heads having an additional hexagonal shaped head designed to break off after installation at a predetermined torque level. Grind remaining portion of neck smooth after hex-head is broken off. Permitted Manufacturers: Tamperproof Screw Co., Inc.; www.tamperproof.com or Sentry Security Fasteners Inc.; www.sentrysf.com.
- 2.2.5. Window Film: Provide "3M Scotchcal ElectroCut Special Effects Film" by 3M; www.3m.com refer to "Material and Finish Schedule" appended to Section 00 10 20 for colour(s), translucent opacity, transparent synthetic liner, clear pressure sensitive adhesive. Ensure film cutouts suit design and are located on glass doors and other areas as indicated on Drawings.
- 2.2.6. Glazing, Sealing Compounds and Accessories:
- 2.2.6.1. Ensure glazing, sealing compounds and accessories are compatible with contact surfaces of frames, other accessories used in glazing system and contact surfaces of compounds used on insulated glass units. Wood or other organic materials are not permitted for use in glazing systems including spacer blocks.
- 2.2.6.2. Glazing Compound: Non-hardening modified oil type. Colour to match adjacent surfaces unless indicated otherwise.
- 2.2.6.3. Sealant Compound: One component type, elastomeric chemical curing, ASTM C920, Type S, Grade NS. Colour to match adjacent surfaces unless indicated otherwise.
- 2.2.6.4. Sealant Compound: ASTM C920, multi-component chemical curing, Type M, Grade NS. Colour to match adjacent surfaces.
- 2.2.6.5. Sealant Compound: One component, silicone base chemical curing. Colour to match adjacent surfaces.
- 2.2.6.6. Sealant for Interior Glass-to-Glass Butt Glazing Installation: Translucent 1 part silicone sealant conforming to ASTM C920, Type S, Grade NS, "Tremsil® 200 General Construction Grade Silicone Sealant" by Tremco Canada or "DOWSIL™ 999-A Building and Glazing Sealant" by The Dow Chemical Company or "GE Contractors SCS1000 Silicone Sealant" by Momentive Performance Materials.

- 2.2.6.7. Cellular Gaskets for Compression Glazing: ASTM C509 cellular, elastomeric, preformed, black. Closed cell neoprene or EPDM extrusions including molded corners where applicable by Cellular Rubber Extrusions, Tremco Canada.
- 2.2.6.8. Dense Gaskets for Compression Glazing: ASTM C864, Option II or ASTM C1115, Type C, dense neoprene or EPDM extrusions, 60 and 70 Durometer density including molded corners where applicable by Poly-Wej Gaskets, Tremco Canada.
- 2.2.6.9. Glazing Splines: Neoprene or EPDM manufacturer's standard dry glazing splines to suit aluminum extrusions. Colour to match adjacent surfaces unless indicated otherwise.
- 2.2.6.10. Glazing Points and Wire Spring Clips: Corrosion resistant, manufacturer's standards.
- 2.2.6.11. Edge Blocking, Setting Blocks, Lateral Shims, Gaskets and Tapes:
 - 2.2.6.11.1. Edge Blocking for Glass: 60 - 70 Durometer neoprene, silicone or EPDM, channel shaped, 100 mm - 150 mm (4" - 6") long.
 - 2.2.6.11.2. Setting Blocks: 7 mm x 100 mm (5/16 x 4") EPDM or extruded 80 - 90 Durometer neoprene; at insulating glass, use EPDM only. At fire-rated glazed doors and partitions, use similar sized fire-rated silicone GE "Gel 516" or asbestos cement blocks. Width; 1.6 mm to 3 mm (1/16" to 1/8") less than design glazing pocket width. For 4 sided structural glazing, use silicone compatible rubber or silicone.
 - 2.2.6.11.3. Lateral Shims: Neoprene, silicone or EPDM, 40 - 60 Durometer, 100 mm (4") long or as required.
 - 2.2.6.11.4. Non-Compression Glazing Tape for Interior Aluminum Screen Glazing: Preformed, 100% solids, cross linked butyl rubber, polyisobutylene, hardness 65 Durometer, unaffected by UV through glass. Permitted Product: "Tremco 440 Tape" by Tremco Canada. Ensure tape is sufficiently wide and thick enough to completely cover bite area of glazing unit when unit is pushed into place.
 - 2.2.6.11.5. Compression Glazing Gaskets for Interior Aluminum Screen Glazing: EPDM, neoprene, thermoplastic or other permitted material with Shore A Durometer of 35, +/-5. Dual Durometer gaskets of a specific permitted type are also permitted. Ensure material has sufficient thickness or be of a configuration to allow 25% compression when installed, have a minimum 2000 psi (1500 psi for silicone) tensile strength, resistance to permanent set of 30% maximum, minimum elongation at break of 300% (700% for silicone) and resistance to ozone showing no cracks; "VISIONstrip®" by Tremco Canada. Other permitted manufacturers are Armet, The Dow Chemical Company and PTI.
 - 2.2.6.11.6. Compression Glazing Tape: Preformed, ribbon-shaped, non-skinning, 100% solids, non-oxidizing polyisobutylene: butyl, paper release, EPDM shim with continuous synthetic rubber spacer rod of 60 Durometer hardness. Permitted Product: "Polyshim II Tape" by Tremco Canada. Ensure tape is sufficiently wide and thick to completely cover bite area of glazing unit when unit is pushed into place.
- 2.2.7. Primer Sealers and Cleaners: To glass manufacturer's standards.
- 2.2.8. Fabrication:
 - 2.2.8.1. Label each light of glass with registered name of Product and weight and quality of glass a.
 - 2.2.8.2. Check dimensions on job site before cutting materials.
 - 2.2.8.3. Grind and chamfer edges of unframed glass and mirrors. Grind and chamfer edges of glass shelves.
 - 2.2.8.4. Ensure minimum bite or lap of glass on stops and rabbets as recommended by glass manufacturer.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Ensure glass is not more than 4 mm (3/16") less than the rebate size in either dimension, with allowance for edge spacers, shims and setting blocks as required.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Thoroughly clean glass rebates and glass of dust, dirt, mortar and other foreign materials prior to glazing. Remove oils and grease with non-staining solvents such as Xycol or Methyl Ethyl Ketone solutions.
 - 3.2.1.2. Properly prime, before glazing, glazing rebates in wood doors.

3.3. INSTALLATION

- 3.3.1. Perform work of this Section in accordance with "GANA Glazing Manual, 50th Anniversary Edition" and "GANA Laminated Glazing Reference Manual, 2009" for laminated glazing installation methods.
- 3.3.2. If required, thoroughly mix glazing compound as recommended by manufacturer. Thinning of glazing compound will not be permitted.
- 3.3.3. Carefully remove glazing stops and replace after glazing. Take care to prevent damage to stops.
- 3.3.4. Doors, Screens, Sidelites and Interior Windows:
 - 3.3.4.1. Place setting blocks on sill at 1/4 points from each corner unless otherwise directed by glazing manufacturer.
 - 3.3.4.2. Place continuous glazing gaskets on edges of glass.
 - 3.3.4.3. Centre and space each piece of glass with spacers located and installed according to manufacturer's directions.
 - 3.3.4.4. Place glass so no voids occur between glass and glazing material and glazing stops.
 - 3.3.4.5. Secure glass in place with stops, secured in place with screws.
- 3.3.5. Glazing Sealant:
 - 3.3.5.1. Apply glazing sealant to clean, dry, grease and oil free surfaces. Provide exposed glazing sealant smooth, free from ridges, wrinkles, air pockets and embedded foreign materials.
 - 3.3.5.2. Prime surfaces if required by glazing sealant manufacturer.
 - 3.3.5.3. Trim glazing sealant flush with tops of stops and glazing channels.
 - 3.3.5.4. Remove excess glazing sealant or droppings which would set up or become difficult to remove from finished surfaces. Do not use chemicals, scrapers, or other tools which would affect finished surfaces.

- 3.3.6. Interior Glazing:
 - 3.3.6.1. Fire Rated Hollow Metal Doors and Screens: Set glass in fire rated metals doors and screens on continuous setting block with 3 mm (1/8") gap between glazing stop glass and embed in glazing compound in accordance with NFPA 80 and OBC requirements. Strike and point exposed joints between metal and glass or install glass in accordance to ULC tested proprietary methods of installation.
 - 3.3.6.2. Tape/Tape Method:
 - 3.3.6.2.1. Cut glazing tape to proper length and install against permanent stop projecting 1.6 mm (1/16") above sightline.
 - 3.3.6.2.2. Place glazing tape on free perimeter of glass projecting 1.6 mm (1/16") above sightline.
 - 3.3.6.2.3. Trim off excess tape to sightline.
 - 3.3.6.3. Combination Method-Tape/Sealant:
 - 3.3.6.3.1. Cut glazing tape to proper length and install against permanent stop projecting 1.6 mm (1/16") above sightline.
 - 3.3.6.3.2. Fill gap between glass and applied stop with sealant to depth equal to bite of frame on glass to uniform and level line.
 - 3.3.6.3.3. Trim off excess tape to sightline.
 - 3.3.6.4. Dry Method (Gaskets):
 - 3.3.6.4.1. Place gasket against permanent stop and position glass sheet.
 - 3.3.6.4.2. Apply removable stops. Install gaskets in frame channels.
 - 3.3.6.5. Two Sided Butt - Joint Glazing:
 - 3.3.6.5.1. 2 sided glazing at head and sill use wet, dry, or wet/dry glazing systems.
 - 3.3.6.5.2. Position glazing so that vertical edges are spaced slightly apart and seal with silicone sealant.
 - 3.3.6.5.3. Grind vertical joint with slight kerf and polish for aesthetics.
 - 3.3.6.6. Window Film:
 - 3.3.6.6.1. Install window film in accordance with manufacturer's printed instructions by experienced film applicators as recommended by glass film manufacturer.
 - 3.3.6.6.2. Ensure glass surfaces are clean and ambient temperature is between 16 deg C and 38 deg C (61 deg F and 100 deg F).
 - 3.3.6.6.3. Whenever 2 or more pieces of same colour translucent film are seamed together as a continuous band of colour, they must match to ensure uniform reflected daytime colour and transmitted night appearance.
- 3.3.7. Mirrors:
 - 3.3.7.1. Install mirrors where indicated on Drawings.
 - 3.3.7.2. Mount plumb and level and accurately in position and secure rigidly in position.
 - 3.3.7.3. Ensure back-up wall surface is thoroughly dry, smooth and firm and is primed or painted.
 - 3.3.7.4. Provide space for air circulation and elimination of condensation between back of mirror and wall.
 - 3.3.7.5. Install tamper proof mirrors according to manufacturer's directions.
 - 3.3.7.6. Install frameless mirrors with mirror edges ground and polished.
 - 3.3.7.7. Locate joints in mirrors to Consultant's direction. Generally joints are permitted only for locations where mirrors are longer than 2440 mm (8' - 0"). Provide butt joints with ground and polished edges. Apply 6 mm (1/4") wide clear silicone bead at butt joints.

- 3.3.7.8. Secure wall and ceiling mirrors in place over special adhesive, temporarily fixing in place until adhesive sets.
- 3.3.7.9. Install mirrors with frames according to manufacturer's direction. Use concealed tamper proof fasteners in addition to adhesive where required.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections: Ensure framing to be glazed is plumb, secure and permanently fixed in position.
- 3.4.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Clean installed glass and metal frequently during construction. Avoid etching and staining glass and metal during construction.
- 3.5.2. Remove sealant and compound droppings from finished surface.
- 3.5.3. Clean and polish glass in accordance with GANA 01-0300 including removal of markings indicating presence of glass.

3.6. CLOSEOUT ACTIVITIES

- 3.6.1. Demonstration: Demonstrate operation and maintenance of switchable glass system to Owner's representatives.

3.7. PROTECTION

- 3.7.1. Provide and maintain necessary protection of completed work against damage.
- 3.7.2. Do not mark or attach anything directly to exposed glass and framing surfaces.
- 3.7.3. If welding is to take place above or near completed glazing work, protect glass with plywood or other suitable means to reduce likelihood of weld spatter damaging glass surfaces.
- 3.7.4. Protect glass from other trades, workers, tools and other similar materials. Avoid storing materials adjacent to glass.
- 3.7.5. Replace cracked, broken, or defective glass at no additional cost to Owner.
- 3.7.6. Identification of Glazing: Mark glass lites with temporary, easily removable, large safety markings, immediately after glass installation. Maintain safety markings until final clean-up.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide louvres including but not limited to following:
 - 1.2.1.1. additional steel support framing.
 - 1.2.1.2. extruded aluminum prefinished wall louvres.
 - 1.2.1.3. bird screens.
 - 1.2.1.4. caulking.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of metal siding system: Section 07 46 19, Metal Siding System.
 - 1.2.2.2. Provision of curtain wall system: Section 08 44 13, Glazed Aluminum Curtain Wall.
 - 1.2.2.3. Provision of window wall system: Section 08 51 66, Aluminum Window Wall.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. AMCA: Air Movement and Control Association International, Inc.; www.amca.org.
 - 1.3.1.2. PVDF: Polyvinylidene Fluoride.
 - 1.3.1.3. SSPC: The Society for Protective Coatings (formerly known as Steel Structures Painting Council); www.sspc.org.
- 1.3.2. Reference Standards:
 - 1.3.2.1. AAMA 2605-22
 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusion and Panels (with Coil Coating Appendix)
 - 1.3.2.2. AMCA 500-L-12(15)
 - Laboratory Methods of Testing Louvers for Rating
 - 1.3.2.3. AMCA 511-21
 - Certified Ratings Program – Product Rating Manual for Air Control Devices
 - 1.3.2.4. ASTM B117-19
 - Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 1.3.2.5. ASTM B209/B209M-21
 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 1.3.2.6. ASTM B221M-21
 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
 - 1.3.2.7. ASTM B244-09(21)
 - Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
 - 1.3.2.8. ASTM C920-18(24)
 - Standard Specification for Elastomeric Joint Sealants

- | | | |
|-----------|-------------------|--|
| 1.3.2.9. | ASTM D523-14(18) | - Standard Test Method for Specular Gloss |
| 1.3.2.10. | ASTM D714-02(17) | - Standard Test Method for Elevating Degree of Blistering of Paints |
| 1.3.2.11. | ASTM D968-22 | - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive |
| 1.3.2.12. | ASTM D2244-22 | - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates |
| 1.3.2.13. | ASTM D2247-15(20) | - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity |
| 1.3.2.14. | ASTM D3363-22 | - Standard Test Method for Film Hardness by Pencil Test |
| 1.3.2.15. | ASTM D4214-07(15) | - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films |
| 1.3.2.16. | CISC/CPMA 2-75 | - A Quick-Drying Primer for Use on Structural Steel |
| 1.3.2.17. | CSA G40.20-13(23) | - General requirements for rolled or welded structural quality steel |
| 1.3.2.18. | SSPC-SP 3-18 | - Power Tool Cleaning |

1.4. SUBMITTALS

- 1.4.1. Shop Drawings:
- 1.4.1.1. Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to minimum requirements indicate following:
- 1.4.1.1.1. structural supports and framing provided as part of this Section.
- 1.4.1.1.2. provision for structural and thermal movement between louvres and adjacent materials.
- 1.4.1.2. Employ a licensed engineer specified herein is responsible for:
- 1.4.1.2.1. production and review of Shop Drawings.
- 1.4.1.2.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.4.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
- 1.4.2.1. louvres minimum 600 mm (24") square.
- 1.4.2.2. louvre flashing minimum 300 mm (12") square.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
- 1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.5.1.2. Licensed Professionals: Employ a licensed engineer carrying a minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Delivery and Acceptance Requirements: Coordinate deliveries to comply with construction schedule and arrange for strategic off-the-ground, undercover storage locations.

- 1.6.2. Storage and Handling Requirements:
- 1.6.2.1. Properly wrap louvres with protective coverings and put in suitable crates to prevent distortion and damage. Carefully unload, handle and store to prevent damage.
- 1.6.2.2. Protect work of this Section from damage. Protect other work from damage resulting from this Work. Repair or replace damaged work to satisfaction of Consultant at no cost to Owner.

1.7. WARRANTY

- 1.7.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to extensive colour fading.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. The Airolite Company, LLC; www.airolite.com
 - 2.1.1.2. Construction Specialties Ltd.; www.c-sgroup.com
 - 2.1.1.3. Greenheck Fan Corporation; www.greenheck.com
 - 2.1.1.4. Ruskin Company; www.ruskin.com
 - 2.1.1.5. TenPlus Architectural Products Ltd.; www.tenplus-online.com
 - 2.1.1.6. Ventex Inc.; www.ventexinc.com
- 2.1.2. Substitution Limitations: Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
 - 2.2.1.1. Material thicknesses stated herein are a minimum. Be responsible for engineering calculations to ensure structural adequacy of wall louvres and louvred penthouses.
 - 2.2.1.2. Structural Design:
 - 2.2.1.2.1. Ensure louvre members deflect no more than L/180 of span between supports when subjected to wind load of 958 Pa (20 psf) applied horizontally to louvre face.
 - 2.2.1.2.2. Employ a licensed engineer specified herein to:
 - 2.2.1.2.2.1. design components for work of this Section requiring structural performance.
 - 2.2.1.2.2.2. be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
 - 2.2.1.3. Vibration Control: Ensure louvre members do not vibrate when subjected to above wind loading. Provide integral bosses as required.
 - 2.2.1.4. Wind Driven Rain Performance: When tested in accordance with AMCA 500-L and AMCA 511 for a 1220 mm x 1220 mm (48" x 48") sized decorative or storm class louvre, following result apply:
 - 2.2.1.4.1. Static Air Pressure Drop Performance: Maximum 0.15" x 0.20" water gauge pressure loss at 1000 fpm.
 - 2.2.1.4.2. Minimum 45% Free Area.

- 2.2.1.4.3. AMCA certified Class A for wind speed of 47 kph (29.1 mph) and rainfall rate of 76 mm/hour (3"/hour).
- 2.2.1.4.4. AMCA certified Class A for wind speed of 80 kph (50 mph) and rainfall rate of 200 mm/hour (8"/hour).
- 2.2.1.5. Thermal Movement: Design louvres to accommodate expansion and contraction of components due to temperature changes.
- 2.2.2. Aluminum Extrusions: ASTM B221M, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T5 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.
- 2.2.3. Aluminum Sheet: ASTM B209/B209M, type and characteristics to match finished extrusions; ensure sheet which is not exposed is Utility Aluminum mill finished; for intricate forming with decorative finishes use AA-1100 and for exposed panels use AA-3003 with specified finish.
- 2.2.4. Fasteners: Supply screws, bolts, nuts, washers, rivets and other fasteners incorporated into aluminum sections of tamperproof aluminum or ANSI Series 300 stainless steel.
- 2.2.5. Anchoring Devices: Aluminum, non-magnetic stainless steel or other non-corrosive metal compatible with aluminum. Steel anchors may be used provided they are zinc coated and insulated from aluminum.
- 2.2.6. Sealant for Precast Areas: Non-sag type, multi-component polyurethane sealant conforming to ASTM C920, Type M, Grade NS, Class 25, Use NT, G, M, A and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.6.1. "MasterSeal® NP 2™" by BASF; www.master-builders-solutions.basf.com.
 - 2.2.6.2. "Sikaflex -2c NS" by Sika Canada Inc.; www.sika.ca.
 - 2.2.6.3. "DYmeric 240" by Tremco Canada; www.tremcosealants.com.
- 2.2.7. Sealant for Areas other than Precast: Non-sag type, 1 component ultra low-modulus, pre-pigmented, neutral cure elastomeric silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 50, Use NT, G, M, A and O. Supply in standard colours as selected. Supply 1 of following:
 - 2.2.7.1. "DOWSIL™ 790 Silicone Building Sealant" by The Dow Chemical Company; www.consumer.dow.com.
 - 2.2.7.2. "GE SilPruf LM SCS2700" by Momentive Performance Materials; www.momentive.com.
 - 2.2.7.3. "Spectrem 1" by Tremco Canada; www.tremcosealants.com.
- 2.2.8. Structural Steel Supports: Supply new material conforming to CSA G40.20, Grade 300W, cleaned to SSPC-SP 3 requirements and shop primed with primer conforming to CISC/CPMA 2-75.
- 2.2.9. Bituminous Coating: Supply "Bakor 810-07" by Henry Company; www.henry.com.
- 2.2.10. Blades, Heads, Jambs and Sills: Supply minimum 2.06 mm (0.08") thick; blades fixed type, stormproof profile.
- 2.2.11. Bird Screen: Supply 13 mm (1/2") square woven mesh of 1.6 mm (0.064") dia (16 B and S ga) aluminum wire in extruded aluminum frame, 2.5 mm (0.102") (10 B and S ga) thick.
- 2.2.12. Insect Screen: Supply manufacturer's standard 14 x 18 mesh.
- 2.2.13. Blank-Off Panels: Supply fixed insulated aluminum sheet blank-off panels over back of louvres in lieu of bird screens. Ensure blank-off panel insulation R-values meet or exceed wall assembly R-value requirements.
- 2.2.14. Metal Sills: Supply 1 mm (0.040") (18 B and S ga) aluminum complete with cover plates at sill joints and drip deflectors at sill ends and at abutting vertical surfaces.

2.3. MANUFACTURED UNITS

- 2.3.1. Louvre Type: Supply aluminum construction, 150 mm (6") deep, step blade with 2.06 mm (0.081") blade and frame thickness. Provide "Model A6115" by C/S Construction Specialties Company, "Model ELF635DX" by Ruskin Company, "Model H6451" by TenPlus Architectural Products Ltd. or "Model 2620" by Ventex Inc.
- 2.3.2. Fabrication:
- 2.3.2.1. Form blades, mullions and frames to sizes and shapes indicated.
- 2.3.2.2. Provide louvre blades with extruded aluminum blade supports in section modulus and depth to resist loads anticipated and meet design requirements specified. Provide integral reinforcing ribs to prevent bowing and distortion.
- 2.3.2.3. Accurately cut and fit components to produce tight hairline junctures. Securely fasten frame members together with adequate concealed welds and seal with sealant to ensure watertight joints.
- 2.3.2.4. Fabricate bird screens using aluminum mesh securely locked into a heavy extruded aluminum channel frame. Install bird screens on the inside of louvres and screw fasten to frames to permit removal if required.
- 2.3.2.5. Coat surfaces of aluminum in contact with steel, concrete and/or masonry using specified bituminous coating.

2.3.3. Finishes: Provide 1 of following systems:

- 2.3.3.1. Superior Performance Coating Finish Process: (3 Coat Wet System (primer/colour coat/clear coat)) including thermal setting application of 70% fluoropolymer resin minimum, PVDF with added colour pigment finish exceeding or meeting AAMA 2605 requirements. Ensure fluoropolymer baked resins form a continuous physically locked finish during manufacturing process. Apply fluoropolymer finish after multistage chemical treatment cleaning providing corrosion resistance surface ready to receive primer. During baking process apply primer in accordance with manufacturer's recommendations followed by a flash process whereby evaporating solvent and then fluoropolymer finish sprayed on to aluminum; apply another flash procedure and then bake for approximately 10 minutes when aluminum surface reaches a temperature of 232 deg C (450 deg F). Permitted Products: "Duramar XL" by PPG Industries; www.ppgideascape.com or "Fluoropon® Classic" by Sherwin-Williams Coil Coatings; www.coil.sherwin.com with following characteristics:

| | Description | Performance Characteristics |
|------------|---|--|
| 2.3.3.1.1. | Coating Thickness: | 0.0063 mm +/-0.0013 mm (0.25 +/-0.05 mils) primer 0.025 mm (1.0 mil) min barrier coat (if applicable) 0.025 mm (1.0 mil) min colour coat 0.015 mm +/-0.0005 mm (0.6 +/-0.02 mil) clear top coat |
| 2.3.3.1.2. | Pre-Treatment: | Multi-Stage Cleaning with Chemical Conversion Coating |
| 2.3.3.1.3. | Gloss (ASTM D523 @ 60°): | Medium gloss |
| 2.3.3.1.4. | Pencil Hardness (ASTM D3363): | F minimum |
| 2.3.3.1.5. | Abrasion Resistance Falling Sand (ASTM D968): | 50 l/ml |
| 2.3.3.1.6. | Acid Resistance 10% Muriatic Acid Spot Test: | 15 minutes - no attack |
| 2.3.3.1.7. | Alkali Resistance-Mortar Pat Test 100% R.H. @ 100°F: | 24 hours - no attack |

- 2.3.3.1.8. Colour Retention
 10 yrs, 45° South Florida
 (ASTM D2244): $\Delta E < 5.0$
- 2.3.3.1.9. Humidity Resistance:
 ASTM D714, ASTM D2247,
 4000 hrs, 100% R.H. @ 100°F: Few #8 blisters maximum
- 2.3.3.1.10. Salt Spray Resistance:
 ASTM B117, 4000 hrs
 5% NaCl @ 100°F: 1/16" maximum undercutting
- 2.3.3.1.11. Chalking Resistance
 10 yrs, 45° South Florida
 (ASTM D4214): No more than #8 (#6 for Whites)
- 2.3.3.1.12. Erosion Resistance:
 10 yrs, 45° South Florida
 (ASTM B244): Maximum 5%
- 2.3.3.2. Superior Performance Coating Finish Process: (1 Coat Dry System) meeting or exceeding AAMA 2605 with minimum 100% fluoropolymer resin. Permitted Product: "Interpon D3000 Fluoromax Powder Coating" by Akzo Nobel Coatings, Inc.; www.akzonobel.com with following characteristics:

Description

Performance Characteristics

- 2.3.3.2.1. Coating Thickness: 0.060 mm to 0.115 mm (2.4 mils to 4.5 mils) with no reading less than 0.045 mm (1.8 mils)
- 2.3.3.2.2. Pre-Treatment: Multi-Stage Cleaning with Chemical Conversion Coating
- 2.3.3.2.3. Gloss (ASTM D523 @ 60°): 20% - 40%
- 2.3.3.2.4. Pencil Hardness
 (ASTM D3363): F minimum
- 2.3.3.2.5. Abrasion Resistance
 Falling Sand (ASTM D968): 40 l/ml
- 2.3.3.2.6. Colour Retention
 10 yrs, 45° South Florida
 (ASTM D2244): $\Delta E < 5.0$
- 2.3.3.2.7. Humidity Resistance
 ASTM D714, ASTM D2247,
 4000 hrs, 100% R.H. @ 100°F: Few #8 blisters maximum
- 2.3.3.2.8. Salt Spray Resistance
 ASTM B117, 4000 hrs
 5% NaCl @ 100°F: 1/16" maximum undercutting
- 2.3.3.3. Colours and Sheens: Refer to "Material and Finish Schedule" appended to Section 00 01 20.

2.4. SOURCE QUALITY CONTROL

- 2.4.1. Tests and Inspections:
- 2.4.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during fabrication and submits sealed and signed Field Review Report within 5 Days of visit.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Secure support frames to openings. Install louvres plumb or true to slope and at correct location in openings, with bird screens on inside. Use concealed method for attachment.
- 3.2.2. Ensure louvres connected to ductwork, plenums, silencers, etc. are sealed weathertight.
- 3.2.3. Caulk perimeter of frames to adjacent materials or to supports using joint backing and sealant. Neatly tool and finish joints.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Tests and Inspections:
 - 3.3.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
- 3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
- 3.3.3. Manufacturer Services: Arrange for Product manufacturer's technical representative to:
 - 3.3.3.1. meet and discuss installation procedures and unique conditions at the Place of the Work.
 - 3.3.3.2. inspect substrate surfaces and recommend solutions to accommodate adverse conditions.
 - 3.3.3.3. periodically visit and inspect installation and report unsatisfactory conditions to Contractor.
 - 3.3.3.4. attend final inspection and to submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

3.4. CLEANING

- 3.4.1. Maintain aluminum work in a clean condition throughout construction period, so it will be without deterioration or damage at time of review. Select methods of cleaning which will promote achievement of uniform appearance and stabilized colours and textures for materials that weather or age with exposure.
- 3.4.2. Immediately before time of Substantial Performance, clean aluminum work thoroughly, inside and out. Demonstrate proper cleaning methods to Owner during this final cleaning. Prepare a "Cleaning and Maintenance Manual" listing types of cleaning compounds and cleaning methods of the work and submit 2 copies to Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. REFERENCES

- 1.1.1. Ontario Painting Contractors Association (OPCA); Architectural Painting Specification Manual.
- 1.1.2. Canadian General Standards Board (CGSB)
 - 1.1.2.1. CGSB 1-GP-55M-82 Primer, Wood Exterior.
 - 1.1.2.2. CGSB 1-GP-138M-78 Paint, Exterior, Latex Type.
 - 1.1.2.3. CGSB 1-GP-16M-79 Shellac Varnish.
- 1.1.3. Master Painters Institute (MPI)
 - 1.1.3.1. Architectural Painting Specification Manual - [current edition].
 - 1.1.3.2. Standard GPS-1-[12], MPI Green Performance Standard.
 - 1.1.3.3. Standard GPS-2-[12], MPI Green Performance Standard.
- 1.1.4. National Fire Code of Canada.
- 1.1.5. Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - 1.1.5.1. Material Safety Data Sheets (MSDS).
- 1.1.6. National Fire Code of Canada.

1.2. SCHEDULING

- 1.2.1. Submit work schedule for various stages of painting to Consultant for approval review. Submit schedule minimum of 48 hours in advance of proposed operations.
- 1.2.2. Paint occupied facilities in accordance with approved schedule. Schedule operations to approval of Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.
- 1.2.3. Obtain written authorization from Consultant for changes in work schedule.
- 1.2.4. Schedule repainting operations to prevent disruption by other trades if applicable and by occupants in and about building.

1.3. ACTION AND INFORMATION SUBMITTALS

- 1.3.1. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- 1.3.2. Product Data:
 - 1.3.2.1. Submit manufacturer's instructions, printed product literature and data sheets for paints and coating products used and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3.3. Samples:
 - 1.3.3.1. Submit triplicate 100 x 200 mm "draw-downs" of each paint/varnish formula type and colour specified on applicable materials for Consultant's review prior to commencement of the work.
 - 1.3.3.2. Colours and finishes to be selected by Consultant.
 - 1.3.3.3. When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
- 1.3.4. Provide WHMIS Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29.06 - Health and Safety Requirements for paints and coating materials to be used.

1.4. CLOSEOUT SUBMITTALS

- 1.4.1. Provide maintenance data for incorporation into manual specified in Section 01 78 39 – Project Record Documents.
- 1.4.2. Provide records of products used. List products in relation to finish system and include following:
 - 1.4.2.1. Product name, type and use (i.e. materials and location).
 - 1.4.2.2. Manufacturer's product number.
 - 1.4.2.3. Colour code numbers.
 - 1.4.2.4. Manufacturer's Material Safety Data Sheets.
- 1.4.3. Record Documentation: submit assembled documentation in the form of a Conservation Report to document every step of the restoration process from examination of existing conditions to reinstallation.

1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications: in accordance with Section 08 03 52.71 – Historic - Wood Window Rehabilitation supplemented as follows.
 - 1.5.1.1. Carry out painting work in this section using skilled tradespersons trained and experienced in removal and installation of specified paint systems.
- 1.5.2. Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, and solvents) to be from a single manufacturer for each system used.
- 1.5.3. Conform to latest MPI requirements for exterior painting work including preparation and priming.
- 1.5.4. Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
- 1.5.5. Mock ups:
 - 1.5.5.1. Provide mock-up in accordance with Section 01 45 00 – Quality Control.
 - 1.5.5.2. Prepare and repaint designated surface or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/sheen, textures and workmanship for review and approval.
 - 1.5.5.3. Provide mock-up on a new wood surface, extant wood surface and epoxy repaired wood surface. Mock-up to determine the number of coats (over to the stated minimums) to obtain a consistent colour and finish between the 3 surfaces.
 - 1.5.5.4. When approved, repainted surface and/or item shall become acceptable standard of finish quality and workmanship for similar on-site painting work.
 - 1.5.5.5. Prepare the work described in this section on one sash and one frame selected by the Consultant. Agree on location and extent of each mock-up with Consultant.
 - 1.5.5.6. Include paint removal, to bare wood and sound painted surface, and finish painting.
 - 1.5.5.7. Provide additional mock-ups on-site for review by Consultant if initial tests prove unsatisfactory.
 - 1.5.5.8. Provide Consultant 5 working days' notice prior to undertaking work.
 - 1.5.5.9. Approved mock-up may be incorporated into final work.

1.6. DELIVERY, STORAGE AND HANDLING

- 1.6.1. Deliver, store, handle and protect materials in accordance with Section 01 61 00 – Common Product Requirements.
- 1.6.2. Deliver and store materials in manufacturers' original container with labels intact.
- 1.6.3. Ensure dry delivery and storage of materials and equipment at site.

- 1.6.4. Store materials and equipment in a well-ventilated place between 10 degrees C and 32 degrees C, and protect from direct sun.
- 1.6.5. Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
- 1.6.6. Remove paint materials from storage only in quantities required for same day use.
- 1.6.7. Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

1.7. AMBIENT CONDITIONS

- 1.7.1. Temperature, Humidity and Substrate Moisture Content Levels:
 - 1.7.1.1. Unless specifically pre-approved by Consultant and applied product manufacturer, perform no painting work when:
 - 1.7.1.2. Ambient air and substrate temperatures are below 10 degrees C.
 - 1.7.1.3. Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.
 - 1.7.1.4. Substrate and ambient air temperatures are expected to fall outside paint manufacturer's prescribed limits.
 - 1.7.1.5. Relative humidity is above 85 % or when dew point is less than 3 degrees C variance between air/surface temperature.
 - 1.7.1.6. Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - 1.7.2. Perform no painting work when maximum moisture content of substrate exceeds:
 - 1.7.2.1. 15% for wood.
 - 1.7.3. Application Requirements:
 - 1.7.3.1.1. Apply paint finish in areas where dust is no longer being generated by related construction operations.
 - 1.7.3.1.2. Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - 1.7.3.1.3. Apply paint when previous coat of paint is dry or adequately cured.
 - 1.7.3.1.4. Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
 - 1.7.3.2. Do not apply paint when:
 - 1.7.3.2.1. Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.
 - 1.7.3.2.2. Substrate and ambient air temperatures are expected to fall outside paint manufacturer's limits.
 - 1.7.3.2.3. Surface to be painted is wet, damp or frosted.
 - 1.7.3.3. Protect until paint is dry or until weather conditions are suitable.
 - 1.7.3.4. Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
 - 1.7.3.5. Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
 - 1.7.3.6. Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Only paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.
- 2.1.2. Paint materials for paint systems: to be products of single manufacturer.
- 2.1.3. Use only MPI listed materials.
- 2.1.4. Latex paint.
 - 2.1.4.1. Exterior latex paint.
 - 2.1.4.2. Alkyd primer, by same manufacturer as paint.
- 2.1.5. Wood stain and varnish:
 - 2.1.5.1. Clear sealer: compatible with stain and topcoat, to manufacturer's standards.
 - 2.1.5.2. Stain: tinted to match existing stain
 - 2.1.5.3. Top coat: post-catalyzed conversion varnish or approved equal, clear non-yellowing.

2.2. COLOURS

- 2.2.1. Consultant will provide Colour Schedule after Contract award.
- 2.2.2. Colour schedule will be based upon selection of single base colour for transom window, single stain colour for door.
- 2.2.3. Selection of colours will be from manufacturer's full range of colours with custom colour for both selected colour, to match existing.

2.3. MIXING AND TINTING

- 2.3.1. Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Consultant's written permission.
- 2.3.2. Add thinner to paint manufacturer's recommendations.
- 2.3.3. Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4. PAINTING SYSTEMS

- 2.4.1. Windows: EXT 6.2L latex paint (over latex primer). Gloss level to be confirmed by Consultant (to be confirmed)
- 2.4.2. Doors: EXT 6.3E varnish (over stain). Gloss level to be confirmed by Consultant (to be confirmed)

2.5. TOOLS

- 2.5.1. Brush: natural bristle brushes of size and shape to suit application.
- 2.5.2. Rags: micro fibre rags
- 2.5.3. Mechanical tools without sharp edges.
- 2.5.4. Scouring pad: plastic mesh.
- 2.5.5. Window putty scraper, tools for re-puttying.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for painting in accordance with manufacturer's written instructions.

3.1.1.1. Inform Consultant of unacceptable conditions immediately upon discovery.

3.1.2. Proceed with installation only after unacceptable conditions have been remedied.

3.2. PREPARATION (PAINT REMOVAL)

3.2.1. For window sashes, door leaves and other disassembled wood components, remove paint to bare wood in shop by either the careful use of infrared light, heat guns or steam, followed by scraping and sanding.

3.2.2. For window and door frames, remove paint remove paint to bare wood in situ by either the careful use of infrared light, heat guns or steam, followed by scraping and sanding.

3.2.2.1. Neatly remove any existing caulking, sealants and putty

3.2.2.2. Scraping and sanding shall be done carefully so as not to gouge or otherwise alter the profiles of mouldings. Orbital sanders are not allowed.

3.2.2.3. Customize blades for scrapers to match the shape of the original profiles.

3.2.2.4. Sand elements lightly and ease corners in preparation for painting. Carefully sand to achieve smooth surface without altering profiles, feather edges, remove all dust with vacuum, and wipe clean.

3.2.2.5. Apply knot sealer recommended by paint manufacture and in accordance with manufacturer's written instructions.

3.2.2.6. Keep all surfaces dry until painting is complete.

3.2.2.7. Remove dust, dirt, and surface debris by brushing, wiping with dry, clean cloths or compressed air.

3.2.3. For new wood, sand surfaces to remove mill scale and wipe clean.

3.2.3.1. Clean unpainted exterior surfaces with soap using scouring pad. Rinse thoroughly with water; be careful not to over soak. Let dry 24 hours.

3.2.3.2. Prevent contamination of cleaned surfaces by salts, acids, alkalis, corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

3.2.3.3. Do not apply paint until prepared surfaces have been accepted by Consultant.

3.2.3.4. Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.3. APPLICATION

3.3.1. Method of application to be as approved by Consultant. Apply paint by brush. Conform to manufacturer's application instructions unless specified otherwise.

3.3.2. Exterior and Interior Paint Latex:

3.3.2.1. Have Consultant approve repairs prior to refinishing.

3.3.2.2. Paint all wood components with one coat of oil primer and two coats of specified finish paint using appropriate equipment.

3.3.3. Staining:

3.3.3.1. Have Consultant approve repairs prior to refinishing.

- 3.3.3.2. Stain and varnish using brushes only onsite; spray application is not permitted onsite but may be used in shop. Follow applicable requirements of MPI Architectural Painting Specifications Manual.
- 3.3.3.3. Seal all woodwork with seal coat. Sand lightly to 150 grit; clean and prepare for staining.
- 3.3.3.4. Stain evenly using stain to match approved samples.
- 3.3.3.5. Apply three coats of satin spar varnish while sanding between second and third coat.
- 3.3.4. Remove runs, sags and brush marks from finished work and repaint.
- 3.3.5. Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- 3.3.6. Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- 3.3.6.1. Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.4. CLEANING

- 3.4.1. Proceed in accordance with Section 01 74 11 – Cleaning and Waste Management.
- 3.4.2. Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- 3.4.3. Keep work area free from unnecessary accumulation of tools, equipment, surplus materials and debris.
- 3.4.4. Clean equipment and dispose of wash water used for water borne materials, solvents used for oil based materials as well as cleaning and protective materials (e.g. rags, drop cloths, and masking papers), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction and as specified.
- 3.4.4.1. Clean brushes and tools with soap from same product line and manufacturer as the paint.

3.5. RESTORATION

- 3.5.1. Clean and re-install hardware items removed before undertaken painting operations.
- 3.5.2. Remove protective coverings and warning signs as soon as practical after operations cease.
- 3.5.3. Remove paint splashings on affected exposed surfaces. Remove smears and spatter immediately as operations progress, using compatible solvent.
- 3.5.4. Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.
- 3.5.5. Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.6. PROTECTION OF COMPLETED WORK

- 3.6.1. Protect area where paint has been applied.
- 3.6.2. On completion of specified work remove surplus materials, tools and equipment and debris on work area; leave clean and tidy to complete satisfaction of Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide gypsum board assemblies work including but not limited to following:
 - 1.2.1.1. supplementary steel supports for ceilings.
 - 1.2.1.2. reinforcement for suspension systems for lighting fixtures, access hatches, etc.
 - 1.2.1.3. steel studs and furring channels.
 - 1.2.1.4. concealed sheet steel reinforcing.
 - 1.2.1.5. ceiling, bulkhead and soffit suspension system.
 - 1.2.1.6. gypsum board ceilings, partitions, bulkheads and soffits.
 - 1.2.1.7. gypsum board directly applied to masonry and concrete surfaces.
 - 1.2.1.8. shaft wall.
 - 1.2.1.9. corner beads, casing beads, trim, control joints and corner reinforcement.
 - 1.2.1.10. taping and filling.
 - 1.2.1.11. acoustically insulated gypsum board partitions.
 - 1.2.1.12. acoustic caulking to acoustically insulated gypsum board partitions.
 - 1.2.1.13. fire rated wall assemblies.
 - 1.2.1.14. installation of access hatches, panels and doors supplied by other trades in gypsum board walls and ceilings as required.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of structural steel studs and exterior sheathing: Section 05 41 00, Structural Metal Stud Framing System.
 - 1.2.2.2. Miscellaneous steel sections and/or framing required to provide additional structural support to suit Project requirements: Section 05 50 00, Metal Fabrications.
 - 1.2.2.3. Installation of hollow metal door and borrowed light frames and frame anchors in gypsum board partitions: Section 06 90 00, General Installations.
 - 1.2.2.4. Firestopping, smoke seals and penetration firestopping: Section 07 84 00, Firestopping and Smoke Seals.
 - 1.2.2.5. Finish painting of gypsum board: Section 09 91 00, Painting.
- 1.3. REFERENCES
 - 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. OBC: Ontario Building Code.
 - 1.3.1.2. STC: Sound Transmission Class.
 - 1.3.1.3. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.

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| 1.3.2. | Definitions: | |
| 1.3.2.1. | Drywall: Gypsum board. | |
| 1.3.3. | Reference Standards: | |
| 1.3.3.1. | ASTM A653/A653M-23 | - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| 1.3.3.2. | ASTM A666-23 | - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar |
| 1.3.3.3. | ASTM C475/C475M-17(22) | - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board |
| 1.3.3.4. | ASTM C645-18 | - Standard Specification for Nonstructural Steel Framing Members |
| 1.3.3.5. | ASTM C754-20 | - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products |
| 1.3.3.6. | ASTM C840-20 | - Standard Specification for Application and Finishing of Gypsum Board |
| 1.3.3.7. | ASTM C954-22 | - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness |
| 1.3.3.8. | ASTM C1047-19 | - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base |
| 1.3.3.9. | ASTM C1178/C1178M-18 | - Standard Specification Coated Glass Mat Water-Resistant Gypsum Backing Panel |
| 1.3.3.10. | ASTM C1280-18 | - Standard Specification for Application of Exterior Gypsum Panel Products for use as Sheathing |
| 1.3.3.11. | ASTM C1396/C1396M-17 | - Standard Specification for Gypsum Board |
| 1.3.3.12. | ASTM C1629/C1629M-19 | - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels |
| 1.3.3.13. | ASTM C1658/C1658M-19e1 | - Standard Specification for Glass Mat Gypsum Panels |
| 1.3.3.14. | ASTM D3273-21 | - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber |
| 1.3.3.15. | ASTM D4060-19 | - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser |
| 1.3.3.16. | ASTM D4397-16 | - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications |
| 1.3.3.17. | ASTM D5420-21 | - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact) |
| 1.3.3.18. | ASTM E90-09(16) | - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements |

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| 1.3.3.19. | ASTM E580/E580M-22 | - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions |
| 1.3.3.20. | ASTM E695-22 | - Standard Test Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading |
| 1.3.3.21. | CSA S136-16(21) | - North American Specification for Design of Cold-Formed Steel Structural Members |
| 1.3.3.22. | CAN/ULC-S101-14 | - Standard Methods of Fire Endurance Tests of Building Construction and Materials |
| 1.3.3.23. | CAN/ULC-S102-18 | - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |
| 1.3.3.24. | CAN/ULC-S114-18 | - Standard Method of Test for Determination of Non-Combustibility in Building Materials |
| 1.3.3.25. | CAN/ULC-S702.1-21 | - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Sequencing:
- 1.4.1.1. Coordinate installation and cooperate with mechanical and electrical trades to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with ceiling and soffit systems.
- 1.4.1.2. Cooperate and coordinate with Sections applying wet trades and trades installing mechanical and electrical services. Coordinate stud layout at partitions accommodating wall mounted fixtures by other trades.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings:
- 1.5.1.1. Submit Shop Drawings in accordance with Section 01 30 00 showing design, construction, control joint layout, sound attenuating construction, adjacent construction, elevations, finishes and relevant details of furring, enclosures and partitions which require fire rating in accordance with ULC Design Numbers shown on Drawings.
- 1.5.1.2. Ensure a licensed engineer specified herein is responsible for:
- 1.5.1.2.1. production and review of Shop Drawings.
- 1.5.1.2.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.5.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
- 1.5.2.1. each trim accessory minimum 300 mm (12") long.
- 1.5.3. Certificates:
- 1.5.3.1. Submit certification from licensed engineer registered in Province of Ontario, ensuring his/her seal and signature is affixed to certificate, stating that installed suspended ceiling system is capable of supporting its own weight and weight of lighting, grilles and other mechanical and electrical fixtures required by Mechanical and Electrical Divisions.
- 1.5.3.2. Obtain approval of electrical utility authorities having jurisdiction for support of light fixtures, by ceiling grid and supports, to satisfy requirements of electrical inspection department of Ontario Hydro. Adjust grid, fixing devices and support hangers as required to obtain approval.

1.6. QUALITY ASSURANCE

1.6.1. Qualifications:

- 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.6.1.2. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements: Deliver materials to site with manufacturer's original labels intact. Do not remove wrappings until ready for use.
- 1.7.2. Storage and Handling Requirements:
 - 1.7.2.1. No outside storage permitted. Store in clean, dry area, off ground. Provide adequate ventilation to avoid excess moisture, surface relative humidity and mould or fungal growth. Remove immediately any board showing signs of mould, mildew or fungal growth.
 - 1.7.2.2. Stack gypsum board flat on level and dry surface without overhanging boards. Prevent sagging and damage to edges, ends and surfaces. Protect bagged Products from moisture or wetting.

1.8. SITE CONDITIONS

- 1.8.1. Ambient Conditions:
 - 1.8.1.1. Do not install work of this Section in any area unless satisfied that work in place has dried out and that no further installation of materials requiring wetness, moisture or dampness is contemplated. Ensure relative humidity in area of work of this Section does not exceed 55% for duration of Project.
 - 1.8.1.2. Ensure temperature of surrounding areas is min 13 deg C (55 deg F) and max 21 deg C (70 deg F) for 7 Days before and during application of gypsum board; maintain for 4 Days thereafter. Ensure heat is provided at appropriate time before work has started to bring surrounding and adjacent materials up to required temperature and maintained as specified. Avoid concentrated or irregular heating during drying by means of deflectors or protective screens.
 - 1.8.1.3. Ensure ventilation is provided for proper drying of joint filler and adhesive and to prevent excessive humidity. Do not force dry adhesives and joint treatment.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Bailey Metal Products Ltd.; www.bmp-group.com
 - 2.1.1.2. CertainTeed Corporation; www.certainteed.com
 - 2.1.1.3. CGC Inc; www.cgcinc.com
 - 2.1.1.4. Dass Metal Studs; www.dassmetal.com
 - 2.1.1.5. Fusion Building Products; www.imperialgroup.ca
 - 2.1.1.6. Georgia-Pacific Canada LP; www.buildgp.com
 - 2.1.1.7. Imperial Manufacturing Group; www.imperialgroup.ca
 - 2.1.1.8. Roll Formed Specialty; www.rollformed.com

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

- 2.2.1.1. Design ceiling suspension system in accordance with manufacturer's printed directions and conforming to ASTM C754 requirements. Do not suspend any items from structural steel deck. Do not support work of this Section from, nor make attachments to, ducts, pipes, conduits or support framing of other trades.
- 2.2.1.2. Design suspended ceiling system for adequate support of electrical fixtures as required by current bulletin of Electrical Inspection Department of Ontario Hydro.
- 2.2.1.3. Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.
- 2.2.1.4. Design suspension system to support weight of mechanical and electrical items such as air grilles, lighting fixtures, drapery track, drapes and with adequate support to allow rotation/relocation of light fixtures.
- 2.2.1.5. Design interior partitions and ceilings using a maximum deflection criteria of L/240 with a minimum lateral load of 0.239 kPa (5 psf) unless otherwise specified herein. Where tile is being applied or height is greater than 3 m (10') use L/360 with a minimum lateral load of 0.239 kPa (5 psf).
- 2.2.1.6. Design sub-framing as necessary to accommodate and circumvent conflicts and interferences where ducts or other equipment prevent regular spacing of hangers.
- 2.2.1.7. Design steel stud reinforcements from hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel minimum 43 mils designation thickness (1.087 mm (0.0428") minimum base steel thickness) (previously 18 ga) where required to support manufactured components without limitations items such as washroom accessories, expansion control covers and similar items. Design weld connections ensuring rigid and secure installation capable of offering resistance to minimum 227 kg (500 lb) pull force. Consider galvanized items in moist areas. Do not design using wood blocking for this purpose.
- 2.2.1.8. Design fire rated construction including ceiling, partition or fire protective membranes and furring to approved ULC design or other design acceptable to authorities having jurisdiction, to provide design fire rating indicated and/or required. Submit written evidence of permitted test design.
- 2.2.1.9. Provide sound rated construction having STC rating indicated and tested in accordance with ASTM E90.
- 2.2.1.10. Ensure partitions acting as guards, including walls around shafts or where floor elevation on 1 side of a wall is more than 600 mm (23-5/8") higher than elevation of floor or ground on other side complies with OBC, Division B, Part 4, Article 4.1.5.16. Provide Shop Drawings bearing seal of a licensed engineer registered in Province of Ontario confirming this requirement.
- 2.2.1.11. Structural Design: Employ a licensed engineer specified herein to:
 - 2.2.1.11.1. design components for work of this Section requiring structural performance.
 - 2.2.1.11.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
- 2.2.2. Steel Studs: CSA S136 and ASTM C645, galvanized sheet steel, minimum 18 mils designation thickness (0.455 mm (0.0179") minimum base steel thickness) (previously 25 ga), minimum Z120 (G40) zinc coating, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths possible. Provide thicker steel in accordance with Section 05 41 00 where required due to height.

- 2.2.3. Heavy Duty Steel Studs at Openings: CSA S136 and ASTM C645, galvanized sheet steel, minimum 54 mils designation thickness (1.367 mm (0.0538") minimum base steel thickness) (previously 16 ga), minimum Z120 (G40) zinc coating, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths possible. Provide thicker steel where required due to height.
- 2.2.4. Studs Supporting Abuse Resistant Gypsum Boards: CSA S136 and ASTM C645, galvanized sheet steel, minimum 33 mils designation thickness (0.836 mm (0.0329") minimum base steel thickness) (previously 20 ga structural). Provide 50 mm (2") deep flanges on ceiling tracks to allow for deflection of structure. Use 92 mm (3-5/8") width unless otherwise noted. Use 0.914 mm (20 ga) solid web members at ceiling and floor tracks.
- 2.2.5. Provide knockout openings in web at 460 mm (18") oc to accommodate (if required) horizontal mechanical and electrical service lines and bracing.
- 2.2.6. Concealed Sheet Steel Reinforcing: Commercial quality galvanized sheet to ASTM A653/A653M, 1.214 mm (18 ga) thick minimum, Z275 (G90) zinc coated by hot-dip process or ASTM A666, Type 304 sheet stainless steel.
- 2.2.7. Floor and Ceiling Partition Track for Gypsum Board: CSA S136 and ASTM C645, galvanized sheet steel, minimum 18 mils designation thickness (0.455 mm (0.0179") minimum base steel thickness) (previously 25 ga), minimum Z120 (G40) zinc coating, with minimum 30 mm (1-1/4") legs, top track having longer legs where required to compensate for deflection of structure above. Width to suit steel studs.
- 2.2.8. Furring Channels: CSA S136 and ASTM C645, galvanized sheet steel, minimum 18 mils designation thickness (0.455 mm (0.0179") minimum base steel thickness) (previously 25 ga), minimum Z120 (G40) zinc coating, screw channels, 67 mm (2-5/8") wide x 22 mm (7/8") deep.
- 2.2.9. Carrying Channels for Gypsum Board: CSA S136 and ASTM C645, galvanized sheet steel, minimum 43 mils designation thickness (1.087 mm (0.0428") minimum base steel thickness) (previously 18 ga), minimum Z120 (G40) zinc coating, 38 mm (1-1/2") high with 19 mm (3/4") flanges, for primary carrying member in suspended ceilings and as horizontal stiffeners or bracing in steel stud systems.
- 2.2.10. Premanufactured Grid Suspension System for Ceilings: ASTM C645, direct-hung system composed of commercial-quality, cold-rolled steel, main beams and cross-furring members that interlock with following characteristics:
 - 2.2.10.1. Main Tees: Fire-Rated Heavy Duty classification with integral reversible splice with knurled face.
 - 2.2.10.2. Cross Members: Fire-Rated members with knurled face.
 - 2.2.10.3. Cross Tees: Cross tee 38 mm (1-1/2") high x 1220 mm (48") long with 38 mm (1-1/2") wide face.
 - 2.2.10.4. Furring Channel: Furring channel 22 mm (7/8") high x 1220 mm (48") long with 38 mm (1-1/2") face.
 - 2.2.10.5. Accessory Cross Tees: Complete with knurled faces.
 - 2.2.10.6. Wall Mouldings: Single web with knurled face.
 - 2.2.10.7. Accessories: Transition clips, Splice clips, wall attachment clips, splice plates and dome hubs as recommended by manufacturer for specific applications.
 - 2.2.10.8. Finish: Hot-dipped galvanized.
 - 2.2.10.9. Permitted Products: "Drywall Grid Systems" by Armstrong World Industries Canada Ltd.; www.armstrongceilings.com or "Drywall Suspension System" by CGC Inc.
- 2.2.11. Resilient Channel Furring: CSA S136 and ASTM C645, "RC-1 Resilient Channel" by CGC Inc. or other permitted manufacturer.

- 2.2.12. Steel Spring Isolator Hangers for Sound Isolation: Steel spring encased in welded steel brackets of size recommended by manufacturer to suit load conditions and to provide minimum 30 mm (1-3/16") static deflection with at least 50% overload reserve deflection capacity. Factory pre-compress spring element to within 6 mm (1/4") of anticipated operating height. Ensure brackets are cadmium plated designed to carry 500% overload without failure. Design hangers to accommodate rod misalignment over 30° arc. Equip hanger assembly with eyebolts both top and bottom. Ensure sound spring isolator hangers are by Kinetics Noise Control, Inc.; www.kineticsnoise.ca, Vibro-Acoustics; www.vibro-acoustics.com or Mason Industries, Inc.; www.mason-industries.com represented by Tecoustics.
- 2.2.13. Hangers: 4.8 mm (3/16") nominal diameter mild steel rod coated with rust inhibitive paint for elsewhere.
- 2.2.14. Inserts for Concrete Slabs: Tie wire anchors, "Red Head TW-1614" by ITW Canada Inc., "Parabolt Wire Hanger" distributed by Acrow-Richmond Ltd., "T-14 Eyebolt" by Ramset Ltd., "HHDCA" or "HLC-T" by Hilti (Canada) Corporation or "Tie Wire Drive TW-932" by Isometric Ltd.
- 2.2.15. Tie Wire: 1.519 mm (16 ga) nominal diameter galvanized, soft annealed steel.
- 2.2.16. Screws for Sheet Steel Members: ASTM C954, self-drilling, self-tapping gypsum board screws, 25 mm (1") long #6 for single layer application, 41 mm (1-5/8") long #7 for double layer application and as follows:
- 2.2.16.1. For single layer application over steel framing; self-drilling, self-tapping, case hardened, No. 6 contoured Phillips head or Type S bugle head, sized for minimum 15.9 mm (5/8") penetration into steel framing. Ensure fasteners are corrosion resistant. Use drill point screws for abuse resistant gypsum fibre panels.
- 2.2.16.2. For double layer application over gypsum backing board and existing gypsum board; 38 mm (1-1/2") Type G bugle head. For each additional layer of board, increase length of fasteners proportionally.
- 2.2.17. Gypsum Board (GB or GWB): Conforming to ASTM C1396/C1396M. Unless indicated otherwise use 1200 mm (4') wide standard facing board in maximum continuous lengths up to 3600 mm (12'), beveled and/or tapered edges to suit design requirements with butted square ends:
- 2.2.17.1. Gypsum Board (Walls): Provide 15.9 mm (5/8") thick with tapered edges unless otherwise specified as follows:
- 2.2.17.1.1. Provide 9.5 mm (3/8") thick gypsum board on curved walls.
- 2.2.17.2. Gypsum Board (Ceiling): Provide 12.7 mm (1/2") and 15.9 mm (5/8") thick with tapered edges unless otherwise specified as follows:
- 2.2.17.2.1. Use anti sag sheets.
- 2.2.18. Moisture Resistant Gypsum Board (MRGB): ASTM C1658/C1658M, glass mat reinforced, silicone treated core gypsum board, ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 12.7 mm (1/2") or Type X, 15.9 mm (5/8") "DensArmor Plus® High Performance Interior Panel" by Georgia-Pacific Canada LP, "CGC Sheetrock® Brand Glass-Mat Panel Mold Tough®" by CGC Inc. or "M2TECH®" by CertainTeed Corporation.
- 2.2.19. Fire Rated Gypsum Board having Testing Agency Fire Rating Identification Stamp on Each Sheet: ASTM C1396/C1396M, Type X, 12.7 mm (1/2") and/or 15.9 mm (5/8") thick gypsum board 1200 mm (4') wide, maximum practical length and tapered edge as required by each fire resistance assembly. "Gyproc Fireguard Type X or Type C" by Georgia-Pacific Canada LP, "CGC Sheetrock Firecode or Firecode C" by CGC Inc. or "CERTAINTEED® Type X or Type C" by CertainTeed Corporation.

- 2.2.20. Gypsum Board Tile Backer Board: ASTM C1178/C1178M, glass mat reinforced, water-resistant gypsum core board, with a rating of 10 in accordance with ASTM D3273, no mould growth after 4 weeks exposure, 15.9 mm (5/8") thick plain or Type X; "DensShield® Tile Backer" by Georgia-Pacific Canada LP or "CGC Durock® Brand Glass-Mat Tile Backerboard" by CGC Inc. or "GlasRoc® Tile Backer" by CertainTeed Corporation.
- 2.2.21. Abuse Resistant Gypsum Board (ARGB): Provide 1 of following:
- 2.2.21.1. Enhanced gypsum core encased in heavy duty paper facers on front and back, 16 mm (5/8"), conforming to ASTM C1396/C1396M and attaining a maximum of 0.014" as tested to ASTM D4060 (H-18 abrasion wheel, 500 grams, 200 cycles), a maximum of 0.123" indentation as tested to ASTM D5420 (72 in lbs) and a minimum of (133 ft lbs) as tested to ASTM E695 (50 lb bag) and ASTM C1629/C1629M Type X in fire rated assemblies, "EXTREME ABUSE" by CertainTeed Corporation or "CGC Sheetrock® Brand Mold Tough® AR Firecode Core" by CGC Inc.
- 2.2.21.2. Enhanced gypsum core encased in fiberglass facers on front and back, 15.9 mm (5/8"), conforming to ASTM C1396/C1396M and attaining a maximum of 0.014" as tested to ASTM D4060 (H-18 abrasion wheel, 500 grams, 200 cycles), a maximum of 0.123" indentation as tested to ASTM D5420 (72 in lbs) and a minimum of (133 ft lbs) as tested to ASTM E695 (50 lb bag) and ASTM C1629/C1629M Type X in fire rated assemblies, "DensAmor Plus® Abuse Guard" by Georgia-Pacific Canada LP.
- 2.2.22. Dust Barrier: Minimum 0.152 mm (6 mil) polyethylene in accordance with ASTM D4397.
- 2.2.23. Resilient Sponge Tape: Self-sticking adhesive on 1 side, closed cell neoprene sponge tape, "Rubatex®" by Rubatex Corp., "Foamflex # 1220" by Jacobs & Thompson Inc.; www.foamparts.com or "Backerseal™ (Greyflex)™" by Emseal; www.emseal.com.
- 2.2.24. Laminating Compound: Asbestos-free, as recommended by manufacturer. Manufacturer's standard, multi-purpose construction adhesive, "Sheetrock Brand Laminating Compound" by CGC Inc., "Dehydratine 9T" by Grace Construction Products or "Stangard Foamastic" by Standard Chemicals Ltd. At fire-rated construction, use adhesive which conforms to that used in applicable fire tests.
- 2.2.25. Joint Tape: Conforming to ASTM C475/C475M, provide following:
- 2.2.25.1. Regular Gypsum Board: Use either kraft paper joint tape with feathered edges and minute perforations 50 mm (2") wide.
- 2.2.25.2. MRGB: Use glass fibre tape only, open weave, with pressure sensitive adhesive 1 side, "Durock Cement Board Tape" by CGC Inc.
- 2.2.26. Joint Fillers and Topping Compound: Either slow or fast setting, low shrinkage type free of asbestos fillers and as recommended by manufacturer. Use "Gyproc 90" by Georgia-Pacific Canada LP or "Durabond 90" by CGC Inc. at exterior soffits.
- 2.2.27. Sealant for Moisture Resistant Gypsum Board Edges: "Sheetrock Brand W/R Sealant" by CGC Inc., or similar type reviewed by Consultant.
- 2.2.28. Corner Bead: ASTM C1047, "Dur-A-Bead™ No. 103 Corner Bead" by CGC Inc. at corners, reveals, or similar. Provide custom shapes of similar materials and design as noted.
- 2.2.29. Metal Trim: CGC No.200-A or BMP D-4411 in lieu of "J" Mould. Do not provide "J" Mould (CGC No. 400-A) unless specifically noted on Drawings as 'Exposed "J" Mould'.
- 2.2.30. Attachment Clips: "Revoe Clips" by Revoe Manufacturing Ltd.; www.revoe-clips.com, type to suit design requirements complete with screws and other fastening system.
- 2.2.31. Control Joints: Prefabricated control joints prepared to suit site conditions; "No. 093" by CGC Inc. zinc alloy control joint.
- 2.2.32. Access Doors and Panels:
- 2.2.32.1. Supplied as part of Divisions 20, 21, 22, 23, 26, 27 and 28 for installation as part of this Section.

- 2.2.32.2. Access Panels for Items Other Than Mechanical and Electrical: Refer to Section 08 31 13 as applicable.
- 2.2.33. Shaftwall:
- 2.2.33.1. Supply components from same manufacturer. Ensure components are compatible and tested by an independent testing facility acceptable to authorities having jurisdiction.
- 2.2.33.2. Ensure shaftwall framing, shaftliner, gypsum board and joint treatment materials provide 1, 2 or 3 hour fire resistance rating as noted on Drawings when tested in accordance with CAN/ULC-S101.
- 2.2.33.3. Shaftwall Framing including Galvanized Steel Studs and Runners: 64 mm (2-1/2"), minimum 18 mils designation thickness (0.455 mm (0.179") minimum base steel thickness) (previously 25 ga) thick galvanized steel, designed for use in shaftwall construction. C-T Studs, J-L Corner and J track and other associated components by Georgia-Pacific Canada, Inc. or C-H or C-T and E studs, J runners and other associated components, "Sheetrock® Brand Glass-Mat Liner Panels" by CGC Inc., "Dens Glass Ultra Shaftliner" by Georgia-Pacific Canada LP or "GlasRoc® Shaftliner Type X" by CertainTeed Corporation fabricated specially for gypsum shaftliner and facing boards in lengths up to 3600 mm (12'). Ensure shaftwall system for elevator shafts does not have pointed ends of screws penetrating into shaft.
- 2.2.33.4. Liner Panels: 25 mm (1") shaft wall liner panels with bevelled edges.
- 2.2.33.5. Face Boards: 13 mm (1/2") or 16 mm (5/8") thick fire rated gypsum boards.
- 2.2.34. Sound Control Materials:
- 2.2.34.1. Sound Attenuation Batts: CAN/ULC-S702.1, mineral (glass and stone wool) fibre, flame spread and smoke developed in conformance with OBC requirements and other authorities having jurisdiction in accordance with CAN/ULC-S102. Non-combustible in accordance with requirements of CAN/ULC-S114. Permitted Products: "EcoTouch™ QuietZone® PINK™ FIBERGLAS® Acoustic Insulation" by Owens Corning Canada LP; www.insulation.owenscorning.ca, "ROCKWOOL™ AFB - Acoustical Fire Batt Insulation" by ROCKWOOL™ International A/S; www.rockwool.com, "Sound-SHIELD® Formaldehyde-Free Fiber Glass Insulation" by Johns Manville Canada Inc.; www.jm.com, "NoiseReducer™ Sound Attenuation Batts" by CertainTeed Corporation or "Thermafiber® SAFB™ Mineral Wool Insulation" by Thermafiber, Inc. (Owens Corning Canada LP); www.thermafiber.com, of sufficient thickness to meet required STC rating for sound-rated partitions and of width to suit metal framing spacing and other miscellaneous spacings.
- 2.2.34.2. Strip Impalement Clips: 25 mm (1") wide strip of "Insul-Hold" by Insul-Hold Co., Inc.; www.insulhold.com, fabricated from 0.531 mm (25 ga) galvanized sheet metal in 30 m (100') rolls with punch-out insulation securement arrows. Alternatively, use special studs with punch-out impalement strips.
- 2.2.34.3. Acoustic Sealant: Single component, non-hardening, non-skinning synthetic rubber sealant; "CP 506 Smoke and Acoustic Sealant" by Hilti (Canada) Corporation; www.hilti.ca or "Tremco Acoustical Sealant" by Tremco Canada; www.tremcosealants.com.
- 2.2.34.4. Elastomeric Sealant: As recommended by manufacturer of fibre-reinforced gypsum sheathing board.
- 2.2.34.5. Gaskets: Closed cell neoprene, 3 mm (1/8") thick x 64 mm (2-1/2") wide.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Partition Types:

- 3.2.1.1. Refer to Drawings for partition types.

- 3.2.1.2. Provide partitions complete to underside of structure, unless otherwise indicated on Drawings.

- 3.2.2. Give minimum 48 hours notice for Consultant's inspection of internal wall insulation, vapour barriers and services prior to concealing with gypsum board.

- 3.2.3. Provide adequate ventilation to eliminate excessive moisture before commencing and during work to ensure proper drying of joint filler and adhesive. Do not force dry adhesive and joint treatment.

- 3.2.4. Examine substrate for compliance with applicable requirements, installation tolerances and other conditions affecting installation of fibre-reinforced gypsum board or sheathing. Do not proceed until unsatisfactory conditions have been corrected. Beginning installation indicates acceptance of substrate conditions.

- 3.2.5. Carry out work using skilled tradesmen carefully supervised by competent foremen. Take measurements accurately.

- 3.2.6. Install framing, blocking and furring in accordance with ASTM C645, ASTM C1280 and ASTM C840.

- 3.2.7. Maintain wallboard panels minimum 6 mm (1/4") and maximum 13 mm (1/2") above floor to prevent moisture transfer. Unless otherwise shown, extend panels to minimum 100 mm (4") above finished ceiling and to underside of deck or structure where exposed and at fire rated and sound control partitions. Omit taping and filling of concealed surfaces above ceiling line, except at fire rated and sound control partitions and walls.

- 3.2.8. Erect plain wallboard vertically or horizontally, whichever results in fewer end joints. Keep end joints away from prominent locations and central portions of ceilings. Locate vertical joints at least 300 mm (12") from jamb lines of openings.

- 3.2.9. Do not secure gypsum board by installing screws into aluminum or steel window and door frames.

- 3.2.10. Install resilient sponge tape where gypsum board ceilings abut heads of door frames and where wallboard abuts heads or jambs of exterior door and window frames. Adhere tape to casing bead and compress during installation. Compressed thickness; 1.6 mm (1/16").

- 3.2.11. At partitions except shaft walls, apply 1 continuous 6 mm (1/4") bead of acoustical sealant to each side of partition where gypsum board meets dissimilar materials. Where 2 layers of gypsum board per face are required, apply bead of sealant at perimeter of base layer only.

- 3.2.12. Apply sealant beads at perimeter of other services and like objects which penetrate wallboard in accordance with manufacturer's directions.

- 3.2.13. Install access panels in locations to be determined by coordination with trades installing mechanical, electrical and other building services. Consultant reserves right to relocate access panels up to 3600 mm (12') from locations shown on Drawings due to site conditions, providing ample warning is given prior to installation.

- 3.2.14. Steel Framing for Partitions and Bulkheads:

- 3.2.14.1. Comply with recommendations of CGC Drywall Steel-Framed Systems Folder 09250-SA 923 for steel stud partition, ceiling, column fireproofing and bulkhead detailing.

- 3.2.14.2. Provide partition tracks at floor and underside of ceiling or structure above. Align accurately. Lay out to partition layout.

- 3.2.14.3. Erect partial height and curved partitions as indicated.

- 3.2.14.4. Place studs vertically at 400 mm (16") oc unless otherwise specified and/or as required, not more than 50 mm (2") from abutting walls, and at each side of openings and corners. Position studs in tracks. Cross brace studs as required to provide rigid installation.
- 3.2.14.5. Provide heavy duty double boxed studs at each side of openings to extend in 1 piece from floor to underside of structure above.
- 3.2.14.6. Co-ordinate erection of studs and installation of service lines.
- 3.2.14.7. Do not secure studs to exterior window framing, or to ceiling grid members.
- 3.2.14.8. Provide continuous gasket between ceiling tracks and structure.
- 3.2.15. Provide continuous horizontal furring channels as backing to wall cabinets.
- 3.2.16. Access Doors and Panels: Install access doors and panels supplied as part of work of Divisions 20, 22, 23 and 26 and where required as part of work of this Section in walls, bulkheads, ceilings and soffits.
- 3.2.17. Metal Furring:
 - 3.2.17.1. Erect furring in accordance with manufacturer's directions and as specified herein.
 - 3.2.17.2. Provide furring rigid, secure, square, level or plumb, framed and erected to maintain finish dimensions and contours indicated. Allow for thermal movement.
 - 3.2.17.3. Furr around ducts, pipes and dropped beams occurring in finished areas and for vertical gypsum board breaks within or at termination of ceilings.
 - 3.2.17.4. Provide metal furring channels fastened to masonry or concrete surfaces in parallel rows at 400 mm (16") oc unless gypsum board is indicated to be adhered directly to masonry or concrete surfaces. Shim metal furring channels to provide a level surface.
- 3.2.18. Shaft Wall:
 - 3.2.18.1. Construct shaft wall assemblies to provide fire resistance ratings indicated, from both sides, and to maintain airtight seal.
 - 3.2.18.2. Install shaft wall studs at centres to meet design requirements in accordance with manufacturer's instructions or fire rated test design. Provide framing to enclose sides, tops and bottoms of shafts terminating at floor or in ceiling space, to maintain fire rating of shaft assembly.
 - 3.2.18.3. Install shaft wall liner in accordance with manufacturer's instructions at areas where specially designed studs require shaft wall liner panel application as required.
 - 3.2.18.4. Apply continuous sealant around partitions to ensure airtight shaft enclosures. Firestopping and smoke seals at penetrations specified under Section 07 84 00.
 - 3.2.18.5. Where shaft wall height exceeds maximum available panel height, ensure liner panel joints are positioned within upper and lower third points of wall and staggered to prevent continuous horizontal joint.
 - 3.2.18.6. Frame around duct openings through shaft walls with 'J' runners.
- 3.2.19. Gypsum Board Application:
 - 3.2.19.1. Provide gypsum board in accordance with manufacturer's written installation instructions and finish to requirements of ASTM C840. Install MRGB on any wall/partition with a paint finish containing a plumbing fixture (i.e. water closets, sinks, tubs, etc.). Install gypsum board tile backer board on any wall/partition requiring a tile finish.
 - 3.2.19.2. Provide metal trim casing bead at junctions with dissimilar materials. Provide reveals at junctions with dissimilar materials where indicated.

- 3.2.19.3. Provide curved uniform surfaces by wetting or dampening board or scoring back gypsum board and form to profiles indicated. Provide additional screws and framing members to maintain design curve. Apply joint compound and trowel smooth to provide continuous, smooth radius free from flat spots, facets and trowel marks. Allow gypsum boards to dry thoroughly before handling.
- 3.2.19.4. Provide finished work plumb, level and true, free from perceptible waves or ridges and square with adjoining work.
- 3.2.19.5. Cut and fit gypsum board to accommodate or fit around other parts of the Work. Provide work of this Section accurately and neatly.
- 3.2.19.6. Butt gypsum board sheets together in moderate contact. Do not force into place. Place tapered or wrapped edges next to 1 another.
- 3.2.19.7. Provide gypsum board perpendicular to framing and in lengths that will span ceilings and walls without creating end (butt) joints. If butt joints do occur stagger and locate them as far from centre of walls and ceilings as possible. Accurately fit exposed butt joints together and make edges smooth.
- 3.2.19.8. Support ends and edges on framing.
- 3.2.19.9. Fasten gypsum board to metal furring and steel studs with screws. Space screws at 200 mm (8") oc at board edges and 300 mm (12") oc on board field.
- 3.2.19.10. Gypsum Board - Single Layer:
 - 3.2.19.10.1. Ceilings: Apply gypsum board to metal furring with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Space screws at 200 mm (8") oc.
 - 3.2.19.10.2. Partitions: Apply gypsum board to steel studs with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Locate vertical joints at least 300 mm (12") from jamb lines of openings. Space screws at 200 mm (8") oc at board edges and 300 mm (12") oc on board field.
 - 3.2.19.10.3. Ceiling and Partition Fasteners: Ensure perimeter screws are not less than 9 mm (3/8") nor more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards. Drive screws with power screw-gun and set with countersunk head slightly below surface of board.
 - 3.2.19.10.4. Joints: Finish all joints unless specified otherwise.
- 3.2.19.11. Gypsum Board - Double Layer:
 - 3.2.19.11.1. Lay out work to minimize end joints on face layer; to offset parallel joints between face and base layers by at least 250 mm (10") and to apply face layer at right angles to base layer.
 - 3.2.19.11.2. Base Layer: Ensure base layer is same as face layer, or backing board, and applied at right angles to framing members. Secure base layer with screws spaced 300 mm (12") oc to each member. Ensure perimeter screws are not more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards. Ensure surface of erected base layer is straight, plumb or level and without protrusions before face layer is applied.
 - 3.2.19.11.3. Face Layer: Apply face layer at right angles to base layer with screws.
 - 3.2.19.11.4. Joints: Finish joints in face layers only, unless otherwise required to achieve fire resistant ratings indicated, as hereinafter specified. Ensure setting compound for fire rated construction conforms to requirements of authorities having jurisdiction to obtain fire rating shown on Drawings.
- 3.2.20. Gypsum Board Laminated to Concrete and/or Concrete Block Masonry:
 - 3.2.20.1. Ensure base is straight, dry uncoated, clean and free from efflorescence.
 - 3.2.20.2. Mix laminating adhesive in accordance with manufacturer's directions. Allow to stand 30 minutes before using.

- 3.2.20.3. Apply adhesive with notched trowel to leave 9 mm x 13 mm (3/8" x 1/2") ribbons, 32 mm (1-1/4") apart over entire back side of face layer.
- 3.2.20.4. Erect gypsum board immediately after spreading adhesive. Use moderate pressure to develop full adhesive contact with substrate.
- 3.2.20.5. Temporarily secure gypsum board in place with concrete nails or bracing. Ensure joints are accurately aligned. Avoid impact or movement of boards until adhesive sets firmly. Remove temporary support when adhesive has set.
- 3.2.20.6. Do not treat joints of laminated gypsum board for at least 24 hrs after lamination.
- 3.2.21. Interior Ceilings:
 - 3.2.21.1. Comply with recommendations of CGC Drywall Steel-Framed Systems Folder 09250-SA 923.
 - 3.2.21.2. Provide hanger wires spaced at maximum 1200 mm (4') oc along carrying channels and within 150 mm (6") of ends of carrying channel runs. Secure hanger wires to inserts in structure above.
 - 3.2.21.3. Provide carrying channels maximum 1200 mm (4') oc and within 150 mm (6") of walls. Secure with hanger wire saddle-tied along channels. Provide 25 mm (1") clearance between runners and walls. Provide splicers behind joints. Level channels to a maximum tolerance of 3 mm (1/8") over 3600 mm (12').
 - 3.2.21.4. Provide metal furring channels at right angles to carrying channels at maximum 600 mm (24") oc and within 150 mm (6") of walls. Provide 25 mm (1") clearance between furring ends and abutting walls. Attach furring channels to carrying channels with saddle-tie of double strand tie wire.
 - 3.2.21.5. Provide additional cross-reinforcing at bulkheads and other openings.
 - 3.2.21.6. Provide ceiling gypsum board, smooth and level. In areas with a high humidity content (ie. Washrooms, janitor closets, etc.) install MRGB.
 - 3.2.21.7. Seismic Bracing: Sway-brace suspension systems with seismic connections, supports and lateral-force bracings conforming to requirements of ASTM E580/E580M and as follows:
 - 3.2.21.7.1. Install lateral-force bracing to ceilings where gypsum wallboard panels are attached by screws to metal suspension members and ceilings extend to walls.
 - 3.2.21.7.2. Install hanger wires splayed 90° from each other at an angle not exceeding 45° from horizontal plane of ceiling to satisfy force-bracing requirements.
 - 3.2.21.7.3. Attach wires to main runners and place within 50 mm (2") of intersection of cross tees. Ensure bracing points do not exceed 3660 mm (12') oc with first point of bracing within 1220 mm (4') of perimeter of suspended ceiling system.
 - 3.2.21.7.4. Fasten vertical uplift strut to and extend from main runner near bracing points to structural support members above. Ensure design and installation of uplift strut is determined for each ceiling system to suit design requirements.
 - 3.2.21.7.5. Partition Bracing: Brace non-bearing interior partitions to suspended ceilings by providing No. 12 gage galvanized, soft annealed mild steel suspension hanger wire laid at 45° maximum to horizontal plane of ceiling at 2440 mm (8') oc. Attach walls to metal suspension runners with a positive attachment designed by metal suspension system manufacturer.
 - 3.2.21.7.6. Provide wider wall moulding on all sides to support individual panels around perimeter. Minimum size: 50 mm (2").
 - 3.2.21.8. Premanufactured Grid Suspension Systems: Install in accordance with manufacturer's instructions. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

- 3.2.22. Metal Trim and Accessories:
 - 3.2.22.1. Provide metal trim casing beads at reveals; at ceiling-wall intersections and partition perimeters; and at intersection of dissimilar constructions such as gypsum board to concrete.
 - 3.2.22.2. Provide metal trim casing beads where gypsum board abutts against a surface having no trim concealing junction.
 - 3.2.22.3. Provide a 13 mm (1/2") separation gasket between metal trim casing beads and window frames or other cold surfaces or provide sponge tape between gypsum board partition or furring framing, where such framing abuts exterior door or window frame, sponge tape between floor and gypsum board partition track. Ensure tape is either full width or 1 strip 9 mm (3/8") wide on each side of framing member.
 - 3.2.22.4. Provide casing bead and sponge tape where gypsum board abuts materials other than itself and acoustic tile ceilings including at exterior door and window frames, where juncture is not concealed with trim; or elsewhere where indicated on Drawings. Unless indicated otherwise, use tape 3 mm (1/8") narrower than casing bead to provide recess at exposed side. Compress tape by 25%.
 - 3.2.22.5. Provide metal trim casing beads where indicated on Drawings.
- 3.2.23. Control Joints:
 - 3.2.23.1. Provide either manufactured control joint devices or field fabricated control joints from suitable materials to suit site conditions in accordance with manufacturer's instructions and/or ASTM C840.
 - 3.2.23.2. Set in gypsum facing board, supporting control joints with studs or furring channels on both sides of joint. Ensure double studs with discontinuous tracks and double suspended ceiling furring channels have been installed prior to commencing board and bead application at control joints. Provide control joints as required to prevent cracks following locations:
 - 3.2.23.2.1. where a partition, wall or ceiling traverses a construction joint (expansion, seismic or building control element) in base building structure.
 - 3.2.23.2.2. where a wall or partition runs in an uninterrupted straight plane exceeding 9.1 m (30') (Note: A full height door frame may be considered a control joint).
 - 3.2.23.2.3. interior ceiling with perimeter relief: installed so linear dimensions between control joints do not exceed 15 m (15') and total area between control joints does not exceed 230 m² (2,500 sq ft).
 - 3.2.23.2.4. interior ceiling without perimeter relief: installed so linear dimensions between control joints do not exceed 9.1 m (30') and total area between control joints does not exceed 84 m² (900 sq ft).
 - 3.2.23.2.5. at stress points (ie corners of openings or changes in direction of surfaces).
 - 3.2.23.3. Provide additional control joints at long and narrow surfaces.
 - 3.2.23.4. Provide control joints full height floor to ceiling or door header to ceiling in partitions and furring runs.
 - 3.2.23.5. Provide control joints from wall to wall in ceiling areas.
 - 3.2.23.6. Provide continuous polyethylene dust barrier behind and across control joints.
 - 3.2.23.7. Ensure Consultant reviews exact locations of control joints.
- 3.2.24. Sound Control:
 - 3.2.24.1. Where indicated on Drawings, provide sound rated partitions and ceiling in locations indicated to meet required minimum STC rating. Apply gypsum board on both sides of sound-proofed partitions. Follow manufacturer's details and recommendations.

- 3.2.24.2. Provide sound attenuation insulation to completely fill height of stud cavities. Tightly butt ends and sides of blankets within cavities to ensure a 90% capacity, do not overfill cavities. Cut blankets to fit small spaces. Carefully fit blankets behind electrical outlets, bracing, fixture attachments and mechanical and electrical services.
- 3.2.24.3. Mechanically fasten blankets to back of gypsum board as recommended by gypsum board manufacturer.
- 3.2.24.4. At sound attenuating suspended ceiling and enclosures having spring isolator hangers, terminate ceiling or enclosure at adjacent construction by providing continuous isolator strip and sealed joint.
- 3.2.25. Joint Treatment - Gypsum Board:
 - 3.2.25.1. Verify board is firm against framing members and screw heads are properly depressed.
 - 3.2.25.2. Mix joint compound or ready-to-use compounds according to manufacturer's directions. Use pure, unadulterated, clean water for mixing. Permit mixed material to stand 30 minutes before using. Do not mix more material than can be used within 1 hour. Do not use set or hardened compound. Clean tools and equipment after mixing each batch.
 - 3.2.25.3. Tape and fill joints and corners in accordance with gypsum board manufacturer's printed instructions. Fill either manually, using hand tools of trade, or by a mechanical taping and filling machine of proven efficiency.
 - 3.2.25.4. Remove plastic tape from control joints after finishing with joint compound.
 - 3.2.25.5. After final coats of filler have dried at least 24 hours, sand surface lightly with No. 00 sandpaper to leave it smooth, ready for decoration.
 - 3.2.25.6. Provide finished work smooth, seamless, plumb and true, flush and with square plumb neat corners.
 - 3.2.25.7. Levels of Finish: Provide following levels of finish in accordance with ASTM C840:
 - 3.2.25.7.1. Level 0: No taping, finishing or accessories required for temporary construction or areas where final decoration is not required.
 - 3.2.25.7.2. Level 1: Use this level in plenum areas above ceilings, attics, areas where assembly would generally be concealed or in building service corridors and other areas.
 - 3.2.25.7.3. Level 2: Use this level where water resistant gypsum backing board is used as substrate for tile; may be used in garages, warehouse storage, or other similar areas where surface appearance is not of primary concern.
 - 3.2.25.7.4. Level 3: Use this level in appearance areas which are to receive heavy or medium texture spray or hand applied finishes before final painting or where heavy grade wall coverings are to be applied as final decoration.
 - 3.2.25.7.5. Level 4: Use this level where flat paints, light textures or wall coverings are to be applied.
 - 3.2.25.7.6. Level 5: Use this level to provide a uniform surface and minimize possibility of joint photographing and of fasteners showing through final decoration.
 - 3.2.25.7.7. Exposed Moisture Resistant Gypsum Board Finish: Ensure joints and interior angles have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Cover fasteners heads and accessories with 3 separate coats of joint compound. Ensure surface is smooth and free of tool marks and ridges.

3.2.26. Fire Rated Partitions:

3.2.26.1. Ensure materials for fire rated construction conform to requirements of authorities having jurisdiction to obtain fire rating shown on Drawings. Where dissimilar components are built into fire rated assemblies ensure continuity of fire separation by boxing in elements with gypsum board and framing to suit authorities having jurisdiction. Work in cooperation with Section providing firestopping work.

3.2.26.2. Provide fire rated enclosures, separations and assemblies as indicated on Drawings conforming to requirements of authorities having jurisdiction.

3.2.26.3. Where required, secure sound attenuation blanket insulation between studs as specified in Article on Sound Control Partitions.

3.2.27. Cutting and Patching: Cooperate and coordinate with other Sections to obtain satisfactory gypsum board finish work. Do cutting, patching and Make Good as required by installation of work of other Sections.

3.3. SITE QUALITY CONTROL

3.3.1. Site Tests and Inspections:

3.3.1.1. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.

3.3.2. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

3.4.1. Clean off beads, casings, joint cement droppings and similar items and remove surplus materials and rubbish on completion and as directed.

3.5. PROTECTION

3.5.1. Provide protection of materials and work of this Section from damage by weather and other causes. Perform work in areas closed and protected from damage due to weather. Protect work of other trades from damage resulting from work of this Section. Make Good such damage immediately.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide glass-fibre-reinforced gypsum fabrications including but not limited to following:
 - 1.2.1.1. glass-fibre-reinforced gypsum (GRG) fabrications.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of wood blocking, etc.: Section 06 10 00, Rough Carpentry.
 - 1.2.2.2. Provision of steel studs and gypsum board assemblies: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.3. Provision of finish painting: Section 09 91 00, Painting.

1.3. REFERENCES

- 1.3.1. Reference Standards:
 - 1.3.1.1. ASTM C473-19
 - Standard Test Methods for Physical Testing of Gypsum Panel Products
 - 1.3.1.2. ASTM C840-20
 - Standard Specification for Application and Finishing of Gypsum Board
 - 1.3.1.3. ASTM C947-03(23)
 - Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam with Third-Point Loading)
 - 1.3.1.4. ASTM D256-23e1
 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
 - 1.3.1.5. ASTM D638-22
 - Standard Test Method for Tensile Properties of Plastics
 - 1.3.1.6. ASTM D696-16
 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer
 - 1.3.1.7. ASTM E84-23
 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.1.8. ASTM E136-22
 - Standard Test Method for Assessing Combustibility of Materials in a Vertical Tube Furnace at 750°C

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week before commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
- 1.5.1.1. Performance criteria, compliance with appropriate reference standards, characteristics and limitations.
- 1.5.1.2. Product transportation, storage, handling and installation requirements.
- 1.5.2. Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00 showing plans, sections, details, joint treatment, reinforcing, fastening devices and relation of GRG components to surrounding construction.
- 1.5.3. Samples: Submit a minimum of 3 - 200 mm x 200 mm (8" x 8") GRG flat samples for paint selection.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
- 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.6.2. Mock-Ups: Construct minimum 10 m² (100 sq ft) mock-up sample at Project location designated by Consultant for review. Once reviewed with no objections recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements: Deliver materials to site with manufacturer's original labels intact. Do not remove wrappings until ready for use.
- 1.7.2. Storage and Handling Requirements: No outside storage permitted. Store in clean, dry area, off ground. Provide adequate ventilation to avoid excess moisture, surface relative humidity and mould or fungal growth. Remove immediately any board showing signs of mould, mildew or fungal growth.

PART 2 - PRODUCTS**2.1. MANUFACTURERS**

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Armstrong World Industries; www.armstrongceilings.com
- 2.1.2. Substitution Limitations: Comparable Products from manufacturers not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS**2.2.1. GRG Units:**

- 2.2.1.1. Prefabricate GRG components with high-density gypsum, free of resin and asbestos, reinforced with chopped strand fibre or continuous filament mat. Reinforce GRG components with steel or wood as required.
- 2.2.1.2. Ensure GRG units have following characteristics:
 - 2.2.1.2.1. Shell Thickness: 4.8 mm (3/16").
 - 2.2.1.2.2. Weight (depending on reinforcing): 1.344 - 2.016 Kg/m (2 - 3 lbs/sq ft).
 - 2.2.1.2.3. Density: 1650 -1794 Kg/m³ (103 - 112 lbs/cu ft).
 - 2.2.1.2.4. Flexural Strength (ASTM C947): Not less than 17.3 MPa (2500 psi).
 - 2.2.1.2.5. Modulus of Elasticity - In flexure (ASTM C947): 3.38×10^6 psi.
 - 2.2.1.2.6. Tensile Strength (ASTM D638): 12.4 MPa (1,810 psi).
 - 2.2.1.2.7. Impact Strength (ASTM D256 notched): (3.26 ft lb/in) of notch.
 - 2.2.1.2.8. Impact Strength (ASTM D256 unnotched): (8.0 ft lb/sq in).
 - 2.2.1.2.9. Hardness - Barcol: <50.
 - 2.2.1.2.10. Fiber Content: 4 - 6% by weight.
 - 2.2.1.2.11. Humidified Deflection (ASTM C473): 0.8 mm to 3 mm (1/32" to 1/8") deflection.
 - 2.2.1.2.12. Coefficient of Expansion (ASTM D696): 0.98×10^{-5} in./in./°F.
 - 2.2.1.2.13. Fuel Contribution (ASTM E136): Pass.
 - 2.2.1.2.14. Flame Spread (ASTM E84): 0, Class A.
 - 2.2.1.2.15. Smoke Index (ASTM E84): 0, Class A.
 - 2.2.1.2.16. Fastener Withdrawal: Not less than 110 lbs.
- 2.2.1.3. Permitted Product: "CASTWORKS™" by Armstrong World Industries.

2.2.2. Fabrication:

- 2.2.2.1. Fabricate GRG unit as per reviewed Shop Drawings. If multiple components are required to complete design criteria, additional site work, installation or finishing may be required.
- 2.2.2.2. Fabrication Tolerances:
 - 2.2.2.3. Dimensional (all directions): +/-3 mm (+/-1/8").
 - 2.2.2.4. Thickness - skin: +/-1.6 mm (+/-1/16").
 - 2.2.2.5. Warpage or Bowing: +/-1.6 mm/m (+/-1/16" per ft).

PART 3 - EXECUTION**3.1. EXAMINATION**

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Lift and handle components with suitable devices.
- 3.2.2. Install components plum and true. Shim where necessary.
- 3.2.3. Fasten components with self-drilling, self-tapping bugle head screws through face or back as indicated on Shop Drawings.
- 3.2.4. Where components are suspended, use as a minimum 2.64 mm (12 ga) galvanized steel wire and suspension points indicated on Shop Drawings.
- 3.2.5. Framing, hangers, etc. as specified for gypsum board in Section 09 21 16.
- 3.2.6. Adhere butt joints together using high grade polyurethane construction adhesive.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide tiling including but not limited to following:
 - 1.2.1.1. grouting control joints in floor slab under tile.
 - 1.2.1.2. uncoupling membrane.
 - 1.2.1.3. CIM for floors and.
 - 1.2.1.4. thin-set mortar bond coat.
 - 1.2.1.5. fast-setting thin-set mortar bond coat.
 - 1.2.1.6. floor tile, base and fittings.
 - 1.2.1.7. wall tile.
 - 1.2.1.8. grouting tile joints.
 - 1.2.1.9. caulking tile control joints.
 - 1.2.1.10. caulking penetrations through wall and floor tile.
- 1.2.2. Related Sections: Following description of work is included as reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of "Maintenance Material Form" for receiving extra/spare material for Owner's future use: Section 00 65 37, Maintenance Material Form (Specimen).
 - 1.2.2.2. Concrete floor slabs and finishing: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.3. Provision of gypsum board tile backer board walls: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.4. Provision of washroom accessories: Section 10 28 00, Washroom Accessories.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CIM: Crack Isolation Membrane.
 - 1.3.1.2. EGP: Exterior Grade Plywood.
 - 1.3.1.3. SDS: Safety Data Sheets.
 - 1.3.1.4. TTMAC: Terrazzo, Tile & Marble Association of Canada; www.ttmac.com.
 - 1.3.1.5. VOC: Volatile Organic Compound.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ANSI A108.02-19 - General Requirements: Materials, Environmental, and Workmanship
 - 1.3.2.2. ANSI A108.6-99(19) - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy
 - 1.3.2.3. ANSI A108.10-17 - Installation of Grout in Tilework

- | | | |
|-----------|---------------------|--|
| 1.3.2.4. | ANSI A118.3-13 | - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive |
| 1.3.2.5. | ANSI A118.4-19 | - American National Standard Specifications for Modified Dry-Set Cement Mortar |
| 1.3.2.6. | ANSI A118.11-17 | - American National Standard Specifications for EGP (Exterior Glue Plywood) Modified Dry-set Mortar |
| 1.3.2.7. | ANSI A118.12-14(19) | - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation |
| 1.3.2.8. | ANSI A136.1-08(13) | - American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile |
| 1.3.2.9. | ASTM C627-18 | - Standard Test Method for Evaluating Ceramic Floor Tile Systems Using the Robinson-Type Floor Tester |
| 1.3.2.10. | ASTM F1869-16a | - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride |
| 1.3.2.11. | ISO 13007-1:2010 | - International Standard - Ceramic tiles - Grouts and adhesives – Part 1: Terms, definitions and specifications for adhesives |
| 1.3.2.12. | ISO 13007-3:2010 | - International Standard - Ceramic tiles - Grouts and adhesives – Part 3: Terms, definitions and specifications for grouts |

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week before commencing work with parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Product Data:
- 1.5.1.1. Submit manufacturer's technical data sheets, SDS and installation instructions for specified materials.
- 1.5.1.2. Where more than 1 manufacturer's Products are part of single tile assembly, arrange for each manufacturer to submit a written statement of compatibility with respect to other manufacturer's materials.
- 1.5.2. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to minimum requirements indicate following:
- 1.5.2.1. details of construction.
- 1.5.2.2. movement joint layouts.
- 1.5.2.3. dimensions.
- 1.5.2.4. patterns.

- 1.5.3. Samples: Submit samples in accordance with Section 01 30 00. Submit individual sample panels of each colour of ceramic tile, set with adhesive, grouting and bonding method as specified, showing quality, colour and finish of material, grout and pattern of tiles. Ensure each panel is minimum 600 mm x 600 mm (24" x 24").

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operational and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00. Provide Owner with 3 copies of TTMAC's "2017-2019 Hardsurface Maintenance Guide". Include specific warnings of any maintenance practice or materials which may damage or disfigure tile work.

1.7. MAINTENANCE MATERIAL SUBMITTALS

- 1.7.1. Extra Stock Materials:
- 1.7.1.1. Supply in addition to quantities required for work, extra materials and Products to be stored by Owner as follows:
- 1.7.1.1.1. Provide 5% extra stock of each type of tile and special units.
- 1.7.1.2. Deliver extra stock to Owner as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed.
- 1.7.1.3. Execute Section 00 65 37.

1.8. QUALITY ASSURANCE

- 1.8.1. Qualifications:
- 1.8.1.1. Manufacturers: Provide Product of company specializing in manufacture of ceramic tile, porcelain tile, mosaics, pavers, trim units, thresholds, setting, grouting and installation Products with minimum experience of 5 years. Provide test reports if requested to substantiate that Products supplied on this Project will be of consistent quality in appearance and physical properties.
- 1.8.1.2. Installers: Execute work of this Section using a company who is a member in good standing with TTMAC and has minimum 5 years successful experience in application of Products, systems and assemblies specified. Perform tile work using skilled mechanics trained and experienced in work of this complexity. Install waterproofing system using an applicator approved by system manufacturer.
- 1.8.2. Mock-Ups:
- 1.8.2.1. Construct a minimum 10 m² (100 sq ft) mock-up complete with movement joint at Project location designated by Consultant for review. Ensure mock-up area is cleaned and properly prepared for tiling using specified setting and grouting materials in accordance with Specifications, Product instructions and discussions from preinstallation meeting. Ensure finish lighting scheme is replicated in area where mock-up is installed. During mock-up installation, ensure participants are present to observe substrate preparation, installation, grouting and cleaning procedures. Caution: When grouting with sanded grout, take special care and caution to prevent scratching, dulling or otherwise damaging tile natural surface appearance.
- 1.8.2.2. After mock-up has cured and been inspected, discuss pertinent remarks, observations and recommendations in the presence of participants.
- 1.8.2.3. Once reviewed, mock-up including recorded observations and recommendations remains part of finished work and used as a quality reference standard for balance of Project.

1.9. DELIVERY, STORAGE AND HANDLING

- 1.9.1. Delivery and Acceptance Requirements:
- 1.9.1.1. Coordinate deliveries to comply with construction progress schedule and arrange for above ground, under cover storage before materials are delivered to site.

- 1.9.1.2. Deliver tile in a manner to avoid chipping, breakage, staining and any other damage.
- 1.9.1.3. Deliver packaged materials in their original bags and containers clearly identified.
- 1.9.2. Storage and Handling Requirements:
 - 1.9.2.1. Store and handle tile in a manner to avoid chipping, breakage, staining and any other damage.
 - 1.9.2.2. Store packaged materials in their original bags and containers clearly identified. Keep containers sealed and labels intact unit time of use. Prevent damage or contamination to materials by water, moisture, freezing, excessive heat, foreign matter or other causes. If materials have frozen, do not stir liquids or mix materials until they are completely thawed.
 - 1.9.2.3. Provide secure heated and dry storage facilities on site. Maintain temperatures in storage area between 15 deg C (59 deg F) and 30 deg C (86 deg F).

1.10. SITE CONDITIONS

- 1.10.1. Ambient Conditions:
 - 1.10.1.1. Do not perform work of this Section at temperature below 12 deg C (54 deg F) when using portland cement mortars or dry set mortars, latex portland mortars or bond coat. Maintain temperature between 12 deg C (54 deg F) and 32 deg C (90 deg F).
 - 1.10.1.2. Observe manufacturer's recommended working temperatures for installation of adhesives and grouts.
 - 1.10.1.3. Close doors and windows and turn off direct forced ventilation systems and apparatus. Turn off radiant floor heating systems and protect work area from direct draft, sun and heat exposure during installation and for at least 72 hours after completion.
 - 1.10.1.4. Do not perform work of this Section when either substrate and/or ambient temperatures are below 10 deg C (50 deg F) or above 35 deg C (95 deg F). Maintain temperature in tiled areas within these temperature limits during installation and for 7 Days after completion of the Work unless otherwise indicated in the Product instructions and/or in ANSI A108 Installation Standard Procedure requirements.

1.11. WARRANTY

- 1.11.1. Manufacturer Warranty: Warrant work of this Section for a period of 3 years against defects, excessive wear and loss of adhesion including replacement of defective tiling, materials, labour costs for demolition of defective work, accessories and installation systems at Owner's convenience. Cracks arising from normal shrinkage and/or expansion of concrete are not considered as structural failure. Hairline cracks in grout joints which result from these causes are considered normal and warranty is not voided as a result of these minor defects.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Ardex Canada, Inc.; www.ardex.ca
 - 2.1.1.2. Custom Building Products; www.custombuildingproducts.com
 - 2.1.1.3. Flextile Ltd.; www.flextile.net
 - 2.1.1.4. Laticrete International, Inc.; www.laticrete.com
 - 2.1.1.5. MAPEI Inc.; www.mapei.ca
 - 2.1.1.6. Olympia Tile International Inc.; www.olympiatile.com
 - 2.1.1.7. Schluter Systems (Canada) Inc.; www.schluter.com

- 2.1.1.8. Stone Tile; www.stone-tile.com
- 2.1.2. Use proprietary Products in full compliance with manufacturer's recommendations. As far as possible obtain Product from single manufacturer ensuring compatibility with adjacent components while maintaining quality.

2.2. MATERIALS

- 2.2.1. Crack Isolation Membrane: Provide 1 of following:
 - 2.2.1.1. Two part system made up of liquid rubber and reinforcing fabric to provide crack bridging capability over non-structural cracks, compatible with thin set mortar, supply "Ardex 8+9™ Rapid Waterproofing and Crack Isolation Compound" by Ardex Canada, Inc., "Custom® 9240 Waterproofing and Anti-Fracture Membrane" by Custom Building Products, "WP-980 Waterproof & Crack Isolation Membrane" by Flextile Ltd., "Laticrete Blue 92" by Laticrete International, Inc. or "Mapelastic™ 315" by MAPEI Inc.
 - 2.2.1.2. Single component highly flexible load bearing peel and stick sheet membrane and primer compatible with tile/stone setting mortars, supply "Crack Buster® Pro Crack Prevention Mat Underlayment + Peel & Stick Primer" by Custom Building Products, "4000 Acrylic Latex Primer" and "1000 - Flexilastic Crack Isolation and Sound Reduction Membrane" by Flextile Ltd. or "Mapeguard™ Primer and Mapeguard™ SM" by MAPEI Inc.
- 2.2.2. Uncoupling Membrane: Provide "Schluter®-DITRA" by Schluter Systems (Canada) Inc.; 3 mm (1/8") thick, orange, high-density polyethylene membrane with a grid structure of 12 mm x 12 mm (1/2" x 1/2") square cavities, each cut back in a dovetail configuration and a polypropylene anchoring fleece laminated to its underside, "RedGard® Uncoupling Membrane" by Custom Building Products, "FlexMat" by Flextile Ltd. or "Mapeguard® UM" by MAPEI Inc. Conforms to definition for uncoupling membranes in TTMAC's "2019-2021 Tile Installation Manual Specification Guide 09 30 00" and meets or exceeds requirements of ANSI A118.12.
- 2.2.3. Surface Preparation:
 - 2.2.3.1. Sound Control Underlayment: Load bearing underlayment for reducing sound transmission through tile flooring surfaces, "Ardex DS 70™ Acoustic Mat" by Ardex Canada, Inc., "EasyMat® Tile & Stone Underlayment" by Custom Building Products, "2000SC - Flexilastic Sound Control and Crack Isolation Membrane" by Flextile Ltd., "Laticrete 18" by Laticrete International, Inc., "Mapesonic™ 2" by MAPEI Inc. or "Sonogrip" by Olympia.
- 2.2.4. Setting Bed and Thin-Set Adhesive:
 - 2.2.4.1. Latex Mortar Bond Coat: ISO 13007-1 performance level (C2ES2P2); ANSI A118.4; ANSI A118.11; for improved (C2) cement adhesive with (E) extended open time (S2) high-deformability (>5 mm) and improved (P2) for adherence to EGP characteristics, conforming to ANSI A118.4 and ANSI A118.11 requirements, supply "ProLite® Premium Large Format tile Mortar" by Custom Building Products, "Laticrete 4237 with 211 Crete Filler Powder" by Laticrete International, Inc., "Kerabond/Keralastic" by MAPEI Inc. or "#51 Floor and Wall Mix Thin-Set Mortar" and "#44 High Solids Latex Thin-Set Mortar Additive" by Flextile Ltd.
 - 2.2.4.2. Latex Cement Mortars:
 - 2.2.4.2.1. ISO 13007-1 (C2) performance level for improved cement adhesive with specific additional characteristics according to specified basis of design Project requirements; ANSI A118.4 and ANSI A118.11.

- 2.2.4.2.2. Polymer-Modified Thin-Set Mortar Bond Coat for Vertical Application of Large Modular Tiling: (300 mm x 300 mm (12" x 12") and larger) ISO 13007-1 performance level (C2TES1) for improved cementitious (C2) for adhesive with (T) slip-resistant (E) extended open time (S1) deformable characteristics conforming to ANSI A118.4 for single component latex cement mortar: supply "Ardex X 77™ Microtec® Premium Microfiber Reinforced Polymer Modified Thin Set Mortar" by Ardex Canada, Inc., "VersaBond®-LFT Professional Large Format Tile Mortar" by Custom Building Products, "56SR Premium Polymer-Modified Sag-Resistant Mortar" by Flextile Ltd. or "Ultraflex™ LFT" by MAPEI Inc.
- 2.2.4.2.3. Polymer-Modified Thin-Set Mortar Bond Coat: ISO 13007-1 performance level (C2ES1P1) for improved (C2) for cementitious adhesive with (E) extended open time, (S1) deformable (2.5 mm to 4.9 mm) and normal (P1) for adherence to EGP characteristics, conforming to ANSI A118.4 (and/or ANSI A118.11 for EGP mortar installation over Plywood); supply "Ardex X 5™ Thin Set Mortar" by Ardex Canada, Inc., "VersaBond®-LFT Professional Large Format Tile Mortar" by Custom Building Products or "Ultraflex™ LFT" by MAPEI Inc.
- 2.2.4.3. Epoxy Mortar Bond Coat and Reactive Resin Polyurethane Adhesive: ANSI A118.3 chemical resistant, water cleanable tile-setting and grouting epoxy. Use 1 of following:
- 2.2.4.3.1. Epoxy Bond Coat: ISO 13007-1 (R2T) and ISO 13007-3 (RG 1) improved (R2) reactive resin adhesive with (T) slip characteristics and (RG1) reactive resin chemical resistant grout, ANSI A118.3 chemical resistant, water cleanable tile-setting and grouting epoxy, supply "Ardex WA™ High Performance, 100% Solids Epoxy Grout and Adhesive" by Ardex Canada, Inc., "CEG-Lite™ 100% Solids Commercial Epoxy Grout" by Custom Building Products or "KER 400 Kerapoxy®" by MAPEI Inc. to ISO 13007-1 (R2T) and ISO 13007-3 (RG1) performance standard with non-slip characteristics.
- 2.2.4.3.2. Epoxy Bond: ISO 13007-1 performance level (R2) improved reactive epoxy resin adhesive normally filled with silica sand and combined with hardener before application, supply "Ardex WA™ High Performance, 100% Solids Epoxy Grout and Adhesive" by Ardex Canada, Inc., "CEG-Lite™ 100% Solids Commercial Epoxy Grout" by Custom Building Products "KER 410 Kerapoxy®" by MAPEI Inc. to ISO 13007-1 (R2) performance standard.
- 2.2.4.3.3. 100% Solids Epoxy Adhesive: Supply "Ardex WA Easy to Use Epoxy Grout and Adhesive" by Ardex Canada, Inc. or "KER 410 Kerapoxy®" by MAPEI Inc. to ISO 13007-1(R2) performance standard; "CEG-Lite™ 100% Solids Commercial Epoxy Grout" by Custom Building Products or "KER 400 Kerapoxy®" by MAPEI Inc. to ISO 13007-1(R2T) and ISO 13007-3 (RG1) performance standards.
- 2.2.5. Pre-Mixed Setting Bed and Dispersion Adhesive for Vertical Application of Tiles Less Than 300 mm x 300 mm (12" x 12"): Interior Use: ISO 13007-1 (D2T) performance level (D2) improved dispersion adhesive with (T) minimum slip characteristics (=0.5 mm) and ANSI A136.1 - Type 1 requirements. Supply Ardex D 14™ Type 1 Premixed Tile Adhesive" by Ardex Canada, Inc., "ReliaBond® Professional Tile Adhesive" by Custom Building Products or "Ultra/Mastic® ECO" by MAPEI Inc., Low VOC, solvent-free water-based (D2T) dispersion adhesive to ANSI A136.1-Type 1.
- 2.2.6. Tile: Refer to "Material and Finish Schedule" appended to Section 00 01 20.
- 2.2.7. Grout:
- 2.2.7.1. Epoxy Grout: Conforming to ANSI A118.3 and ISO 13007-3 (RG) performance level for reactive resin grouts; 100% solids, 2 component water washable epoxy grout, "Ardex WA Easy to Use Epoxy Grout and Adhesive" by Ardex Canada, Inc., "CEG-Lite™ 100% Solids Commercial Epoxy Grout" by Custom Building Products, "100 Flex-Epoxy 100% Solids Epoxy Grout" by Flextile Ltd., "SpectraLOCK® PRO Premium Grout" by Laticrete International, Inc. or "Kerapoxy®" by MAPEI Inc.
- 2.2.7.2. Do not add water or other materials to dilute mortar or grout additives unless recommended by admixture manufacturer.

- 2.2.8. Edge-Protection and Transition Profiles for Floors: Provide L-shaped profile with 3 mm (1/8") wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg and integrated grout joint spacer. Material and Finish: E - Stainless Steel Type 304 = V2A. Height as required. Permitted Product: "Schluter®-SCHIENE" by Schluter Systems (Canada) Inc.
- 2.2.9. Finishing and Edge-Protection Profiles for Walls: Provide L-shaped profile with 3 mm (1/8") wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer. Material and Finish: AT - Satin Nickel Anodized Aluminum. Height as required. Permitted Product: "Schluter®-JOLLY" by Schluter Systems (Canada) Inc.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
- 3.1.1.1. Verify existing conditions and finishes are ready to receive specified tile work. Ensure backings are structurally sound, level, and plumb within required tolerances. Notify Consultant in writing of unacceptable substrate conditions.
- 3.1.1.2. Ensure compatibility of adhesives, waterproofing, reinforcing and fillers with adjacent substrate and component coming in contact with these Products.
- 3.1.2. Preinstallation Testing: Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to tiling for moisture on concrete floors around perimeter of areas, at columns and where moisture may be anticipated. Conduct 3 tests for first 93 m² (1000 sq ft) and 1 additional test for every 93 m² (1000 sq ft) of flooring. Ensure moisture emission from concrete floor does not exceed 1.36 kg/93 m² (3 lbs/1000 sq ft) in 24 hours unless otherwise stated in flooring Product instructions and limitations. Do not proceed with installation until moisture problem has been corrected. Provide results to Consultant prior to commencement of installation.
- 3.1.3. Evaluation and Assessment:
- 3.1.3.1. Prior to installation, set aside for further inspection and replacement on a tile for tile basis by tile or dimension stone Supplier, sub-standard tiles, fractured tiles or tiles with chipped corners, pinholes or voids that are unusable for cuts. Ensure this Subcontractor replaces at his own expense, sub-standard and/or pre-damaged tiles once installed.
- 3.1.3.2. Carefully select, set-aside and shade-mix tiles and/or dimension stones to a homogeneous blend throughout. During installation, provide supplementary lighting equipment if necessary to easily identify shade differences, which could normally be very slight and provide a standard even aesthetic blend effect. This is best achieved by using a strong floodlight or spotlight fitted to a movable pole stand immediately over Work area.
- 3.1.3.3. Before setting, examine tile backs for possible dust or other contaminants. If necessary, use a slightly damp towel and wipe tile backs to remove any such dust or contaminant residue.
- 3.1.3.4. Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
- 3.2.1.1. Ensure substrates are structurally sound, solid, stable, level, plumb and true to a tolerance in plane of 3 mm in 3 m (1/8" in 10' - 0") in accordance with ANSI A108 specification requirements. Ensure substrates are clean and free of dust, oil, grease, paint, tar, wax, curing agent, primer, sealer, form release agent or any deleterious substance and debris which may prevent or reduce adhesion.

- 3.2.1.2. Mechanically sand, shot blast or scarify substrate as required to completely remove paint, loosely bonded topping, loose particles and contaminants. Surface etching or contaminant removal by chemical means is not permitted. When sanding or scarifying surfaces that may contain silica sand, wear a permitted dust mask.
- 3.2.1.3. Apply latex cementitious leveling coat to correct substrate irregularity up to 8 mm (5/16") thickness. Above 8 mm (5/16") correct irregularity by mortar bed method or fast-setting mortar bed method.
- 3.2.1.4. Ensure substrates are dry.
- 3.2.1.5. In all cases, structural design of substrate shall not allow a deflection greater than L/360 when tested to 136 kg (300 lb) concentrated loads in accordance with ASTM C627 test method. Deflection and curvature should be uniform over length of the span.
- 3.2.1.6. Review setting out point with Consultant for each location, verify patterns and edge condition.
- 3.2.1.7. Verify substrate expansion joints have been installed properly.

3.3. INSTALLATION

- 3.3.1. Provide tiling in accordance with TTMAC's "2019-2021 Tile Installation Manual Specification Guide 09 30 00" unless specified otherwise.
- 3.3.2. Lay out tile so field or patterns are centered on wall and floor areas or conform architectural details, so no tile less than 1/2 size occurs. No cut tiles are allowed at finished ceiling level. Align joints in walls, bases and floors, where tile sizes accommodate. Provide uniform joint widths throughout.
- 3.3.3. Prior to installation ensure back of each tile is free of contaminants. Distribute production run variations evenly, maintaining continuity of appearance. When necessary, wipe the back face of stone or tile with a damp towel or cloth to remove dust and residual contaminants.
- 3.3.4. Arrange accessories in tile work so they are spaced evenly, centered with joints and set true with proper and adequate projection conforming to manufacturer's recommendations.
- 3.3.5. Make sure tile has adequate solid backing. Ensure corner and edges are fully supported by bonding material. Avoid slippage. Ensure tile installation has a minimum of 95% bond coverage by backbuttering or other permitted technique.
- 3.3.6. Fit tile units around corners, fitments, fixtures, drains and other built-in-objects to maintain uniform joint appearance. Cut, drill and set anchors, bolts for fastening fixtures and fittings in tile work. Make cut edges smooth, even and free from chipping. Do not split tile.
- 3.3.7. Grout to match colour of tile unless indicated otherwise. Fill joints.
- 3.3.8. Control Joints:
 - 3.3.8.1. Carry existing movement joints all the way through from substrate surface layer including tiling surface. Ensure control joints are kept free of setting materials.
 - 3.3.8.2. Install control joints where tiling abuts restraining surfaces, around perimeter of work (and or panel) and at base of columns and curbs.
 - 3.3.8.3. Install and space expansion and control joints in accordance with following:
 - 3.3.8.3.1. interior: 4878 mm (16') to 6098 mm (20') in each direction with minimum joint width of 6 mm (1/4").
 - 3.3.8.3.2. interior exposed to direct sunlight or moisture: 2439 mm (8') to 3659 mm (12') in each direction with minimum joint width of 6 mm (1/4").
 - 3.3.8.4. Caution: Under no circumstances cut in control joints after tiling has been installed. Install tiling up to movement joint and stop. If required, cut tiling and resume setting from opposite side of the joint. Before continuing, rake joint clean.

- 3.3.8.5. Install a permitted compressible bead and specified sealant to caulk control joints. Follow sealant manufacturer's installation instructions or install preformed proprietary brand control joint profiles as specified.
- 3.3.9. Uncoupling Membrane:
 - 3.3.9.1. Apply a thin-set mortar suitable for substrate (mixed to a fairly fluid consistency, but still able to hold a notch) using uncoupling membrane manufacturer's recommended trowel.
 - 3.3.9.2. Apply uncoupling membrane to floor, fleece side down. Solidly embed uncoupling membrane into thin-set mortar using a float, screed trowel or manufacturer's recommended roller.
 - 3.3.9.3. When using a roller, place weight not to exceed 34 kg (75 lbs) on roller shelf. Slowly move roller from 1 end of uncoupling membrane to other, slightly overlapping successive passes.
 - 3.3.9.4. Lift up a corner of uncoupling membrane to check coverage. Proper installation results in full contact between fleece webbing and thin-set mortar. Simply abut end and side sections of adjacent sheets.
- 3.3.10. Tile:
 - 3.3.10.1. Provide setting bed in accordance with manufacturer's printed instructions and as specified herein.
 - 3.3.10.2. Prepare gypsum board and cement board surfaces, by applying a scratch coat of setting bed material.
 - 3.3.10.3. Provide setting compound in 1 layer with notched trowel to provide a continuous 3 mm to 6 mm (1/8" to 1/4") bed, in accordance with tile manufacturer's written instructions.
 - 3.3.10.4. Place tiles to achieve uniform:
 - 3.3.10.4.1. shading.
 - 3.3.10.4.2. colouring.
 - 3.3.10.4.3. jointing.
 - 3.3.10.5. Lay tiles in true lines, conforming to lines of building and arrange symmetrically in accordance with Drawing layouts. Review layout and slopes with Consultant prior to setting of tiles.
 - 3.3.10.6. When tiles are laid by thin-set method on exterior surfaces, in wet areas or laying large size tiles, achieve minimum of 95% coverage. Ensure bonding is notched in horizontal straight lines. Lay tile on freshly notched thin-set mortar, slide tile back and forth at 90 degree to notches. Ensure tiles are set while bond coat is wet and in tacky stage without skin. Provide back buttering by applying thin troweled coat to back side of tile using flat side of trowel immediately before laying to achieve minimum 95% adhesion for exterior work, or large tile area or wet areas.
 - 3.3.10.7. Tile Joints: Minimum 3 mm (1/8") width joints when grouting with epoxy grout. No butt joints are permitted.
 - 3.3.10.8. Lippage: Conform to paragraph 4.3.7 of ANSI A108.02.
 - 3.3.10.9. Lay out work to produce a symmetrical pattern with minimum amount of cutting. Ensure cut tile at room perimeter is not less than 1/2 full size.
 - 3.3.10.10. Provide slopes to floor drains using levelling bed material.
 - 3.3.10.11. Set wall tile in a true vertical plane with edges of tiles flush with each other.
 - 3.3.10.12. Set floor tile flat and level, with uniform joints throughout, properly aligned. Provide uniform slopes to floor drains.
 - 3.3.10.13. Neatly and closely fit tiles around pipes, accessories and other items occurring in floor and walls. Provide necessary cutting without marring tile.

- 3.3.10.14. Provide tile bases to work of Architectural Woodwork and Modular Casework Sections as indicated.
- 3.3.10.15. Replace cracked, discoloured, chipped and damaged tile.
- 3.3.10.16. Align joints of floor, wall and base tiles.
- 3.3.11. Grouting:
 - 3.3.11.1. Where tiling or stone tiling is installed with normal setting thin-set mortar, grout no sooner than 24 hours after installation.
 - 3.3.11.2. Where tiling or stone tiling is installed with reactive epoxy mortars and adhesives, grout no sooner than 24 hours after installation.
 - 3.3.11.3. Install epoxy grouts in accordance with Product instructions, ANSI A108.6 and ANSI A108.10.

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.
- 3.4.2. Manufacturer Services: Have manufacturer's representative visit site at commencement of tile work to give proper direction and thereafter at regular interval to ensure proper workmanship.

3.5. CLEANING

- 3.5.1. Remove grout and mortar residue immediately while work progresses and before materials harden on tiling surface.
- 3.5.2. Clean tiling completely leaving no apparent cement laitance on the surface. Do not acid wash especially where pigmented grouts are specified.
- 3.5.3. Clean adjacent surfaces that have been soiled or otherwise marred, to completely remove evidence of materials causing same.
- 3.5.4. Upon completion, remove protective coverings and clean down finished work of this Section leaving it in a correct condition according to industry standards. Correct defective jointing and grouting and other non-conformities.

3.6. PROTECTION

- 3.6.1. Protect other parts of work from spatters, stains or damage.
- 3.6.2. Remove and replace with new materials, sections of work that have become stained, soiled, broken, chipped or otherwise damaged.
- 3.6.3. Protect finished work from weather, freezing and complete water immersion for periods of at least 72 hours to 14 Days after completion of the Work depending on setting and grouting materials used. Follow Product instructions for requirements.
- 3.6.4. Walls: Protect walls from impact, vibration and hammering on adjacent and opposite walls for periods of at least 24 hours to 7 Days after installation depending on setting and grouting materials used. Follow Product instructions for requirements.
- 3.6.5. Floors: Protect floors from foot traffic for at least 4 hours to 48 hours after installation depending on the setting and grouting materials used. In all cases prohibit heavy commercial and equipment traffic for at least 48 hours to 7 Days depending on setting and grouting materials used. Follow product instructions for requirements.
- 3.6.6. Since temperature and humidity conditions during and after installation affect final curing time of cement based and epoxy materials, allow for extended periods of cure and protection when ambient and/or substrate temperatures drop below 15 deg C (60 deg F) and/or when relative humidity is higher than 70%.

- 3.6.7. Protect finished work from damage by other trades and general abuse until Substantial Performance of the Work and.

3.7. ATTACHMENTS

- 3.7.1. Schedules:

- 3.7.1.1. Install tiles according to TTMAC's "2019-2021 Tile Installation Manual Specification Guide 09 30 00".

- 3.7.1.2. Expansion and Control Joints: Movement Joints for Tile Installations: TTMAC Detail 301MJ-2019-2021.

- 3.7.1.3. Wall Tile:

- 3.7.1.3.1. Tile Installed Over Masonry or Concrete Walls - Thin-Set Method: TTMAC Detail 303W-2019-2021; Interior/Exterior.

- 3.7.1.3.2. Tile Installed on Coated Glass Mat Backer Board: TTMAC Detail 305W-2019-2021 Detail B - Interior Wet/Dry Areas.

- 3.7.1.3.3. Large Format Tile On Interior Walls: TTMAC Detail 330LFTW-2019-2021.

- 3.7.1.4. Floor Tile:

- 3.7.1.4.1. Tile Over Mortar Bed with Cleavage Membrane Interior Only: TTMAC Detail 309F-2019-2021.

- 3.7.1.4.2. Tile Bonded to Concrete Slab - Thin-Set Method, TTMAC Detail 311F-2019-2021; Detail A Interior/Exterior.

- 3.7.1.4.3. Tile Bonded to Concrete Slab - Thin-Set Method, TTMAC Detail 311F-2019-2021; Detail B - Epoxy Method Interior Only.

- 3.7.1.4.4. Tile Bonded to Concrete Slab - Thin-Set Method, TTMAC Detail 311F-2019-2021; Detail D - Uncoupling Over Green/Young Concrete.

- 3.7.1.4.5. Large Format Tile On Interior Floors: TTMAC Detail 329LFT-2019-2021.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide acoustical panel ceilings including but not limited to following:
 - 1.2.1.1. ceiling suspension systems.
 - 1.2.1.2. lay-in acoustical ceiling panels.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of "Maintenance Material Form" for receiving extra/spare material for Owner's future use: Section 00 65 37, Maintenance Material Form (Specimen).
 - 1.2.2.2. Removal of existing ceiling system: Section 02 41 00, Demolition and Salvage.
 - 1.2.2.3. Provision of suspended gypsum board ceilings: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.4. Provision of mechanical fixtures: Division 20, Mechanical General Requirements, Division 21, Fire Suppression, Division 22, Plumbing and Division 23, Heating, Ventilating and Air Conditioning.
 - 1.2.2.5. Provision of electrical, communication and security fixtures: Division 26, Electrical, Division 27, Communications, Division 28, Electronic Safety and Security.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CAC: Ceiling Attenuation Class.
 - 1.3.1.2. NRC: Noise Reduction Co-efficient.
 - 1.3.1.3. OBC: Ontario Building Code.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM C423-22
 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 1.3.2.2. ASTM C635/C635M-22
 - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 1.3.2.3. ASTM C636/C636M-19
 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
 - 1.3.2.4. ASTM E1414/E1414M-21a
 - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
 - 1.3.2.5. CAN/ULC-S102-18
 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - 1.3.2.6. CAN/ULC-S114-18
 - Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - 1.3.2.7. CAN/ULC-S702.1-21
 - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.4. SUBMITTALS

- 1.4.1. Product Data: Submit Product data on ceiling grid system, acoustical panels; clearly indicate specific items proposed for use if manufacturer's catalogues are submitted.
- 1.4.2. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to minimum requirements indicate following:
 - 1.4.2.1. reflected plans of ceilings, joint pattern, position of suspension grids, seismic requirements, methods of suspension and termination at walls, partitions, bulkheads, lighting fixtures and mechanical fixtures.
 - 1.4.2.2. Submit reflected ceiling plans detailed in measurement system (e.g. imperial or metric) to match Drawings.
 - 1.4.2.3. Ensure a licensed engineer specified herein is responsible for:
 - 1.4.2.3.1. production and review of Shop Drawings.
 - 1.4.2.3.2. sealing and signing each Shop Drawing and any associated calculations performed.
- 1.4.3. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.4.3.1. Submit 300 mm (12") long samples of suspension system parts, including trim and seismic items.
 - 1.4.3.2. Submit 300 mm x 300 mm (12" x 12") samples of acoustical panels.
- 1.4.4. Certificates:
 - 1.4.4.1. Submit independent test data and certificate confirming system meets or exceeds specified NRC rating in accordance with ASTM C423 and CAC rating in accordance with ASTM E1414/E1414M.
 - 1.4.4.2. Submit independent test data and design tables for each type of insert to be employed on this Project for hanger supports.

1.5. CLOSEOUT SUBMITTALS

- 1.5.1. Operational and Maintenance Data: Submit maintenance instructions to Owner for recommended cleaning materials and methods for panels and trim. Include precautions for use of and composition of cleaning materials detrimental to acoustic materials and trim.

1.6. MAINTENANCE MATERIAL SUBMITTALS

- 1.6.1. Extra Stock Materials: Leave 1 carton per 93 m² (1000 sq ft) of each type of ceiling panel specified for Owner's future maintenance use. Supply spare panels from same production run as installed panels. Execute Section 00 65 37.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
 - 1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
 - 1.7.1.2. Licensed Professionals: Employ a licensed engineer carrying minimum \$2,000,000.00 professional liability insurance and is registered in the Province of Ontario.
- 1.7.2. Mock-Ups: Construct minimum 10 m² (100 sq ft) mock-up sample of complete system in correct measure unit (imperial or metric) at Project location designated by Consultant for review. Once reviewed with no objections recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver materials in original packages, containers and bundles, bearing brand and manufacturer's name.
- 1.8.2. Storage and Handling Requirements:
 - 1.8.2.1. Store materials in a covered area, off ground, on flat, smooth, dry surfaces. Protect from moisture. Remove damaged or deteriorated materials from site.
 - 1.8.2.2. Comply with ceiling panel manufacturer's recommendations regarding temperature and humidity conditions before, during and after ceiling installation.

1.9. SITE CONDITIONS

- 1.9.1. Ambient Conditions: Continuously maintain rooms or areas scheduled to receive acoustical treatment at not less than 21 deg C (70 deg F) and at occupancy humidity, at least 3 Days prior to installation and 3 Days after work is completed. Schedule work to eliminate risk of damage to these materials due to adverse environmental conditions in rooms or areas when and after work is installed.

1.10. WARRANTY

- 1.10.1. Manufacturer Warranty: Warrant work of this Section for period of 3 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Armstrong World Industries Canada Ltd.; www.armstrongceilings.com
 - 2.1.1.2. Bailey Metal Products Ltd.: www.bmp-group.com
 - 2.1.1.3. CertainTeed Ceilings; www.certainteed.com
 - 2.1.1.4. CGC Inc.; www.cgcinc.com
 - 2.1.1.5. ROCKFON; www.rockfon.com
- 2.1.2. Substitution Limitations: Comparable Products from manufacturers listed or not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
 - 2.2.1.1. Design suspension system to support safely and without distortion, superimposed loads of:
 - 2.2.1.1.1. Lighting fixtures.
 - 2.2.1.1.2. Air supply diffusers, boots, fire alarm grilles and exhaust and return air grilles.
 - 2.2.1.2. Design suspension system to support lighting fixtures according to Ontario Hydro regulations and submit certification in accordance with Rule 30-302 (1).
 - 2.2.1.3. Prepare panels for sprinkler head penetrations.
 - 2.2.1.4. Coordinate installation and cooperate with Mechanical and Electrical Subcontractors, to accommodate mechanical and electrical items, or any other Work required to be incorporated in or coordinated with the ceiling system.

- 2.2.1.5. Structural Design: Employ a licensed engineer specified herein to:
 - 2.2.1.5.1. design components for work of this Section requiring structural performance.
 - 2.2.1.5.2. be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.
 - 2.2.1.5.3. design acoustical ceiling system in compliance with seismic requirements for the Place of the Work as determined by authorities having jurisdiction and verified by an independent third party.
- 2.2.2. Unless otherwise indicated, manufacture ceiling suspension Products to minimum requirements of ASTM C635/C635M, for Medium Duty, modified as required to suit grid design shown.
- 2.2.3. Exposed Grid System: "DONN DX® Suspension System" by CGC Inc., "Prelude® XL 15/16" Exposed Tee System" by Armstrong World Industries, "Lance-Lock® System 900" by Bailey Metal Products Ltd., "Chicago Metallic 1200 Seismic 15/16" Exposed" by ROCKFON or "15/16" Classic Stab Systems" by CertainTeed Ceilings, factory finished satin white on hot dipped galvanized cold rolled steel. Ensure system provides lock joint intersections of cross and main tees.
- 2.2.4. Basic Steel Material and Finish: Commercial quality cold rolled steel 0.455 mm (26 ga) minimum thickness, galvanized to zinc coating designation Z90 (G30) for normal interior spaces, Z180 (G60) for high humidity spaces and Z275 (G90) for exterior spaces. Ensure exposed surfaces of metal products are factory finished in non-yellowing, low sheen satin white enamel to Consultant's review to match whiteness in panels. Provide paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of all exposed metal components in the ceiling assemblies. Provide slip-on trim mouldings or metal mouldings with baked enamel finish, as standard with grid manufacturer, to trim around light fixtures.
- 2.2.5. Accessories for Suspension System: Complete with splices, clips and perimeter moulding of manufacturer's standard and aluminum types to suit the applicable conditions unless special conditions and access areas are shown or specified. In high humidity areas provide galvanized suspension system.
- 2.2.6. Hangers: Minimum 2.642 mm (12 ga) overall thickness galvanized steel wire to zinc coating designation Z275 (G90), meeting "Heavy-duty" classification of ASTM C635/C635M.
- 2.2.7. Main Tees: 3.66 m (12') long, 23.8 mm (15/16") face width double web design, rectangular bulb at top of web, 38 mm (1-1/2") web height. Expansion cut-outs in main tees controlling buckling caused by heat expansion.
- 2.2.8. Main Tee Splices: Designed to lock lengths of main tees together so joined lengths of tee function structurally as single unit with tee faces at joint perfectly aligned and presenting tight seam.
- 2.2.9. Cross Tees: 1220 mm (4') long, 25 mm (1") web height structural cross-section, design same as main tees, designed to connect at main tees forming positive lock without play, loss or gain in grid dimensions with offset over-ride of face flange over main tee flange to provide flush joint. Provide 38 mm (1-1/2") web height of cross-tee for fire rated assemblies.
- 2.2.10. Edge Moulding Around Ceiling Perimeters: Materials and finish to match tees.
- 2.2.11. Panel Hold-Down Clips: As recommended by lay-in panel manufacturer.
- 2.2.12. Inserts for Concrete Slabs: Certified type for setting in concrete or self drilling expansion inserts for placing afterwards. Tie wire anchors, Red Head TW-1614 by ITW Canada, Inc., or Parabolt Wire Anchor by Acrow Richmond, or T-14 Eyebolt by Ramset Ltd., "HHDCA" or "HLC-T" by Hilti (Canada) Corporation or Tire Wire Drive TW-932 by Isometric Ltd.
- 2.2.13. Fasteners: Galvanized and of size suited to loading conditions.
- 2.2.14. Metal Closures and Trim: Bonderized and with factory-applied white baked enamel finish. Provide anchors as standard with manufacturer.
- 2.2.15. Supplementary Steel Supports: Steel conforming to Section 05 50 00.

- 2.2.16. Sound Attenuation Batts: CAN/ULC-S702.1, mineral (glass and stone wool) fibre, flame spread and smoke developed in conformance with OBC requirements and other authorities having jurisdiction in accordance with CAN/ULC-S102. Non-combustible in accordance with requirements of CAN/ULC-S114. Permitted Products: "EcoTouch™ QuietZone® PINK™ FIBERGLAS® Acoustic Insulation" by Owens Corning Canada LP; www.insulation.owenscorning.ca, "ROCKWOOL™ AFB - Acoustical Fire Batt Insulation" by ROCKWOOL™ International A/S; www.rockwool.com or "Sound-SHIELD® Formaldehyde-Free Fiber Glass Insulation" by Johns Manville Canada Inc.; www.jm.com or "Thermafiber® SAFB™ Mineral Wool Insulation" by Thermafiber, Inc. (Owens Corning Canada LP); www.thermafiber.com, thickness; 64 mm (2-1/2") [89 mm (3-1/2")] except as otherwise noted.
- 2.2.17. Acoustical Lay-In Panels (ACT): Refer to "Material and Finish Schedule" appended to Section 00 01 20.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Do not start installation until exterior glazing has been completed and exterior openings are closed in. Ensure wet work is completed and dried out to a degree acceptable to panel manufacturer before installation is commenced. Maintain uniform temperatures of at least 21 deg C (72 deg F) for 72 hours prior to commencement of work and maintain temperature until 72 hours after completion.
- 3.2.2. Install ceiling panels and metal suspension system in accordance with applicable requirements of ASTM C636/C636M, seismic design and manufacturer's directions. Where manufacturer's directions are at variance with Contract Documents, notify Consultant before proceeding with work.
- 3.2.3. Do not commence installation until all work above suspended ceiling has been completed, inspected and reviewed.
- 3.2.4. Install supporting inserts for hangers of suspended ceiling system into concrete slab above.
- 3.2.5. Install acoustical ceilings using tradesmen skilled in this class of work, in accordance with manufacturer's instructions and as specified herein.
- 3.2.6. Neatly and symmetrically install suspended ceiling to true lines, evenly balanced to pattern indicated on Drawings or as directed.
- 3.2.7. Centre ceiling system on room axis unless otherwise thereon or directed leaving equal border panels not less than 1/2 a full width.
- 3.2.8. Recessed items shall replace or be centred on acoustical panels, except where shown otherwise. Consult with Mechanical and Electrical to co-ordinate work. Provide additional supports where required.
- 3.2.9. Space hangers for suspended ceilings to support grillage independent of walls, columns, pipes and ducts at maximum 1220 mm (4') centres along support grillage and not more than 150 mm (6") from ends. Provide additional hangers at light fixtures and diffusers.
- 3.2.10. Attach hangers to inserts in overhead concrete slab. Bend top of hangers at right angles, turn down and securely fasten. Turn bottom of hangers upwards and securely wrap 3 times.

- 3.2.11. Suspension to Metal Deck: Punch lower part of metal deck with special puncher at required distances. Put hanger wire through holes, turn down, make a loop and securely wrap 3 times.
- 3.2.12. Provide written confirmations to Divisions 20, 21, 22, 23, 26, 27 and 28, when requested by Consultant, that suspended ceiling is capable of supporting additional weight of mechanical and electrical fixtures specified in Divisions 20, 21, 22, 23, 26, 27 and 28.
- 3.2.13. Run main tees at right angles to length of light fixtures.
- 3.2.14. Space main tees 1220 mm (4') oc in 1 direction and securely tie to hangers.
- 3.2.15. Space cross tees 610 mm (2') oc at right angles to main tees and properly lock at intersections.
- 3.2.16. Level suspended systems with a maximum tolerance of 3 mm (1/8") over 3.66 m (12').
- 3.2.17. Use longest practical lengths of tees, furring and running channels to minimize joints. Make joints square, tight, flush and reinforced with concealed splines. Assemble framework to form a rigid and interlocking system.
- 3.2.18. Design suspension system to accommodate movement caused by thermal expansion or contraction.
- 3.2.19. Design and space hangers and carrying members to support entire ceiling system, including lighting fixtures, diffusers and equipment openings in locations indicated on Drawings.
- 3.2.20. Use edge moulding where ceiling abutts vertical surface.
- 3.2.21. Use corner moulding along external edges at ceiling steps.
- 3.2.22. Exposed Grid Lay-in Panel Ceilings:
 - 3.2.22.1. Install direct-hung exposed grid lay-in acoustical panel ceilings where shown. Install main tees, cross tees and wall mouldings so bottom flanges are in flat, level plane at finish ceiling elevations. Arrange grid so opposite wall edge panels are of equal width but not less than 1/2 panel width and lay out and erect grid system to provide following panel pattern as shown:
 - 3.2.22.1.1. Pattern of 610 mm x 1220 mm (24" x 48"), with main beam tees spaced 1220 mm (48") oc and cross tees 610 mm (24") oc unless reviewed otherwise.
 - 3.2.22.1.2. Pattern of 610 mm x 610 mm (24" x 24"), with main beam tees spaced 1220 mm (48") oc, primary cross tees at 610 mm (24") oc and secondary cross tees at 610 mm (24") oc.
 - 3.2.22.2. Install exposed ceiling grid per ASTM C636/C636M, reviewed Shop Drawings and specified herein.
 - 3.2.22.3. Erect main beams parallel to main wall and to each other; space uniformly at centres specified. Stop ends of main beams 13 mm (1/2") from walls allowing for expansion. Supply main beams in as long lengths as possible to minimize number of joints in a run. Join lengths of main beams together at hangers only; use special splice pieces. In ceilings having recessed lighting fixtures, modify grid framing to provide main beams along and parallel to both long sides of lighting fixtures; at each 300 mm (12") wide fixture, provide an additional main beam along the long side of fixture. At other items recessed in ceiling and designed to be framed by main beams, provide additional main beams necessary. Rest ends of main beams on horizontal leg of wall mouldings.

- 3.2.22.4. Support main beams with hangers along each run, spaced at not more than 1220 mm (48") centres; except in areas of steel framing, provide hangers at each intersection of main beam and framing. If ductwork or equipment located in ceiling plenum area interferes with hanger spacing, provide a trapeze or other arrangement reviewed by Consultant to support main beams at proper spacing. Do not secure hangers to metal roof deck, ductwork, conduit, piping, equipment or support system for any of these. Provide an additional hanger at each corner of each opening to receive a recessed lighting fixture and each opening that has been framed by main beam members. Provide additional hangers at each diffuser, grille and other points of extra loading. Secure hangers to main beams to develop full strength of hangers and per manufacturer's published directions. Secure hangers to construction above per ASTM C636/C636M and following requirements:
- 3.2.22.4.1. Exposed Concrete Slab: Use anchors, cast-in hanger wires or inserts, specifically designed for hanger use.
- 3.2.22.4.2. Steel Beams: Use beam clips.
- 3.2.22.4.3. Steel Joists: Wrap hanger wire around lower chord member.
- 3.2.22.4.4. Permanent Metal Forms and Cellular Floor Deck: Tabs, holes or slots specifically provided for hanger attachment. Prevent hanger twisting or turning by cross tying.
- 3.2.22.5. Install primary cross tees at right angles to main beam tees and space uniformly at centres specified. Join ends of cross tees to web of main beams with a positive interlock; except at light fixtures, secure members together with concealed steel clips and bolts. Install tees to produce fine-line joints between flanges of abutting members.
- 3.2.22.6. Install secondary cross tees at right angles to primary tees and space uniformly at centres specified, and secure in a manner similar to primary tees.
- 3.2.22.7. At locations where ceilings abut walls, columns and other vertical surfaces, install continuous wall moulding to trim ceiling edges. Install moulding with bottom horizontal leg at elevation required to support acoustical panel and to be flush with bottom flange of grid members, and with vertical leg concealed. Bolt mouldings to supporting construction at 610 mm (24") on centres and within 150 mm (6") of end of each moulding piece. Provide tight, inconspicuous butt joints in moulding if several pieces are required in any 1 run.
- 3.2.22.8. Install acoustical panels with undamaged edges fitted accurately into suspension-system runners and edge mouldings. Scribe and cut panels at borders and penetrations to provide a precise fit. For circular penetrations through panels, provide edge mouldings fabricated to diameter required to fit penetration tightly. Fit panels moderately tight between upright legs of members. Cut panels neatly and accurately to fit closely around items piercing the finish ceiling plane ensuring no "light bleeding" is occurring at light fixtures. Secure each panel into grid opening with concealed hold-down clips.
- 3.2.22.9. Paint cut edges of panels remaining exposed after installation; match colour of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.3. SITE QUALITY CONTROL

- 3.3.1. Site Test and Inspection:
- 3.3.1.1. After interior finishing work has been substantially completed, or when directed by Consultant, inspect acoustical treatment work.
- 3.3.1.2. Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
- 3.3.2. Non-Conforming Work: Replace broken, chipped or damaged work, reset loose units or units out of place and touch up marred surfaces with matching paint.

3.4. CLEANING

- 3.4.1. Clean exposed surfaces of acoustical panel ceilings, including trim and edge mouldings. Comply with manufacturer's written instructions for cleaning and touch-up of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned or repaired to permanently eliminate evidence of damage.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide tactile warning surfacing including but not limited to following:
 - 1.2.1.1. cast-in-place tactile warning surfacing.
 - 1.2.1.2. surface applied tactile warning surfacing.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Filling and sealing of sawcut joints in concrete slab: Section 03 35 13, Concrete Floor Finishing.
 - 1.2.2.2. Provision of laminate flooring: Section 09 62 19, Laminate Flooring.
 - 1.2.2.3. Provision of linoleum sheet flooring: Section 09 65 43, Linoleum.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. SDS: Safety Data Sheet.

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week before commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit Product data on tactile warning surfacing; clearly indicate specific items proposed for use if manufacturer's catalogues are submitted.
- 1.5.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.5.2.1. cast-in-place tactile surfacing 300 mm (12") square.
 - 1.5.2.2. surface applied tactile surfacing 300 mm (12") square.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operational and Maintenance Data: Submit 3 copies of Product maintenance manual to Consultant prior to completion of the Work. Ensure manual contains specific maintenance recommendations and gives specific warning of any maintenance practice or materials which may damage or disfigure tactile warning surfacing.

1.7. MAINTENANCE MATERIAL SUBMITTALS

- 1.7.1. Extra Stock Materials: Leave 2 extra tiles of each type of tactile warning surfacing specified for Owner's future maintenance use. Supply tactile warning surfacing from same production run as installed. Execute Section 00 65 37.

1.8. QUALITY ASSURANCE

- 1.8.1. Qualifications:
- 1.8.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.8.2. Mock-Ups: Construct minimum 10 m² (100 sq ft) mock-up sample at Project location designated by Consultant for review. Once reviewed with no objection recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

1.9. DELIVERY, STORAGE AND HANDLING

- 1.9.1. Delivery and Acceptance Requirements:
- 1.9.1.1. Deliver materials in good condition to site in manufacturer's original unopened containers that bears name and brand of manufacturer, Project identification, shipping and handling instructions.
- 1.9.1.2. Deliver flooring material in a manner to avoid deterioration, staining or any other damage.
- 1.9.1.3. Deliver packaged floor preparation and adhesive materials in their original bags or containers clearly identified; keep containers sealed and labels intact until time of use. Prevent damage or contamination to materials by water, moisture, freezing, excessive heat, foreign matter or other causes.
- 1.9.1.4. Deliver materials on site at least 24 hours before work begins.
- 1.9.2. Storage and Handling Requirements:
- 1.9.2.1. Store and handle flooring material in a manner to avoid deterioration, staining or any other damage.
- 1.9.2.2. Store packaged floor preparation and adhesive materials in their original bags or containers clearly identified; keep containers sealed and labels intact until time of use. Prevent damage or contamination to materials by water, moisture, freezing, excessive heat, foreign matter or other causes. If materials are frozen, do not stir any such liquids or adhesives until they are completely thawed.
- 1.9.2.3. Provide secure heated and dry storage facilities on site. Maintain temperature in storage area between 18 deg C (65 deg F) and 38 deg C (100 deg F).
- 1.9.2.4. Store materials on site at least 24 hours before work begins.

1.10. SITE CONDITIONS

- 1.10.1. Ambient Conditions:
- 1.10.1.1. Maintain appropriate environmental conditions and protect work during and after installation. Comply with trade standards and manufacturer's Product instructions. Follow Product SDS and label instructions concerning safety, health and other related precautionary and environmental protection. Comply with applicable federal, provincial, local and statutory regulations.
- 1.10.1.2. Close doors and windows. Turn off radiant floor heating systems and protect work area from direct draft, sun and heat exposure during installation and for at least 72 hours after completion.
- 1.10.1.3. When necessary, build a temporary shelter and use indirect auxiliary heaters to maintain an adequate temperature level in work environment.

- 1.10.1.4. Exhaust temporary heaters to building exterior to prevent health hazards and damage to work from toxic fumes and emanations.
- 1.10.1.5. Maintain temperature of floor covering areas at not less than 18 deg C (65 deg F) or more than 38 deg C (100 deg F) 48 hours before, during installation and for 48 hours after application unless otherwise required in Product instructions.

1.11. WARRANTY

- 1.11.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. AccessTile; www.accesstile.com
 - 2.1.1.2. Engineered Plastics Inc.; www.armor-tile.com
 - 2.1.1.3. Kinesik Engineered Products Incorporated; www.kinesik.ca
- 2.1.2. Substitution Limitations: Comparable Products from other manufacturers not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Cast-in-Place Tactile Warning Surfacing: Provide 1 of following:
 - 2.2.1.1. Ceramic Tile Type: Provide 10 mm thick porcelain tactile walking surface indicator with 4 mm high truncated domes in colour indicated in "Material and Finish Schedule" appended to Section 00 01 20. Permitted Product: "Elan® Tile" by Kinesik Engineering Products Incorporated.
 - 2.2.1.2. Polymer Type:
 - 2.2.1.2.1. Provide 3 mm thick polymer based tactile walking surface indicator with 5 mm high truncated domes in colour indicated in "Material and Finish Schedule" appended to Section 00 01 20. Permitted Products: "Eon® Tile" by Kinesik Engineering Products Incorporated or "Intelligent Design™ Cast In Place Replacement" by AccessTile.
 - 2.2.1.2.2. Provide vitrified polymer composite based tactile walking surface indicator with raised truncated domes in colour indicated in "Material and Finish Schedule" appended to Section 00 01 20. Permitted Product: "Armor-Tile™ Cast in Place" by Engineered Plastics Inc.
 - 2.2.1.2.3. Provide fire resistant vitrified polymer composite based tactile walking surface indicator with raised truncated domes in colour selected later by Consultant. Permitted Product: "Access Tile® FR Cast in Place" by Kinesik Engineered Products Incorporated.
- 2.2.2. Surface Applied Tactile Warning Surfacing: Provide 1 of following:
 - 2.2.2.1. Domes: Provide 4 mm high 316L, marine grade stainless steel truncated domes 22 mm in diameter with concentric rings in middle; "Advantage® One Tactile Walking Surface Indicators (TWSI) Dome, Product Code: ADV-D-1281-N" by Kinesik Engineered Products Incorporated.
 - 2.2.2.2. Provide vitrified polymer composite based tactile walking surface indicator with raised truncated domes in colour indicated in "Material and Finish Schedule" appended to Section 00 01 20. Permitted Products: "Armor-Tile™ Surface Applied" by Engineered Plastics Inc. or "Intelligent Design™ Surface Applied" by AccessTile.

- 2.2.2.3. Provide fire resistant vitrified polymer composite based tactile walking surface indicator with raised truncated domes in colour indicated in "Material and Finish Schedule" appended to Section 00 01 20. Permitted Product: "Access Tile® FR Surface Applied" by Kinesik Engineered Products Incorporated.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- 3.2.2. Place tactile warning surfacing units in dimensions and orientation indicated on Drawings.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Remove protective plastic sheeting from detectable warning tiles within 24 hours of installation.
- 3.4.2. Clean tiles not more than 4 Days prior to date scheduled for inspection intended to establish Date of Substantial Performance in each area of the Project.

3.5. PROTECTION

- 3.5.1. Protect detectable warning tiles against damage during construction period to comply with tile manufacturer's specifications.
- 3.5.2. During and after detectable warning tile's installation and concrete curing stage, it is imperative no walking, leaning, or external forces are placed on tile to rock tile, causing a void between underside of tile and concrete substrate.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide laminate flooring including but not limited to following:
 - 1.2.1.1. underlayment.
 - 1.2.1.2. laminate flooring.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of "Maintenance Material Form" for receiving extra/spare material for Owner's future use: Section 00 65 37, Maintenance Material Form (Specimen).
 - 1.2.2.2. Filling and sealing of sawcut joints in concrete slab: Section 03 35 13, Concrete Floor Finishing.
 - 1.2.2.3. Provision of expansion joint covers for use with resilient flooring: Section 07 95 13, Expansion Joint Control Assemblies.
 - 1.2.2.4. Provision of resilient base and accessories: Section 09 65 13, Resilient Base and Accessories.
 - 1.2.2.5. Provision of linoleum sheet flooring: Section 09 65 43, Linoleum.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. LVT: Laminate vinyl tile.
 - 1.3.1.2. RH: Relative Humidity.
 - 1.3.1.3. SDS: Safety Data Sheet.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM F710-19e1
 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 1.3.2.2. ASTM F1869-16a
 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 1.3.2.3. ASTM F2170-19a
 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week before commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Indicate installation methods, transitions/moulding details, manufacturer's installation instructions and detail of additional accessory items.
- 1.5.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
- 1.5.2.1. plank width x 300 mm (12") long sample.
- 1.5.2.2. 150 mm (6") lengths of each transition/moulding to be used for installation.
- 1.5.3. Test and Evaluation Reports: If requested, submit test reports from recognized independent testing laboratory for following requirements:
- 1.5.3.1. Submit calcium chloride test results in accordance with requirements specified herein.
- 1.5.3.2. Submit pH test results and verify their acceptability to resilient flooring manufacturer in accordance with requirements specified herein.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operational and Maintenance Data: Submit 3 copies of Product maintenance manual to Consultant prior to completion of the Work. Ensure manual contains specific maintenance recommendations and gives specific warning of any maintenance practice or materials which may damage or disfigure resilient flooring and bases.

1.7. MAINTENANCE MATERIAL SUBMITTALS

- 1.7.1. Extra Stock Materials: Leave 1 carton of tile for each 93 m² (1000 sq ft) or less of each colour of laminate flooring installed, for Owner's future use. Label cartons as to contents and indicate areas where tiles were used. Execute Section 00 65 37.

1.8. QUALITY ASSURANCE

- 1.8.1. Qualifications:
- 1.8.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.8.2. Mock-Ups: Construct minimum 10 m² (100 sq ft) mock-up sample at Project location designated by Consultant for review. Once reviewed with no objections recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

1.9. DELIVERY, STORAGE AND HANDLING

- 1.9.1. Delivery and Acceptance Requirements:
- 1.9.1.1. Deliver packaged materials in original containers with seals unbroken and labels intact until time of use.

- 1.9.1.2. Deliver materials only when environmental conditions meet requirements specified for installation areas.
- 1.9.1.3. Deliver materials sufficiently in advance of installation to acclimate materials to the environment prior to installation if required per manufacturer's instructions.
- 1.9.2. Storage and Handling Requirements:
 - 1.9.2.1. If materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.
 - 1.9.2.2. Store and handle in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

1.10. SITE CONDITIONS

- 1.10.1. Ambient Conditions:
 - 1.10.1.1. Maintain appropriate environmental conditions and protect work during and after installation. Comply with trade standards and manufacturer's Product instructions. Follow Product SDS and label instructions concerning safety, health and other related precautionary and environmental protection. Comply with applicable federal, provincial, local and statutory regulations.
 - 1.10.1.2. Close doors and windows. Turn off radiant floor heating systems and protect work area from direct draft, sun and heat exposure during installation and for at least 72 hours after completion.
 - 1.10.1.3. When necessary, build a temporary shelter and use indirect auxiliary heaters to maintain an adequate temperature level in work environment.
 - 1.10.1.4. Exhaust temporary heaters to building exterior to prevent health hazards and damage to work from toxic fumes and emanations.
 - 1.10.1.5. Maintain temperature of floor covering areas at not less than 18 deg C (65 deg F) or more than 38 deg C (100 deg F) 48 hours before, during installation and for 48 hours after application unless otherwise required in Product instructions.

1.11. WARRANTY

- 1.11.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Armstrong World Industries Canada Ltd.; www.armstrongflooring.com
 - 2.1.1.2. Mannington Commercial; www.manningtoncommercial.com
 - 2.1.1.3. MAPEI Inc.; www.mapei.ca
 - 2.1.1.4. R&D Technical Solutions Ltd.; www.kelmar.com
 - 2.1.1.5. Sika Canada Inc.; www.sika.ca
- 2.1.2. Substitution Limitations: This Specification is based on Products specified herein. Comparable Products from manufacturers listed or not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Provide Products free from blisters, cracks, chipped edges and corners, embedded foreign matter or other defects.
- 2.2.2. Concrete Moisture Emission Reducer: Provide 1 of following:
 - 2.2.2.1. "Planiseal™ VS" by MAPEI Inc.
 - 2.2.2.2. "Kelmar MVB" by R&D Technical Solutions Ltd.
 - 2.2.2.3. "Sikafloor® 81 EpoCem^{CA}" by Sika Canada Inc.
- 2.2.3. Underlayment: Latex/cement/sand patching compound compatible with resilient flooring and associated adhesives; "S-194 Patch & Underlayment" by Armstrong World Industries Canada Ltd., "Ultra/Plan" by MAPEI Inc. or if acceptable to Product manufacturer "Sureflo, hydraulic cement based self-levelling floor underlayment" by Gemite Products Inc.
- 2.2.4. Laminate Vinyl Tile (LVT): 156 mm x 1380 mm x 8 mm (6-1/8" x 54-11/32" x 0.315") thick by Mannington Commercial, colours: Refer to "Material and Finish Schedule" appended to Section 00 01 20.
- 2.2.5. Epoxy Adhesive and Caulking Compound: As required for surfaces involved recommended and supplied by rubber tile and tread manufacturer.
- 2.2.6. Primers and Adhesives: As required for surfaces involved as recommended and supplied by tile manufacturer used.
- 2.2.7. High Moisture Tolerant Adhesive: "S-515 Floor Tile Adhesive" by Armstrong World Industries Canada Ltd. or "Paniseal™ VS" by MAPEI Inc.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Ensure concrete substrates are dry after performing tests as specified herein before using methods recommended by laminate flooring and adhesive manufacturers and that they exhibit no alkalinity, carbonization, dusting and scaling.
 - 3.1.1.2. Ensure concrete floor to receive laminate flooring has been prepared in accordance with ASTM F710.
 - 3.1.1.3. Examine substrates for curing compounds, sealers, hardeners and other substances not compatible with adhesive.
 - 3.1.1.4. Apply laminate flooring in respective areas during final stages of building completion when ceilings and permanent partitions are finished, paint prime coats are applied and substrate conditions are suitable.
- 3.1.2. Preinstallation Testing:
 - 3.1.2.1. Perform calcium chloride test no earlier than 28 Days after concrete has been placed in accordance with requirements of ASTM F1869 and/or RH testing in accordance with ASTM F2170 immediately prior to installation of laminate flooring for moisture on concrete floors around perimeter of areas, at columns and where moisture may be anticipated. Conduct 3 tests for first 93 m² (1000 sq ft) and 1 additional test for every 93 m² (1000 sq ft) of flooring. Ensure moisture emission from concrete floor does not exceed 2.27 kg/93 m² (5 lbs/1000 sq ft) in 24 hours or has a maximum RH of 85%. Do not proceed with installation until moisture problem has been corrected. Provide results to Consultant prior to commencement of installation.
 - 3.1.2.2. When concrete moisture emission rate is between 2.27 kg/93 m² (5 lbs/1000 sq ft) and 4.53 kg/93 m² (10 lbs/1000 sq ft) in 24 hours use either a concrete moisture emission reducer or a high moisture tolerant adhesive.

- 3.1.2.3. When concrete moisture emission rate is between 4.53 kg/93 m² (10 lbs/1000 sq ft) and 6.79 kg/93 m² (15 lbs/1000 sq ft) in 24 hours use a concrete moisture emission reducer.
- 3.1.2.4. Conduct pH test no earlier than 28 Days after concrete has been placed to ensure alkali salt residue is within the limitation acceptable to manufacturer and to avoid adhesive failure, discolouration, shrinkage and softening of the floor covering. If the pH results are higher than 10, report to Consultant, Contractor or Owner for investigation and remedial. Also refer to manufacturer for ways to neutralize floor prior to beginning of installation. Neutralize by sanding, vacuuming and/or by water plus mild muriatic acid application as recommended by manufacturer. Retest to assure pH has been neutralized.
- 3.1.3. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Prepare concrete floors to receive laminate sheet flooring in accordance with requirements of ASTM F710. Consult individual manufacturer for their specific recommendations and follow them as required.
 - 3.2.1.2. Clean laminate flooring substrates free of loose and adhered material perfectly clean and in accordance with laminate flooring manufacturer's instructions.
 - 3.2.1.3. Perform bond test over floors where paint, varnish and other foreign agents are removed.
 - 3.2.1.4. Ensure concrete substrates are dry after performing tests as specified herein before using methods recommended by laminate flooring and adhesive manufacturers and that they exhibit no alkalinity, carbonization, dusting or scaling.
 - 3.2.1.5. Remove subfloor ridges and bumps to flush with adjacent subfloor.
 - 3.2.1.6. Stripping:
 - 3.2.1.6.1. Remove and dispose of existing flooring. Remove existing adhesives and prepare substrate as recommended by laminate flooring manufacturer.
 - 3.2.1.6.2. Test existing substrate for soundness and remove unsound substrates.
 - 3.2.1.7. Underlayment:
 - 3.2.1.7.1. Fill depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with underlayment, flat, even and flush with adjacent substrate.
 - 3.2.1.7.2. Floor fills, toppings and underlayment shall have minimum compressive strength of 24 MPa (3500 psi). Do not install underlayment, leveler, patching and skim coat over expansion joints.
 - 3.2.1.7.3. Provide underlayment to achieve a flat substrate to within the following tolerances:
 - 3.2.1.7.3.1. 3 mm (1/8") total maximum deviation +/- along a 3000 mm (10') straight edge applied omnidirectionally over entire floor area.
 - 3.2.1.7.4. Provide a flat, smooth 610 mm (24") wide underlayment strip at the junction of laminate flooring with other finish flooring materials for a flush transition at the meeting edge. Feather strip edges to conceal its perimeter.

3.3. INSTALLATION

- 3.3.1. Do not commence resilient flooring installation prior to 28 Days of placing concrete.
- 3.3.2. Verify floor direction and pattern with Consultant prior to installation.
- 3.3.3. Install laminate flooring in accordance with flooring manufacturer's directions and to areas and patterns scheduled and detailed on Drawings, reviewed Shop Drawings and Finish Schedules.

- 3.3.4. Provide expansion void at perimeter vertical interfaces (walls, millwork, adjacent floor finishes, and at openings as required) of width and in accordance with flooring manufacturer's recommendations and requirements using temporary blocking if and as required and expansion material as recommended by flooring manufacturer.
- 3.3.5. Unless otherwise indicated, install flooring symmetrically about room centre line and parallel to long dimension of room(s) and corridor(s), continuous through doorways and cut to fit projections, with joints straight, true to plane and with minimum half plank width at perimeters. Stagger end joint locations a minimum of 250 mm to 300 mm (10" to 12") and seal cut ends as recommended by manufacturer. When required by manufacturer install specified adhesive to laminate joints in accordance with manufacturer's written instructions.
- 3.3.6. Terminate laminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar, unless indicated otherwise on Drawings.
- 3.3.7. Seal perimeters of wet areas, i.e., in expansion gap under stoves, fridges and dishwashers with a clear silicone sealant.
- 3.3.8. Install protective edgings/reducer strips and laminate thresholds to exposed laminate flooring edges and interfaces with other flooring materials as required to suit conditions, fixed as recommended by manufacturer.
- 3.3.9. Install metal thresholds at openings and where indicated and attached to adjacent rigid floor surface. Where thresholds cover an expansion space, ensure they are fastened to substrate and not to laminate flooring, to allow flooring to move (i.e. expand and contract) under threshold.

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Remove excess adhesive from floor, base and wall surfaces without damage.
- 3.5.2. Clean flooring and base surface to flooring manufacturer's instructions.

3.6. PROTECTION

- 3.6.1. Protect installed laminate flooring with minimum 1 layer of kraft paper, joints taped.
- 3.6.2. Protect installed laminate flooring as recommended by flooring manufacturer against damage from rolling loads, other trades or placement of fixtures and equipment.
- 3.6.3. Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide resilient base and accessories including but not limited to following:
 - 1.2.1.1. resilient base.
 - 1.2.1.2. reducing strips.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of "Maintenance Material Form" for receiving extra/spare material for Owner's future use: Section 00 65 37, Maintenance Material Form (Specimen).
 - 1.2.2.2. Provision of laminate flooring: Section 09 62 19, Laminate Flooring.
 - 1.2.2.3. Provision of linoleum sheet flooring: Section 09 65 43, Linoleum.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. PVC: Polyvinyl Chloride.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM F1861-21 - Standard Specification for Resilient Wall Base

1.4. SUBMITTALS

- 1.4.1. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.
- 1.4.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.4.2.1. resilient base 300 mm (12") long.
 - 1.4.2.2. reducing strips 300 mm (12") long.

1.5. CLOSEOUT SUBMITTALS

- 1.5.1. Operational and Maintenance Data: Submit 3 copies of Product maintenance manual to Consultant prior to completion of the Work. Ensure manual contains specific maintenance recommendations and gives specific warning of any maintenance practice or materials which may damage or disfigure resilient bases and accessories.

1.6. MAINTENANCE MATERIAL SUBMITTALS

- 1.6.1. Extra Stock Materials: Leave minimum 3 m (10') of each colour of resilient base installed, for Owner's future use. Label and indicate areas where resilient base was used. Execute Section 00 65 37.

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

- 1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact.

1.8.2. Storage and Handling Requirements:

- 1.8.2.1. Store materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact. Store materials in a warm, dry area.

- 1.8.2.2. Prevent damage to materials during handling and storage.

1.9. SITE CONDITIONS

1.9.1. Ambient Conditions:

- 1.9.1.1. Maintain appropriate environmental conditions and protect work during and after installation. Comply with trade standards and manufacturer's Product instructions.

- 1.9.1.2. Close doors and windows. Turn off radiant floor heating systems and protect work area from direct draft, sun and heat exposure during installation and for at least 72 hours after completion.

- 1.9.1.3. When necessary, build a temporary shelter and use indirect auxiliary heaters to maintain an adequate temperature level in work environment.

- 1.9.1.4. Exhaust temporary heaters to building exterior to prevent health hazards and damage to work from toxic fumes and emanations.

- 1.9.1.5. Maintain temperature of floor covering areas at not less than 18 deg C (65 deg F) or more than 38 deg C (100 deg F) 48 hours before, during installation and for 48 hours after application unless otherwise required in Product instructions.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

- 2.1.1.1. Flexco; www.flexcofloors.com

- 2.1.1.2. Mannington Commercial; www.manningtoncommercial.com

- 2.1.1.3. Roppe Corporation, USA; www.roppe.com

- 2.1.1.4. Tarkett; www.commercial.tarkett.com

- 2.1.2. Substitution Limitations: Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Provide Products free from blisters, cracks, chipped edges, embedded foreign matter or other defects.

- 2.2.2. Resilient Base (RB): 3 mm (1/8") thick x 100 mm (4") high in accordance with ASTM F1861, Type TP, Group 1, PVC-free vulcanized rubber, in coil lengths, colour selected from manufacturer's standard range. Provide "Tightlock® Wall Base" by Tarkett.

- 2.2.3. Reducing Strips (RS): Vinyl, thickness to suit adjacent flooring; Flexco, Mannington Commercial, Roppe Corporation, USA or Tarkett.
- 2.2.4. Primers and Adhesives: As required for surfaces involved as recommended and supplied by tile manufacturer used.
- 2.2.5. Colours: Refer to "Material and Finish Schedule" appended to Section 00 01 20.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Resilient Base:
 - 3.2.1.1. Provide resilient base to substrate surfaces in accordance with manufacturer's recommendations.
 - 3.2.1.2. Apply adhesive evenly and continuously for full base adhesion and contact. Do not apply adhesive in a manner which promotes induced waviness in resilient base.
 - 3.2.1.3. Provide base in longest lengths possible with top and bottom edges installed straight and true. Provide preformed inside and outside corners.
 - 3.2.1.4. Provide resilient bases to walls, partitions, columns and items of Architectural Woodwork.
- 3.2.2. Reducing Strips: Protect exposed edges of resilient flooring, where finished and unfinished area adjoin, by means of reducing strips butting to and flush with finished surface of floor covering material.
- 3.2.3. Remove and replace base showing shrinkage or adhesion failure.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Remove adhesive from surface of flooring and/or resilient base as work progresses.

3.5. PROTECTION

- 3.5.1. Protect this work and work of other trades at all times.
- 3.5.2. Provide and maintain necessary protection of finished resilient bases. Replace damaged resilient bases with new materials without cost to Owner.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide linoleum including but not limited to following:
 - 1.2.1.1. preparing substrate.
 - 1.2.1.2. linoleum sheet flooring.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of "Maintenance Material Form" for receiving extra/spare material for Owner's future use: Section 00 65 37, Maintenance Material Form (Specimen).
 - 1.2.2.2. Concrete floor finishing: Section 03 35 13, Concrete Floor Finishing.
 - 1.2.2.3. Supply of sealants and caulking: Section 07 92 00, Joint Sealants.
 - 1.2.2.4. Supply of resilient base: Section 09 65 13, Resilient Base and Accessories.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. RH: Relative Humidity.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM F710-19e1 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 1.3.2.2. ASTM F1869-16a - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 1.3.2.3. ASTM F2170-19a - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Coordination: Coordinate installation of prefabricated flash cove bases with linoleum installation.
- 1.4.2. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Submit Shop Drawings for all areas showing seam layout for major seams between rolls, coving details, treatment at walls, floor drains, treatment where flooring meets dissimilar materials and other special conditions.
- 1.5.2. Samples:
 - 1.5.2.1. Submit samples in accordance with Section 01 30 00.
 - 1.5.2.2. Submit duplicate 300 mm x 300 mm (12" x 12") sample pieces of sheet material. Where applicable feature strips, edge strips and applicable accessories.
 - 1.5.2.3. Submit 300 mm (12") samples of welding rod, each type of seam specified, to indicate quality of joint treatment and each type of flooring accessory.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data: Submit 3 copies of detailed instructions for maintaining, preserving and keeping linoleum flooring clean and give adequate warning of maintenance practices or materials detrimental to linoleum flooring.

1.7. MAINTENANCE MATERIAL SUBMITTALS

- 1.7.1. Extra Stock Materials:
 - 1.7.1.1. Ensure maintenance materials are of same production run as installed materials.
 - 1.7.1.2. Supply 10 m² (100 sq ft) of each colour, pattern and type of flooring material required for maintenance use. Store where directed on site. Identify each roll as to type, pattern, colour, thickness and location of installation.
 - 1.7.1.3. Execute Section 00 65 37.

1.8. QUALITY ASSURANCE

- 1.8.1. Qualifications:
 - 1.8.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.8.2. Mock-Ups:
 - 1.8.2.1. In coordination with Consultant, Owner, Contractor, Subcontractor, flooring manufacturer and adhesive manufacturer, meet to select and block-off a floor area of approximately 9 m² (100 sq ft). Clean and properly prepare for building a mock-up of linoleum flooring using specified adhesive and floor finish materials in accordance with Specifications, Product instructions and discussions from preinstallation meeting. Ensure finish lighting scheme is replicated in area where mock-up is installed. During mock-up area installation, ensure participants are present to observe substrate preparation, installation and cleaning procedures.
 - 1.8.2.2. After mock-up installation and inspection, discuss pertinent remarks, observations and recommendations are discussed in presence of participants.
 - 1.8.2.3. Once reviewed, mock-up including recorded observations and recommendations remains part of finished work and used as quality reference standard for balance of linoleum flooring work. Protect mock-up area from dirt, dust, damage and abuse until Substantial Performance of the Work.

1.9. DELIVERY, STORAGE AND HANDLING

- 1.9.1. Delivery and Acceptance Requirements: Deliver materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact.

- 1.9.2. Storage and Handling Requirements:
 - 1.9.2.1. Store materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact. Store materials in warm and dry area. Store linoleum rolls upright.
 - 1.9.2.2. Prevent damage to materials during handling and storage. Do not stack tile material over 2 cartons in height, nor in excess of allowable floor loading. Store materials on smooth surfaces only, in area designated by Consultant.
 - 1.9.2.3. Protect this work and work of other trades at all times.

1.10. SITE CONDITIONS

- 1.10.1. Ambient Conditions:
 - 1.10.1.1. Ensure temperature of room floor surface and materials is not less than 18 deg C (65 deg F) and not more than 29 deg C (85 deg F) for 48 hours before, during and for 48 hours minimum after installation. Maintain minimum temperature as recommended Product manufacturer.
 - 1.10.1.2. Ensure humidity levels of spaces to receive linoleum are maintained at design levels for minimum 24 hours before installation.
 - 1.10.1.3. Avoid high humidity, cold drafts and abrupt temperature change.

1.11. WARRANTY

- 1.11.1. Manufacturer Warranty: Warrant work of this Section for period of 5 years against defects and/or deficiencies and installation in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to, buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Forbo Flooring, Inc.; www.forboflooringna.com
 - 2.1.1.2. Gerflor; www.gerflor.com
 - 2.1.1.3. MAPEI Corporation; www.mapei.ca
 - 2.1.1.4. R&D Technical Solutions Ltd.; www.kelmar.com
 - 2.1.1.5. Sika Canada Inc.; www.sika.ca
- 2.1.2. Substitution Limitations: This Specification is based on Forbo Flooring, Inc.'s Products. Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Description:
- 2.2.2. Concrete Moisture Emission Reducer: Provide 1 of following:
 - 2.2.2.1. "Forbo Sustain 885M – Marmoleum Sheet Adhesive" by Forbo Flooring, Inc.
 - 2.2.2.2. "Planiseal™ VS" by MAPEI Corporation.
 - 2.2.2.3. "Kelmar® MVB" by R&D Technical Solutions Ltd.
 - 2.2.2.4. "Sikafloor® 81 EpoCem^{CA}" by Sika Canada Inc.

- 2.2.3. Linoleum Sheet Flooring: "Marmoleum®" by Forbo Flooring, Inc.; 2.5 mm (0.1") thickness; 2 m (6' - 6") width by maximum length available; composed of natural ingredients which are mixed and calendered onto jute backing and has flame spread rating and smoke developed rating to meet Code requirements in accordance with CAN/ULC-S102.2. Colours and patterns: refer to "Material and Finish Schedule" appended to Section 00 01 20.
- 2.2.4. Sawcut and Control Joint Filler: Latex-cement compound.
- 2.2.5. Levelling Materials: Hydraulic cement based self-levelling floor underlayment as recommended by linoleum manufacturer.
- 2.2.6. Primers and Adhesives: As required for surfaces involved as recommended by and supplied by manufacturers used.
- 2.2.7. High Moisture Tolerant Adhesive: "Planiseal™ VS" by Mapei Corporation.
- 2.2.8. Linoleum Welding Rod: Provide "Marmoweld Solid" by Forbo Flooring, Inc. Colours: refer to "Material and Finish Schedule" appended to Section 00 01 20.
- 2.2.9. Thresholds: Vinyl edge trim where floors of 2 different materials butt; mill finish aluminum thresholds where floors of different levels butt; mill finish aluminum butt level type at edges of linoleum flooring at finished concrete floors.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Ensure concrete substrates are dry after performing tests as specified herein before using methods recommended by linoleum flooring and adhesive manufacturers and that they exhibit no alkalinity, carbonization, dusting and scaling.
 - 3.1.1.2. Ensure concrete floor to receive linoleum flooring [and prefabricated flash cove base] has been prepared in accordance with ASTM F710.
 - 3.1.1.3. Examine substrates for curing compounds, sealers, hardeners and other substances not compatible with adhesive.
 - 3.1.1.4. Apply linoleum flooring in respective areas during final stages of building completion when ceilings and permanent partitions are finished, paint prime coats are applied and substrate conditions are suitable.
- 3.1.2. Preinstallation Testing:
 - 3.1.2.1. Perform calcium chloride test no earlier than 28 Days after concrete has been place in accordance with requirements of ASTM F1869 and/or RH testing in accordance with ASTM F2170 immediately prior to installation of linoleum for moisture on concrete floors around perimeter of areas, at columns, and where moisture may be anticipated. Conduct 1 test for every 93 m² (1000 sq ft) of flooring. Ensure moisture emission from concrete floor does not exceed 2.27 kg/93 m² (5 lbs/1000 sq ft) in 24 hours or has a maximum RH of 85%. Do not proceed with installation until moisture problem has been corrected. Provide results to Consultant prior to commencement of installation including diagram of area tested showing location of each moisture test.
 - 3.1.2.2. When concrete moisture emission rate is between 2.27 kg/93 m² (5 lbs/1000 sq ft) and 4.53 kg/93 m² (10 lbs/1000 sq ft) in 24 hours use either a concrete moisture emission reducer or a high moisture tolerant adhesive.

- 3.1.2.3. Conduct pH test no earlier than 28 Days after concrete has been placed to ensure alkali salt residue is within limitation acceptable to manufacturer and to avoid adhesive failure, discolouration, shrinkage and softening of floor covering. If pH results are higher than 10, report to Consultant, Contractor or Owner for investigation and remedial. Also refer to manufacturer for ways to neutralize floor prior to beginning of installation. Neutralize by sanding, vacuuming and/or by water plus mild muriatic acid application as recommended by manufacturer. Retest to assure pH has been neutralized.

- 3.1.3. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:

- 3.2.1.1. Prepare concrete floors to receive linoleum flooring in accordance with requirements of ASTM F710. Consult individual manufacturer for their specific recommendations and follow them as required.

- 3.2.1.2. Vacuum clean and remove oil, grease and other deleterious materials from surfaces to receive linoleum flooring.

- 3.2.1.3. Fill cracks, crevices and holes in concrete sub-floors. Finish smooth and level. Grind bumps level.

- 3.2.1.4. Fill sawcut and control joints to be covered with linoleum flooring.

3.3. INSTALLATION

- 3.3.1. Spread primer evenly over floor surfaces. Permit primer to dry. Mix and apply adhesive evenly over floor surfaces using correct tool, in accordance with manufacturer's instructions. Apply to only area which can be covered by linoleum flooring Products within adhesive working time. If adhesive over dries, completely remove it. Use removal solvents compatible with adhesive. Reapply adhesive. Do not soil walls, bases, fitments and adjacent areas with adhesive. Promptly remove spillage.

- 3.3.2. Lay sheet linoleum with minimum of seams. Ensure seams are tight and parallel to axes of rooms.

- 3.3.3. Heat weld seams of linoleum sheet flooring following installation with linoleum welding rod in accordance with manufacturer's printed instructions.

- 3.3.4. Cut and fit neatly around fixed objects. Fit tightly to electrical and mechanical fittings, piping and equipment. Scribe and fit to abutting surfaces.

- 3.3.5. Roll linoleum with 45 kg (100 lb) roller in both directions immediately after laying.

- 3.3.6. Install reviewed edging where linoleum terminates adjacent to dissimilar flooring material or at different finished floor height. Install metal thresholds with stainless steel wood screws in plastic plugs on concrete sub-floors. Install thresholds at door ways.

- 3.3.7. Terminate linoleum at centreline of door in openings where adjacent floor finish or colour is dissimilar, unless indicated otherwise on Drawings.

- 3.3.8. Where linoleum terminates at exterior doors with thresholds or transition trim, feather linoleum as required to achieve maximum allowable distance of 13 mm (1/2") between linoleum and top of threshold or transition trim. Extend linoleum a minimum of 13 mm (1/2") under threshold and apply sealant to perimeter of threshold.

- 3.3.9. Promptly remove and replace flooring showing bumps from underlying dirt, discolouration, excessive wear, shrinkage or adhesion failure. Remove and replace base showing shrinkage or adhesion failure.

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Remove adhesive from surfaces as work progresses. Five Days after installation, clean surfaces with neutral pH cleaning detergent approved by linoleum manufacturer. Avoid flooding linoleum with water. Pick up excess water with vacuum or squeegee. Rinse linoleum floor with clean water and allow to dry.
- 3.5.2. Cover cleaned surfaces with fibre reinforced, non-staining kraft paper, secured in position with non-staining gummed tape to prevent drifting. Remove covering when directed by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide fixed sound-absorptive panels including but not limited to following:
 - 1.2.1.1. cementitious wood fibre plank acoustical ceiling panels.
 - 1.2.1.2. framework mounting extrusions.
 - 1.2.1.3. fasteners.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of acoustical ceiling systems: Section 09 51 13, Acoustical Panel Ceilings.
 - 1.2.2.2. Provision of wall coverings: Section 09 72 00, Wall Coverings.
 - 1.2.2.3. Provision of finish painting: Section 09 91 00, Painting.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CISCA: Ceilings & Interior Systems Construction Association; www.cisca.org.
 - 1.3.1.2. HVAC: Heating, Ventilating and Air Conditioning.
 - 1.3.1.3. NRC: Noise Reduction Coefficient.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM E84-23 - Standard Test Method for Surface Burning Characteristics of Building Materials

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.
- 1.4.2. Scheduling: Schedule installation of fixed sound-absorptive panels as late as possible in sequence of construction schedule to reduce damage and as follows:
 - 1.4.2.1. Do not install fixed sound-absorptive panels until space is enclosed, weather tight and conditioned.
 - 1.4.2.2. Do not install prior to completion of abutting grid ceiling installation.
 - 1.4.2.3. Ensure no wet work remains with exception of touch-up.

1.5. SUBMITTALS

- 1.5.1. Product Data: Submit manufacturer's literature describing system to be provided.
- 1.5.2. Shop Drawings:
 - 1.5.2.1. Submit Shop Drawings showing general layout, jointing, anchoring sizes and types, shapes, thickness and other similar detailed information necessary to fully describe installation.
 - 1.5.2.2. Ensure elevations indicate arrangement of joints. Clearly indicate locations of seams, methods of joining seams, direction of panels and notations occur.
 - 1.5.2.3. Ensure Shop Drawings include key plans, elevations, plan sections and details.
- 1.5.3. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.5.3.1. Submit 300 mm (12") long samples of suspension system parts, including trim.
 - 1.5.3.2. Submit 300 mm x 300 mm (12" x 12") samples of fixed sound-absorptive panels showing full range of exposed texture expected on completed work.
- 1.5.4. Certificates:
 - 1.5.4.1. Provide certification from manufacturer of fixed sound-absorptive panels attesting to their Product's compliance with specified requirements including mandatory fire performance characteristics under ASTM E84.
 - 1.5.4.2. Provide certification stating technicians utilized for installation have been trained or qualified by manufacturer.
- 1.5.5. Test and Evaluation Reports: Submit complete test reports for fixed sound-absorptive panels prepared by an independent testing laboratory IAS Certified indicating full compliance with both acoustical and fire resistance performance requirements under ASTM E84 and as follows:
 - 1.5.5.1. Ensure systems are certified under ASTM E84 and Class is compliant with placement in building as follows:
 - 1.5.5.1.1. Class A - Flame Spread Index (0-25).
 - 1.5.5.1.2. Smoke Developed Index (0-450) for all Classes A, B or C.
- 1.5.6. Manufacturers' Instructions: Submit manufacturer's summary of installation procedures which will be basis for reviewing or rejecting actual installation procedures.

1.6. MAINTENANCE MATERIAL SUBMITTALS

- 1.6.1. Extra Stock Materials: Leave manufacturer's recommended percentage of each type of panel specified for Owner's future maintenance use. Supply panels from same production run as installed panels. Execute Section 00 65 37.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
 - 1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.7.2. Mock-Ups: Construct minimum 10 m² (100 sq ft) mock-up sample at Project location designated by Consultant for review. Once reviewed with no objections recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements:

- 1.8.1.1. Deliver materials in manufacturer's original unopened packaging.
- 1.8.1.2. Remove carton type wrappings and inter-leavings that are wet.
- 1.8.1.3. Unwrap and inspect panels upon arrival for flaws and defects. Notify Consultant at least 24 hours in advance of inspection.
- 1.8.1.4. Reject panels that are flawed by poor colour match with goods specified, water damage or other unsatisfactory conditions.

1.8.2. Storage and Handling Requirements:

- 1.8.2.1. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer.
- 1.8.2.2. Prevent soiling, physical damage or wetting.
- 1.8.2.3. Store cartons open at each end to stabilize moisture content and temperature.

1.9. SITE CONDITIONS

1.9.1. Ambient Conditions:

- 1.9.1.1. Do not install acoustical panels until building is closed in and HVAC system is operational.
- 1.9.1.2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
- 1.9.1.3. Maintain following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
 - 1.9.1.3.1. Relative Humidity: 65 - 75%.
 - 1.9.1.3.2. Uniform Temperature: 13 deg C - 21 deg C (55 deg F - 70 deg F).

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 2.1.1.1. Tectum Inc.; www.tectum.com
- 2.1.2. Substitution Limitations: Comparable Products from other manufacturers not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
 - 2.2.1.1. Provide fixed sound-absorptive panel assembly designed and tested to provide surface burning characteristics in accordance with ASTM E84 as follows:
 - 2.2.1.1.1. Flamespread: 5.
 - 2.2.1.1.2. Smoke Developed: 15.
 - 2.2.1.2. Provide fixed sound-absorptive panel system which has been manufactured, fabricated and installed to provide a sufficient NRC rating.
- 2.2.2. Fixed Sound-Absorptive Panel System (CP): Refer to "Material and Finish Schedule" appended to Section 00 01 20.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Comply with instructions and recommendations of sound-absorptive panel system manufacturer.
- 3.2.2. Install materials in accordance with governing regulations, fire resistance rating requirements and industry standards applicable to work including CISCA's "Custom Acoustical Glass Fiber Wall & Ceiling Panels".
- 3.2.3. Ensure screw head is flush with panel surface.
- 3.2.4. Securely affix sound-absorptive panels by means of splines attached vertically to smooth wall or furring strips. Engage vertical kerfs on the edges of the wall panels with splines. Apply adhesive or use Velcro hook and loop fastening where necessary.
- 3.2.5. Cover field cut edges by means of trim or other mouldings.
- 3.2.6. Site Tolerances:
 - 3.2.6.1. Maximum variation of panels from true location is +/-3 mm (+/-1/8").
 - 3.2.6.2. Maximum variation of surfaces intended to be flush is +/-1.6 mm (+/-1/16").
 - 3.2.6.3. Maximum variation of reveal width is +/-1.6 mm (+/-1/16").

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLEANING

- 3.4.1. Clean exposed surfaces of sound-absorptive panel, trim, mouldings and suspension members complying with manufacturer's instructions for cleaning.
- 3.4.2. Touch up any minor finish damage.
- 3.4.3. Remove surplus materials, rubbish and debris, leaving area in a neat and clean condition.

3.5. PROTECTION

- 3.5.1. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so work will be without damage and deterioration at time of acceptance by Owner.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide painting including but not limited to following:
 - 1.2.1.1. surface preparation of substrate: abrasive blasting, cleaning and preparation of surfaces for application of paint systems.
 - 1.2.1.2. interior priming and painting of:
 - 1.2.1.2.1. exposed building surfaces indicated on Room Finish Schedule or on Drawings.
 - 1.2.1.2.2. hollow metal doors and frames.
 - 1.2.1.2.3. edges of plastic laminated wood doors and trim of lites in same doors.
 - 1.2.1.2.4. borrowed lite frames.
 - 1.2.1.2.5. exposed miscellaneous metal and steel items for work of other trades, including hangers, screws, supports, etc.
 - 1.2.1.2.6. steel stairs, landings and railings.
 - 1.2.1.2.7. gypsum board walls, ceilings, bulkheads and other enclosures.
 - 1.2.1.2.8. telephone closet backboards.
 - 1.2.1.2.9. access panels and doors.
 - 1.2.1.2.10. wood fitments unless plastic laminated as noted.
 - 1.2.1.2.11. conduit, piping, ductwork, light panels, etc. exposed to view in areas listed in Room Finish Schedule or on Drawings.
 - 1.2.1.2.12. natural gas piping.
 - 1.2.1.2.13. finish painting of prime painted diffusers, registers and grilles in exposed locations.
 - 1.2.1.2.14. shop primed materials of other Sections.
 - 1.2.1.2.15. exposed surfaces of open ceilings including, structure, ducts, mechanical and electrical items, hangers, screws, miscellaneous metals, etc.
 - 1.2.1.2.16. exposed surfaces behind mechanical louvres and grilles.
 - 1.2.1.2.17. pipes, conduits, ducts and thermal insulation covers on ducts in rooms where walls and/or exposed ceilings are painted except mechanical/ electrical plant rooms.
 - 1.2.1.3. provision of materials, labour and equipment required to complete painting work and ancillary work described and implied herein to full intent of Drawings and Schedules.
 - 1.2.1.4. waste management and disposal of paint, stain and wood preservatives and other related hazardous materials.
- 1.2.2. Section Excludes: Painting of:
 - 1.2.2.1. pre-finished metal siding, fascia and soffit, coping cap flashing and similar components.
 - 1.2.2.2. chrome, stainless steel, vinyl, plastic laminate and aluminum surfaces throughout unless specified otherwise.

- 1.2.2.3. wallcoverings unless otherwise noted.
- 1.2.2.4. primed and finish painted equipment supplied by manufacturer unless required to be field painted in 1 common corporate colour as identified in Room Finish Schedule or on Drawings.
- 1.2.2.5. areas indicated as "unfinished" or "exposed" on Room Finish Schedule or on Drawings.
- 1.2.2.6. special finishes for cast-in-place concrete.
- 1.2.2.7. sealers over concrete.
- 1.2.2.8. shop priming of steel including structural steel, joists and steel decking, metal fabrications and custom metal work.
- 1.2.2.9. shop priming and finishing of finish woodwork.
- 1.2.2.10. pre-finishing of wood doors and frames.
- 1.2.2.11. electrostatic painting (powder coating).
- 1.2.2.12. fluoropolymer thermal setting enamels or other organic coatings.
- 1.2.3. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.3.1. Surface preparation and shop priming of structural steel and joists: Section 05 12 00, Structural Steel.
 - 1.2.3.2. Surface preparation and shop priming of miscellaneous metal work: Section 05 50 00, Metal Fabrications.
 - 1.2.3.3. Shop priming of metal stairs and balustrades: Section 05 51 00, Metal Stairs and Balustrades.
 - 1.2.3.4. Wood preservative or fire retardant treatment for rough carpentry: Section 06 10 00, Rough Carpentry.
 - 1.2.3.5. Coordination for application of paint on fire resistive coatings: Section 07 81 00, Sprayed Fire-Resistive Materials.
 - 1.2.3.6. Shop priming of steel doors, frames and screens: Section 08 11 13, Hollow Metal Doors and Frames.
 - 1.2.3.7. Back painting of glass or glass units: 08 80 00, Glass and Glazing.
 - 1.2.3.8. Coordination of paint for application on suspended acoustic ceilings: Section 09 51 13, Acoustical Panel Ceilings.
 - 1.2.3.9. Instructions on painting, stenciling and banding of mechanical and electrical work: Division 20 Mechanical General Requirements, Division 22, Plumbing, Division 23, Heating, Ventilating and Air Conditioning and Division 26, Electrical.
 - 1.2.3.10. Factory assembled pre-finished roof mounted air handling and air conditioning equipment: Division 23, Heating, Ventilating and Air Conditioning.
 - 1.2.3.11. Prime and finish coats applied by other Sections. Read carefully other Sections of Specifications to determine extent thereof.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. DFT: Dry Film Thickness.
 - 1.3.1.2. MPI: The Master Painters Institute; www.paintinfo.com.
 - 1.3.1.3. OPCA: Ontario Painting Contractors Association; www.ontpca.org.
 - 1.3.1.4. PDCA: Painting and Decorating Contractors of America; www.pdca.org.
 - 1.3.1.5. SDS: Safety Data Sheets.

- 1.3.1.6. SSPC: The Society for Protective Coatings (formerly known as Steel Structures Painting Council); www.sspc.org.
- 1.3.1.7. TSP: Tri-sodium Phosphate.
- 1.3.1.8. VOC: Volatile Organic Compound.
- 1.3.2. Definitions:
 - 1.3.2.1. Exposed: Visible in completed work. In case of closets, cabinets and drawers, it includes their interiors. Exposed surfaces in underground parking areas are considered "Exterior" for purpose of this Specification. Exposed surfaces in aboveground parking areas are considered "Interior" for the purpose of this Specification.
 - 1.3.2.2. Gloss or Sheen: Capacity of a finish on a surface to reflect light at specific angles as tested in accordance with ASTM D523.
 - 1.3.2.3. Hazardous Waste: Construction and demolition materials that are regulated for disposal by local, city, county, province or federal authorities having jurisdiction.
 - 1.3.2.4. Painting: In this Section refers to application of various types of paint, stain, varnishes and lacquers, etc.
 - 1.3.2.5. Surface Preparation: Cleaning or treating of surface to be painted to ensure best possible bond between surface and painting to be applied to surface; remove surface contaminants that will affect performance of painting, without limitations such as oil, grease, salts, dust, dirt, rust, rust scale, mill scale and old coatings where applicable; remove surface imperfections without limitation including but not limited to such as weld spatter, sharp edges, burrs, slivers, laminations, pits, porosities and crevices; prepare surfaces to provide anchor profile or surface profile which improve mechanical bonding of coating to prepared surface by increasing surface area.
- 1.3.3. Reference Standards:
 - 1.3.3.1. ASTM D523-14(18) - Standard Test Method for Specular Gloss
 - 1.3.3.2. MPI Painting Manual-07 - The Master Painters Institute – Architectural Painting Specification Manual by PDCA
 - 1.3.3.3. MPI Approved – The Master Painters Institute – Approved Products List Products List (Includes United States, Canada and International Editions), January 2012

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings:
 - 1.4.1.1. Review Drawings, details and Schedules, determine intent, extent, materials, types of surfaces, locations and be fully cognizant of intent of Work. Review Product literature, SDS, related safety data, proper disposal requirements and inform those involved in work of this Section.
 - 1.4.1.2. Review Specifications and Drawings for work of other Sections regarding provisions for prime and finish coats and ensure compatibility with each other and substrate prior to application.
 - 1.4.1.3. Prior to start of work, arrange for Project site meeting of parties associated with Work of this Section. Presided over by Contractor, include Consultant, Subcontractor, manufacturer's representative, any sub-trades whose work will be painted (including Mechanical and Electrical trades) or whose work is adjacent to, or whose work or schedule may be affected by work of this Section.
 - 1.4.1.4. Review Specification for work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas requiring painting and other matters affecting construction, to permit compliance with intent of this Section.

- 1.4.2. Scheduling:
- 1.4.2.1. Schedule painting operations to prevent disruption of and by other trades. Ensure painting is completed for locations requiring application of finishes by other trades in a timely fashion to prevent delays.
- 1.4.2.2. Schedule painting operation in occupied facilities to prevent disruption of occupants in and about Project.

1.5. SUBMITTALS

- 1.5.1. Product Data:
- 1.5.1.1. Submit Product data conforming to Section 01 70 00 and submit a Schedule of Finishes listing manufacturer's Product name, colour, textures, SDS and test reports requested for each paint system. Submit test reports for odourless, low or zero VOC Products when specified.
- 1.5.1.2. Painting Subcontractor to receive written confirmation of specific surface preparation procedures and primers used for fabricated steel items from fabricator/supplier to ensure appropriate and manufacturer compatible finish coat materials prior to commencement of painting.
- 1.5.1.3. Submit Product data for concrete and concrete block primers.
- 1.5.2. Samples: Submit samples 30 Days before materials are required in accordance with Section 01 30 00. Submit following samples in sizes indicated:
- 1.5.2.1. 3 copies of brushouts minimum 200 mm x 250 mm (8" x 10") of each finish including colour, sheen and texture required at least 30 Days prior to commencement of application. Identify each sample with job, finish, colour name, number, sheen and gloss values, substrate to be applied to, date and name of Subcontractor.

- | | Substrate | Sample, Base Material |
|------------|--|------------------------------|
| 1.5.2.1.1. | Masonry | Face of typical unit |
| 1.5.2.1.2. | Gypsum Board | Face of typical unit |
| 1.5.2.1.3. | Metal | Steel Plate |
| 1.5.2.1.4. | Woodwork | Wood |
| 1.5.2.2. | sample panels of stain, varnish, lacquer or other wood finish on each species of wood specified, minimum 300 mm (12") square and of specified thickness. | |
| 1.5.3. | Certificates: Surface Preparation: Submit manufacturer's representative's written approval of surface preparation methods and any specific recommendations for alternative methods. | |
| 1.5.4. | Site Quality Control Submittals: | |
| 1.5.4.1. | Submit site instruction reports in accordance with Section 01 30 00 containing information required by this Section. | |
| 1.5.4.2. | Progress Reports: Submit in accordance with Section 01 30 00. Arrange to have paint manufacturer's representative inspect work of this Section on a regular basis and prepare weekly job progress reports. Submit copy of reports to Consultant. | |

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data: Upon completion of Project, submit a coating maintenance manual. Ensure manual includes an 'Area Summary' with finish schedule, 'Area Detail' designating where each Product/colour/finish was used, Product data pages, SDS, care and cleaning instructions, touch-up procedures and colour samples of each colour and finish used.

1.7. MAINTENANCE MATERIAL SUBMITTALS

- 1.7.1. Extra Stock Materials: Submit to Owner 3% but not less than 1 - 4 ℓ (1 gal) can of each different type and colour and degree of gloss of paint used (batch mix) on this Project for touch-ups. Ensure paint is boxed and in sealed, unopened cans in undamaged condition, with name of manufacturer, contents, type and colour clearly indicated on a label securely adhered to can. Give to Consultant at time of final inspection.

1.8. QUALITY ASSURANCE

- 1.8.1. Qualifications:
- 1.8.1.1. Applicators:
- 1.8.1.1.1. Execute work of this Section by a firm which has adequate plant, equipment and skilled workers to perform work expeditiously and which is known to have been responsible, during immediate past 5 years, for installations similar to work contained herein. Ensure firm is fully conversant with applicable laws, bylaws, codes, fire, health and safety regulations and other regulations which govern.
- 1.8.1.1.2. Provide work of this Section executed by competent applicators with membership in good standing in OPCA and/or PDCA and have a minimum of 5 years experience in application of Products, systems, coatings and assemblies specified and with approval and training of Product manufacturers.
- 1.8.1.1.3. Ensure materials, preparation and workmanship conforms to requirements of MPI Painting Manual.
- 1.8.2. Certifications: Ensure paint manufacturers and Products used are listed under Approved Product List section of MPI Painting Manual.
- 1.8.3. Mock-Ups:
- 1.8.3.1. Provide mock-up at location established by Consultant, complete with required lighting. Mock-up to establish standard of workmanship, texture, gloss and coverage.
- 1.8.3.2. Apply minimum 300 mm x 300 mm (12" x 12"), or where required, full size mock-up of each finish on each type of surface to be coated with correct material, number of coats, colour, texture and degree of gloss required.
- 1.8.3.3. Provide additional mock-ups of each finish in modified colour, texture or degree of gloss when required, to obtain no objections.
- 1.8.3.4. Prepare surfaces and apply treatment to galvanized or other components as required for Consultant's review. Do no painting until mock-ups have been reviewed with no objections recorded.
- 1.8.3.5. Reviewed mock-up to become standard of comparison for painting work on site. Correct and refinish work which does not compare with reviewed finishes at no expense to Owner.
- 1.8.3.6. Reviewed full size mock-up may become integral part of finished work if permitted by Consultant.

1.9. DELIVERY, STORAGE AND HANDLING

- 1.9.1. Delivery and Acceptance Requirements:
- 1.9.1.1. Deliver to site, materials manufacturer's original, sealed and labeled containers bearing manufacturer's name, brand name, type of paint or coating and colour designation, degree of gloss, batch number, standard compliance, materials content as well as mixing, reducing and application requirements.
- 1.9.1.2. Manufacturer to certify, materials delivered to site conform to approved list.
- 1.9.2. Storage and Handling Requirements:
- 1.9.2.1. Store on site, materials in manufacturer's sealed and labeled containers.

- 1.9.2.2. Comply with applicable local fire and building code requirements during storage and application.
- 1.9.2.3. Store containers of paint, thinner and other volatile materials in secure, well ventilated location, heated to minimum 10 deg C (50 deg F), where they will not be exposed to excessive heat or direct solar radiation. Keep tightly closed when not in actual use.
- 1.9.2.4. Presence of any unauthorized materials or containers on site is sufficient cause for rejection of paint materials on site at that time.
- 1.9.2.5. Protect floor and wall surfaces in storage areas from paint drips and splatters.
- 1.9.2.6. Be totally responsible for prevention of fire or explosion caused by improper storage of paints, solvents, rags and similar items. Store fire hazardous materials in location and in manner approved by local fire authority. Post "No Smoking" signs in areas of storage and mixing and strictly enforce this requirement. Provide and maintain CO₂ fire extinguishers of minimum 9 kg (20 lb) capacity. Repair damage to storage area or surrounding area at no cost to Owner.
- 1.9.2.7. Where toxic, volatile, explosive, flammable materials are used, provide adequate fireproof storage lockers and take necessary precautions and post adequate warnings (eg "No Smoking" signs) as required.

1.10. SITE CONDITIONS

- 1.10.1. Ambient Conditions:
 - 1.10.1.1. Paint and finish in clean, dust-free, properly ventilated and adequately lit areas minimum 323 Lx (30 ft candles) on surfaces to be painted or decorated.
 - 1.10.1.2. Provide each paint materials in accordance with manufacturer's recommended tolerances for:
 - 1.10.1.2.1. Substrate Moisture Content: Perform tests with a properly calibrated electronic moisture meter to ensure compliance with manufacturer's recommendations. Without limitation, maximum moisture content as follows:
 - 1.10.1.2.1.1. Concrete and Concrete Unit Masonry: Maximum 12 - 14% for solvent coatings and as recommended by manufacturer for each water based system.
 - 1.10.1.2.1.2. Gypsum Based Board and Plaster: Maximum 12 - 14%.
 - 1.10.1.2.1.3. Wood: Maximum 15%.
 - 1.10.1.3. Temperature and Ventilation:
 - 1.10.1.3.1. Do not provide paint under ambient and surface temperatures less those required below in any instance for 24 hours before, during and 7 Days after installation.
 - 1.10.1.3.2. Provide ventilation to remove odours, evaporating solvents and moisture. Maintain adequate ventilation at all times to control excessive humidity.
 - 1.10.1.3.3. Interior Paint:
 - 1.10.1.3.3.1. Water Based Paints: Maintain minimum interior surface and ambient air temperature of between 18 deg C (65 deg F) and 32 deg C (90 deg F) during application and drying of paint and maintain until building occupancy occurs.
 - 1.10.1.3.3.2. Solvent Based Paints: Maintain minimum interior surface and ambient air temperature of between 7 deg C (45 deg F) and 35 deg C (95 deg F) during application and drying of paint and maintain until building occupancy occurs.
 - 1.10.1.3.3.3. Do not undertake interior painting on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Benjamin-Moore & Co., Limited; www.benjaminmoore.com
- 2.1.1.2. Dulux Paints; www.dulux.ca
- 2.1.1.3. Para Paints; www.para.com
- 2.1.1.4. Pittsburgh Paints; www.pittsburghpaints.com
- 2.1.1.5. The Sherwin-Williams Company; www.sherwin-williams.com
- 2.1.2. Substitution Limitations: Comparable Products from other manufacturers not listed herein may be reviewed provided they meet requirements of "MPI Approved Products List" and this Specification.
- 2.1.3. Source Limitations: Provide primers for each coating system from same manufacturer as finish coats.

2.2. MATERIALS

- 2.2.1. Description:
- 2.2.1.1. Regulatory Requirements:
- 2.2.1.1.1. Conform to latest edition of Industrial Health and Safety Regulations issued by applicable authorities having jurisdiction in regard to site safety (ladders, scaffolding, ventilation, etc.).
- 2.2.1.1.2. Comply with more stringent of applicable laws, bylaws, codes, fire regulations, health and safety regulations of authorities having jurisdiction or requirements of this Specification. Ensure standards used for work of this Section are considered a minimum.
- 2.2.1.1.3. Where required, ensure paints and coatings meet flame spread and smoke developed ratings designated by local code requirements and/or authorities having jurisdiction.
- 2.2.1.1.4. Comply with toxic trace limitations stipulated by authorities having jurisdiction.
- 2.2.1.1.5. Conform to requirements of local authorities having jurisdiction in regard to storage, mixing, application and disposal of paint and related waste materials.
- 2.2.2. Performance/Design Criteria:
- 2.2.2.1. Provide best practices specified or recommended in MPI Painting Manual.
- 2.2.2.2. Consultant reserves right to refuse any paint or finishing material if in its opinion it is not suitable or adequate for proposed use.
- 2.2.2.3. Paint material containers not displaying manufacturer's Product identification will not be permitted. Ensure paint is not diluted.
- 2.2.2.4. Use brand of paint chosen throughout work of this Section, except where specified otherwise. As far as practical, factory mix paint for immediate application without thinning or alteration at site.
- 2.2.2.5. Provide primers in recommended DFT/coat.
- 2.2.2.6. Only materials (primers, paints, coatings, varnishes, stains, lacquers, etc.) listed in MPI Approved Product List are permitted for use on this Project.
- 2.2.2.7. Provide other materials such as linseed oil, shellac, thinners, solvents, etc. of highest quality Product of an MPI listed manufacturer and be compatible with paint materials being used as required.
- 2.2.2.8. Ensure materials used are lead and mercury free and have low VOC content where possible.

- 2.2.2.9. Provide paint materials with good flowing and brushing properties and dry or cure free of blemishes, sags, air entrapment, etc.
- 2.2.2.10. Paint materials which from time to time will become hot, such as convector covers and similar item, a paint type approved by paint manufacturer for particular condition.
- 2.2.3. Finishes:
 - 2.2.3.1. Colours: Refer to "Material and Finish Schedule" appended to Section 00 01 20.
 - 2.2.3.2. Gloss Values:
 - 2.2.3.2.1. Walls: Satin (G4) or Semi-gloss (G5)
 - 2.2.3.2.2. Ceilings: Flat or Matte (G1)
 - 2.2.3.2.3. Trim and Doors: Semi-gloss (G5) or Gloss (G6)

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Do work only when surfaces and conditions are satisfactory for production of quality work. Report to Consultant in writing any surfaces which are found to be unsatisfactory.
 - 3.1.1.2. Ensure temperature of surfaces to be finished are as required for application of finish. Refer to "Temperature and Ventilation" article specified herein. Ensure surfaces are dry and free of dirt, grease or other contaminants that may affect applied finish.
 - 3.1.1.3. Verify moisture content of surfaces with electronic moisture meter. Do not proceed without written directions if moisture reading is higher than as required for application. Refer to "Ambient Conditions" article specified herein for substrate moisture content requirements.
 - 3.1.1.4. If substrate is steel, do not apply coatings over moisture or when surface temperature is within 3 deg C (5 deg F) of dew point.
 - 3.1.1.5. If substrate is wood, do not stain or paint if moisture reading is higher than 15%. Inspect work to assure surfaces are smooth, free from machine marks and nail heads have been countersunk.
 - 3.1.1.6. If substrate is cast-in-place concrete, allow to cure for 60 to 90 Days before proceeding with priming.
 - 3.1.1.7. If substrate is new plaster or masonry, allow to cure for 30 to 90 Days. Ensure moisture content is between 12% and 14% and test for alkalinity and neutralize (pH 6.5 - 7.5) before proceeding with priming.
 - 3.1.1.8. If substrate is gypsum board, inspect to ensure joints are completely filled and sanded smooth. Inspect surfaces for "nail popping", screw heads not recessed and taped, breaks in surface or other imperfections and have repaired as required.
 - 3.1.1.9. Verify each substrate is dry and not frozen and free from tool and sandpaper marks, dust, rust, insects, grease and other foreign matter liable to impair finished work.
- 3.1.2. Evaluation and Assessment:
 - 3.1.2.1. Prior to commencement of work of this Section, thoroughly examine (and test as required) conditions and surfaces scheduled to be painted and report in writing to Contractor and Consultant any conditions or surfaces that will adversely affect work of this Section.
 - 3.1.2.2. Do not commence painting work until adverse conditions and defects have been corrected and surfaces and conditions are acceptable to this Subcontractor.

- 3.1.2.3. Commencement of work does not imply acceptance of surfaces except as qualified herein. Surfaces such as concrete, masonry, structural steel and miscellaneous metal, wood, gypsum board and plaster, is not responsibility of this Subcontractor. Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Protection of In-Place Conditions:

- 3.2.1.1. Provide scaffolding, staging, platforms and ladders, as required for execution of work. Erect scaffolding to avoid interference with work of other trades. Comply with Occupational Health and Safety Act.

- 3.2.1.2. During work of this Section, provide drop cloths, plastic, plywood or metal sheets to protect floors in areas assigned for storage and mixing of paints. Cover finished floors, walls, ceilings and other work in vicinity and protect from paint and damage.

- 3.2.1.3. Protect work of other trades against paint splattering and Make Good at own expense any such damage.

- 3.2.1.4. Remove and securely store miscellaneous and finish hardware and surface fittings, electrical switch and outlet covers, receptacle plates, louvres, fittings and fastenings, to protect from paint splatter. Mask items not removable. Use sufficient drop cloths and protective coverings for full protection of floors, furnishings, mechanical, electrical and special equipment, other components of building which do not require painting or to be removed, from paint spotting and other soiling. Carefully clean and re-install items when paint is dry. Clean any components that are paint spotted or soiled. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes).

- 3.2.1.5. Prohibit traffic, where possible, from areas where painting is being carried out and until paint is cured. Post "wet paint" or other warning signage during and on completion of work. Provide also warning signs at points of entry to areas where painting is applied and drying.

- 3.2.2. Surface Preparation:

- 3.2.2.1. Prepare defective surfaces to obtain a satisfactory substrate and in accordance with paint manufacturer's instructions.

- 3.2.2.2. Prior to painting, sweep areas dust-free.

- 3.2.2.3. Clean soiled surfaces to be painted.

- 3.2.2.4. Remove efflorescence, chalk, dust, dirt, oil, grease, rust, form oil, release agents, loose mill scale and other extraneous matter from surfaces (except rust occurring on items specified to be primed under other Sections be removed and work re-primed under those Sections). Vacuum (fibre acoustic tile and) insulation covering surfaces. Vacuum clean floors before painting; wipe clean adjacent surfaces and surfaces to be painted before work is commenced to prevent dust and debris damage to wet paint.

- 3.2.2.5. Remove mildew by scrubbing affected area with solution of 150 g (5.3 oz) TSP and 125 g (4.4 oz) bleach in 3.5 l (0.92 gal) water. Rinse well with clean water and allow to dry. If condition is serious, source out finishes with extra mildew resistance.

- 3.2.2.6. Be responsible for surface preparation to suit surface condition and conform to level of cleaning based on SSPC, recommended metal cleaning procedures most commonly used to suit site conditions.

- 3.2.2.7. Concrete and Masonry:

- 3.2.2.7.1. Form Oil Removal: Remove with Xylol or TSP.

- 3.2.2.7.2. Efflorescence Removal: Remove by dry brushing or washing with 1 part commercial muriatic acid to 20 parts water by volume and thoroughly rinse with clean water.

- 3.2.2.7.3. Mildew Removal: Remove by scrubbing affected area with 1 part sodium hypochlorite to 3 parts water. Where dirt is also evident, add 1.36 kg (3 lbs) TSP to 6.8 ℓ (1.5 gal) of above solution.
- 3.2.2.7.4. Concrete Vertical Surfaces: Use sand blasting, high pressure water blasting, high pressure water blasting with abrasives, vacuum blasting with abrasives or alternatively, needle guns or power grinders equipped with suitable grinding stone, to remove concrete, loose mortar, fins, projections and surface contaminants. Vacuum or blow down and remove dust and loose particles from surface. Fill large cracks and/or voids in consultation with design engineer using either polyester, epoxy or acrylic resin, block filler or cement sand mixture in accordance with design engineer's written instructions. Fill only flush to surface and allow to set.
- 3.2.2.7.5. Concrete Block Masonry: Fill voids and cracks in masonry block wall to provide uniform surface for subsequent coats.
- 3.2.2.8. Metals:
 - 3.2.2.8.1. Ensure application of paint and coatings occurs within appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or manufacturer's paint specifications require earlier applications.
 - 3.2.2.8.2. Ferrous Metal: Clean to SSPC-SP 1/2/3, to suit site conditions. Remove loose rust and prime bare metal with rust inhibitive steel primer. Touch-up damaged shop applied primer using compatible Product. Provide full coat primer only if damage is extensive. Treat weld areas with phosphoric acid (5% solution).
 - 3.2.2.8.3. Structural Steel/Miscellaneous Steel (previously painted and exposed by alterations work): Remove oil, grease, dirt, rust scale, loose mill scale, loose paint or coating by abrasive blasting in accordance with SSPC-SP 6.
 - 3.2.2.8.4. Hot Dipped Galvanized Steel (Unweathered): Allow to weather minimum of 26 weeks and Xylene clean to SSPC-SP 1 specified herein prior to coating to remove dust, dirt, grease, oxides and other foreign material. Remove silicates or similar surface treatments or any deposits of white rust by sanding or similar abrasive methods (bronze wool). Use of acetic acid to prepare galvanized surfaces is not permitted.
 - 3.2.2.8.5. Galvanized Steel (Weathered): Remove dust, dirt, grease, oxides and other foreign material and clean to SSPC-SP 1 specified herein prior to coating.
 - 3.2.2.8.6. Galvanized Steel (Pre-Treated) (Non-Crystal Appearance): Follow manufacturer's recommendations for preparation, priming and coating of pre-treated galvanized steel.
 - 3.2.2.8.7. Light Zinc Coated or Satin Coated Products (ZF075) mostly found in environmentally controlled areas. Follow manufacturer's recommendations for preparation, priming and coating.
 - 3.2.2.8.8. Heavy Coated Zinc Z275 (G90) for high humidity areas and as specified. Follow manufacturer's recommendations for preparation, priming and coating.
 - 3.2.2.8.9. Metal Doors: Remove doors before painting to paint bottom and top edges and re-hang once dry. Do not paint stainless steel or bronze door butts. Paint or finish top and bottom edges of doors. Touch-up or refinish tops and edges after fitting. Exterior doors to have tops, bottoms and side edges finished same as exterior faces to these doors. Paint elevator doors and frames where supplied primed by elevator manufacturer.
- 3.2.2.9. Woodwork:
 - 3.2.2.9.1. Verify and determine wood species, grain direction and structure, properties of finish, application method and exposure to elements. Check moisture content to avoid movement of wood caused by expansion and contraction due to changes in moisture content. Verify grain cut as it may interfere with adhesion of paint.

- 3.2.2.9.2. Apply wood finishing Product in following order and as needed for specific appearance and application specified herein. Sanding sealer to control penetration of subsequent coats to create more uniform finish. Stain to colour wood and highlight grain for final finish. Filler to fill pores of wood and control penetration of subsequent coats. Apply filler across grain forcing it into pores followed with rubbing and sanding when dried. For staining requirements mix stain with filler before applying for uniform finish. Finish coats to provide protection to wood.
- 3.2.2.9.3. Wood work for Opaque Coating: Seal knots and sapwood in surfaces to receive paint with alcohol-based primer-sealer. Seal door edges. Sand smooth rough surfaces of woodwork to be finished using No. 150 grit paper followed by a second sanding using No. 220 grit paper. Sand in direction of grain. Clean surfaces free of dust before applying first coat using brush, compressed air or tack rags. Fill nail holes, splits and scratches with non-shrinking filler after first coat is dry.
- 3.2.2.9.4. Prepare plywood surface by removing dirt and debris. Fill screw and nail holes or minor imperfections with recommended filler and sand properly to receive finish coating. Ensure plywood requiring stained or painted finish is primed with top quality alkyd primer. Use only penetrating quality stain over plywood.
- 3.2.2.9.5. Woodwork for Clear Finish or Stain: Sand smooth woodwork to be finished using No. 150 grit paper followed by a second sanding using No. 220 grit paper and clean surfaces free of dust using brush, compressed air or tack rags before applying first coat. Abrade surfaces with stiff brush to remove loose fibres and splinters. Fill nail holes, splits and scratches with non-shrinking filler tinted to match local grain condition after first coat is dry. Sand lightly between coats with No. 220 grit sandpaper and remove dust.
- 3.2.2.9.6. Remove salt deposits that may appear on wood surfaces treated with fire retarder.
- 3.2.2.9.7. Obtain inspection of glue laminated beams by assigned painting inspector to ensure shop sealer has been applied. Where non-specified shop sealer has been applied to beams or columns, remove and refinish in accordance with manufacturer's written instructions.
- 3.2.2.9.8. Wood Doors: Remove doors before painting to paint bottom and top edges and re-hang once dry. Paint or finish top and bottom edges of doors to be painted or stained. Touch-up or refinish tops and edges after fitting.
- 3.2.2.10. Previously Finished Surfaces: Clean existing interior and exterior surfaces to be repainted or varnished to provide bond. Remove rust, scale, oil, grease, mildew, chemicals and other foreign matter. Remove loose paint and fill flush with suitable patching material. Clean off bubbled, cracked, peeling or otherwise defective paint by stripping with suitable environmental strippers or by burning. Do not burn off paints suspected of having lead content. Treat residue from stripping as Hazardous Waste. Flatten gloss paint and varnish with sandpaper and wipe off dust. If previous coatings have failed so as to affect proper performance or appearance of coatings to be applied, remove previous coatings completely and prepare substrates properly and refinish as specified for new work. Leave entire surface suitable to receive designated finishes and in accordance with finish manufacturer's instructions.
- 3.2.2.11. Gypsum Board:
- 3.2.2.11.1. Examine and ensure gypsum board surfaces are without defects or deficiencies and suit able to receive painting applications. Commencement implies acceptance of gypsum board work. Examine surfaces after for imperfections showing through and fill small nicks or holes with patching compound and sand smooth. Examine surfaces after priming for imperfections showing through.
- 3.2.2.11.2. Clean surfaces dry, free of dust, dirt, powdery residue, grease, oil, wax or any other contaminants. Sand and dust as necessary prior to painting and between coats to provide an anchor for next coat and to remove defects visible from a distance up to 1 m (39").

3.3. APPLICATION

- 3.3.1. Safety Precautions: When handling solvent coating materials, wear approved vapour/particulate respirator as protection from vapours. Dust respirators do not provide protection from vapours.

- 3.3.2. Material Compatibility: Provide primers and finish coat materials compatible with each other and substrate including fillers.
- 3.3.3. Mixing and Tinting:
 - 3.3.3.1. Unless otherwise specified herein, paint to be ready and factory tinted. Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment and colour and gloss uniformity.
 - 3.3.3.2. Mix and prepare paint materials including paste, powder or catalyzed paint mixes in accordance with manufacturer's directions for particular material and coat to be applied to produce a mixture of uniform density. If reducing is required, do so in accordance with recommendations of manufacturer for particular material and coat.
 - 3.3.3.3. Where thinner is used, addition is not to exceed manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
 - 3.3.3.4. Mix primer-sealer with a certain amount of colour coat in proportions recommended by manufacturer of material actually used. Tint undercoats and each finish coat with correct type colours, for identification of each succeeding coat.
 - 3.3.3.5. Thoroughly mix materials before application. Apply materials evenly, under adequate illumination, free from sags, runs and other defects. Do cutting-in neatly.
- 3.3.4. Obtain colour chart giving colour schemes and gloss value for various areas from Consultant. Ensure colour chart gives final selection of colours and surface textures of finishes and whether finishes are transparent (natural) or opaque (paint).
- 3.3.5. Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.
- 3.3.6. Apply materials in accordance with manufacturer's directions and specifications paying particular attention to appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or manufacturer's paint specifications require earlier applications. Do not use adulterants. Do any reduction of coating's viscosity in accordance with manufacturer's directions.
- 3.3.7. Use up paints within period of shelf life recommended by paint manufacturer.
- 3.3.8. Ensure successive coatings are harmonious chemical compositions and materials of same manufacturer.
- 3.3.9. Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1 m (39").
- 3.3.10. Ensure each coat is dry and hard before a following coat is applied.
- 3.3.11. Continue through paint finish behind wall-mounted items (e.g. chalk and tack boards).
- 3.3.12. Finish listed surfaces indicated on Room Finish Schedule(s) and/or noted on Drawing(s) and as specified. Refer to Room Finish Schedule for type, location and extent of finishes required and include touch-ups and field painting necessary to complete work shown, scheduled or specified.
- 3.3.13. Finishes and number of coats specified herein are intended as minimum requirements guide only. Refer to manufacturer's recommendations for exact instructions for thickness of coating to obtain optimum coverage and appearance. Some materials and colours may require additional coats and deeper colours may require use of manufacturers' special tinted primers. Unless otherwise specified, provide Premium Grade finish as defined by MPI as minimum finish.
- 3.3.14. Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas which have been cut and patched. Patching is not permitted. Vary each coat slightly in successively darker tones to permit supervision identity.
- 3.3.15. Do not paint baked paint surface, chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory. Finish paint primed surfaces.

- 3.3.16. Advise Consultant when each applied paint coat can be inspected. Do not recoat without inspection. Tint each coat slightly to differentiate between applied coats.
- 3.3.17. Apply additional paint coats, beyond number of coats specified for any surface, to completely cover and hide substrate and to produce a solid, uniform appearance.
- 3.3.18. Apply primer coat soon after surface preparation is completed to prevent contamination of substrate.
- 3.3.19. Primer/Sealers: Apply primer-sealer coats by brush or roller. Permit to dry in accordance with manufacturer's recommendations before applying succeeding coats. Touch up suction spots and sand between coats with No. 120 sandpaper.
- 3.3.20. Metals: Apply primer coat to unprimed ferrous metal surfaces. Where sandblast preparation is specified, apply specified primer immediately after blast cleaning.
- 3.3.21. Woodwork:
 - 3.3.21.1. Fill open grain woods with filler tinted to match wood and work well into grain. Wipe excess from surface before filler sets.
 - 3.3.21.2. Sand smooth paint and varnish undercoats prior to recoating.
 - 3.3.21.3. Prime woodwork designated for painting as soon as possible after delivery to site and before installation. Prime cut surfaces, whether exposed or not, i.e. 6 edges of wood doors, before installation. Prime cut surfaces of woodwork to receive transparent finish with 1 coat of transparent finish reduced 25% or as directed by manufacturer.
 - 3.3.21.4. Apply final coats on smooth surfaces by roller or brush. Hand brush wood trim surfaces.
- 3.3.22. Allow each coat of paint to cure and become dry and hard before application of succeeding coats (unless manufacturer's directions require otherwise).
- 3.3.23. Before finishing paint coats are applied, inspect and touch-up shop coats of primers previously applied by other trades or fabricators.
- 3.3.24. Provide paint coating thicknesses indicated, measured as minimum DFT.
- 3.3.25. Apply a minimum of 4 coats of paint where deep or bright colours are used to achieve satisfactory results.
- 3.3.26. Ledges: Finish projecting ledges, both above and below sight lines, as specified for adjacent surfaces.
- 3.3.27. Existing Spaces:
 - 3.3.27.1. Refinish existing surfaces of rooms or areas which have been damaged, altered or otherwise affected by work. Also finish "new" work occurring thereon unless otherwise specified. Use same procedure as for new work but primer (or filler, stain and sealer in case of varnish finish) may be omitted. Prepare existing surfaces as specified herein. Ensure finish matches previous finish.
 - 3.3.27.2. Paint or repaint rooms or areas where noted on Room Finish Schedule and/or as indicated on Drawings.
 - 3.3.27.3. Repaint surfaces entirely between changes of plane.
 - 3.3.27.4. Use finish coat of respective new surface paint system for minor repair of existing finishes. Use system primer where existing finishes are damaged down to bare surface.
 - 3.3.27.5. Extend painting to a suitable boundary to avoid a "patched" effect. Sand, wire-brush, or scrape such existing finished surfaces to remove loose paint and to reduce gloss. Also clean existing films of dirt, grease or wax. If metallic surfaces are rusted, remove loose scale to provide a firm surface. Patch and sand cracks and other imperfections.

- 3.3.27.6. Provide paint to interior existing spaces effected by alterations [and shelled-in spaces] in accordance with following:
 - 3.3.27.6.1. Paint walls to nearest inside and outside corners for full wall height.
 - 3.3.27.6.2. Paint columns floor to ceiling.
 - 3.3.27.6.3. Paint full ceilings to nearest wall or bulkhead.
 - 3.3.27.6.4. Unless indicated otherwise match existing colour.
 - 3.3.27.6.5. Where Room Finish Schedule indicates existing and/or new wall finishes to be painted, existing surfaces such as, existing door and frames, mechanical supply and return air grilles (both on walls and ceilings), access doors and electrical panels which have been previously painted to be painted for a complete finish room. If Room Finish Schedule indicates "-" it denotes entire room need not be painted, paint only patched area.
- 3.3.27.7. Example Locations:
 - 3.3.27.7.1. pressed steel frames.
 - 3.3.27.7.2. hollow metal doors.
 - 3.3.27.7.3. access doors and frames.
 - 3.3.27.7.4. hose cabinets.
 - 3.3.27.7.5. miscellaneous exposed interior metal work.

3.4. SITE QUALITY CONTROL

- 3.4.1. Site Tests and Inspections:
 - 3.4.1.1. Provide and coordinate site inspection service by manufacturer's representative in advance of work commencing and during progress of work to ensure correct use and application of each specified material. Manufacturer's representative to review and submit approval of surface preparation methods in Specifications or obtain specific recommendations for alternative methods. Report such conditions to Consultant.
 - 3.4.1.2. As work progresses and upon completion of work, submit written reports and manufacturers' confirmation that materials and application methods conform to manufacturers' requirements.
 - 3.4.1.3. Inspect surfaces, preparation and paint applications.
- 3.4.2. Non-Conforming Work:
 - 3.4.2.1. Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction to Consultant at no cost to Owner. Touch up small affected areas, repaint large affected areas or areas without sufficient DFT of paint. Remove runs, sags of damaged paint by scraper or by sanding prior to application of paint.
 - 3.4.2.2. Following are considered non-conforming qualities:
 - 3.4.2.2.1. Lack of Uniformity:
 - 3.4.2.2.1.1. brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas and foreign materials in paint coatings.
 - 3.4.2.2.1.2. evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - 3.4.2.2.1.3. damage due to touching before paint is sufficiently dry or any other contributory cause.
 - 3.4.2.2.1.4. damage due to application on moist surfaces or caused by inadequate protection from weather.
 - 3.4.2.2.1.5. damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).

- 3.4.2.2.2. Aesthetic Problems: If following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
- 3.4.2.2.2.1. visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1 m (39").
- 3.4.2.2.2.2. visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1 m (39").
- 3.4.2.2.2.3. visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
- 3.4.2.2.2.4. when final coat on any surface exhibits a lack of uniformity of colour, sheen, texture and hiding across full surface area.
- 3.4.3. Manufacturer Services: Arrange for manufacturer's representative to visit site at intervals during surface preparation and paint coating application to ensure proper specified surface preparation is being performed, specified Product are being used, appropriate number of coats are being applied and specified finishing procedures are being carried out.

3.5. CLEANING

- 3.5.1. Keep waste rags in covered metal drums containing water and remove from building at end of each Day. Remove other combustible rubbish materials and empty paint cans each Day from site and safely dispose of same in accordance with requirements of authorities having jurisdiction.
- 3.5.2. Clean equipment and dispose of wash water/solvents as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction.
- 3.5.3. Clean containers used for storage, mixing and application of materials free of foreign materials and residue.
- 3.5.4. Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- 3.5.5. Clean adjacent surfaces which have been painted, soiled or otherwise marred. Remove spilled, splashed, splattered or sprayed paint as work progresses using means and materials that are not detrimental to affected surfaces.
- 3.5.6. Remove masking and other protection provided under this Section.
- 3.5.7. Remove temporary protective wrappings provided by others for protection of work after completion of painting operations unless instructed otherwise.
- 3.5.8. Painting work will not be considered complete until spatters, drippings, smears and overspray have been cleaned and removed to satisfaction of Consultant.
- 3.5.9. Make Good any damage to structure building surfaces or furnishings resulting from painting operations at no cost to Owner.

3.6. ATTACHMENTS

- 3.6.1. INTERIOR FINISH SCHEDULE:
- 3.6.1.1. INT 3.1 - Concrete Vertical Surfaces: (including ceilings and undersides of mezzanines, stairs, etc.):
- 3.6.1.1.1. Latex (over alkali-resistant primer) (INT 3.1A-G3):
- 3.6.1.1.1.1. 1 coat primer alkali resistant W.B.: MPI #3
- 3.6.1.1.1.2. 2 coats latex: MPI #52
- 3.6.1.1.1.3. Finish: Eggshell.

- 3.6.1.2. INT 4.2 - Concrete Masonry Units (CMU's): (concrete block and concrete brick):
- 3.6.1.2.1. Latex (INT 4.2A-G3):
- 3.6.1.2.1.1. 1 coat latex block filler: MPI #4
- 3.6.1.2.1.2. 2 coats latex: MPI #52
- 3.6.1.2.1.3. Finish: Eggshell.
- 3.6.1.3. INT 5.1 - Structural Steel and Metal Fabrications: (columns, beams, joists, etc.):
- 3.6.1.3.1. Steel and Metal Fabrications (with existing shop coat primer) - Unexposed: No further finishing required except for touch-up of damaged surfaces.
- 3.6.1.3.2. Latex (over Q.D. shop primer) (INT 5.1X-G5):
- 3.6.1.3.2.1. 1 coat Q.D. shop applied primer: MPI #275
- 3.6.1.3.2.2. 2 coats latex: MPI #54
- 3.6.1.3.2.3. Finish: Semi-Gloss.
- 3.6.1.4. INT 5.3 - Galvanized Metal (Not Chromate Passivated): (High contact/high traffic areas (doors, frames, railings, pipes, etc.) low contactor low traffic areas (overhead decking, pipes, ducts, etc.):
- 3.6.1.4.1. Latex (over w.b. galvanized primer) (INT 5.3J-G5):
- 3.6.1.4.1.1. 1 coat waterborne primer: MPI #134
- 3.6.1.4.1.2. 2 coats latex: MPI #54
- 3.6.1.4.1.3. Finish: Semi-Gloss.
- 3.6.1.5. INT 9.2 - Plaster and Gypsum Board: (gypsum wallboard, drywall, "Sheet Rock" type material, & texture finishes, etc.):
- 3.6.1.5.1. Latex (over latex primer sealer) (INT 9.2A-G3):
- 3.6.1.5.1.1. 1 coat latex primer sealer: MPI #50
- 3.6.1.5.1.2. 2 coats latex: MPI #52
- 3.6.1.5.1.3. Finish: Eggshell.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide high-performance interior coatings including but not limited to following:
 - 1.2.1.1. high-performance interior epoxy paint for door frames.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of hollow metal door frames: Section 08 11 13, Hollow Metal Doors and Frames.
 - 1.2.2.2. Caulking and sealants: Section 07 92 00, Joint Sealants.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. DFT: Dry Film Thickness.
 - 1.3.1.2. MPI: The Master Painters Institute; www.mpi.net.
 - 1.3.1.3. OHSA: Occupational Health and Safety Act.
 - 1.3.1.4. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM E84-23 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 1.3.2.2. ASTM F1869-22 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.5. SUBMITTALS

- 1.5.1. Samples: Submit 300 mm x 300 mm (12" x 12") samples of each type of coating on specified substrata showing stages of application. Submit additional samples until review with objections recorded is obtained. Make corrections to mix as required to secure correct colour and texture. Label sample(s) with Project name and number, applicator, names of material and manufacturer, area where material will be applied, date of sample, colour, texture and mix proportion.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operational and Maintenance Data: Submit maintenance manuals in accordance with Section 01 70 00. Provide specific instructions for maintenance, preservation, cleaning and adequate warning of maintenance practices or materials detrimental to finish surfaces.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
- 1.7.1.1. Installers: Execute work of this Section by applicators approved by wall coating manufacturer having proven record of satisfactory installations similar to that specified and with proper equipment and skilled workers to perform it expeditiously. If requested, submit proof of these qualifications.
- 1.7.2. Mock-Ups: At site, in area designated by Consultant erect mock-up wall area 1 m² (10 sq ft) by specified coating thickness (for each type of coating), including primer, block filler and necessary number of coats to obtain specified finish, showing colour, bond and quality of work. Erect additional mock-ups if required for additional reviews. Do not proceed with work until mock-ups have been reviewed. Once reviewed with no objections recorded mock-ups become standard of comparison for wall coating on site and not destroyed or moved until authorized by Consultant.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver materials to site in original unopened containers with manufacturer's labels and seals intact. Ensure labels identify manufacturer's name, brand name of Products, grade and type, application directions and shelf life or expiry date of Product.
- 1.8.2. Storage and Handling Requirements:
- 1.8.2.1. Handle and store materials in accordance with manufacturer's printed directions. Store in warm, dry, lockable area until surfaces are ready for application. Do not store out-of-doors, in boiler rooms, compressor rooms, refrigerated areas, near radiators, steam pipes or other hazardous materials.
- 1.8.2.2. Prior to mixing, store components at temperature between 10 deg C and 32 deg C (50 deg F and 90 deg F) for minimum 24 hours before use.
- 1.8.2.3. Store flammable materials in safe, approved containers to eliminate fire hazards. Remove from site at end of each work shift.
- 1.8.2.4. Do not use materials that have been stored for period of time exceeding maximum recommended shelf life of materials.

1.9. SITE CONDITIONS

- 1.9.1. Ambient Conditions:
- 1.9.1.1. Maintain minimum surface temperatures at 10 deg C (50 deg F) for 24 hours before, during, and for 48 hours following application, or until cured.
- 1.9.1.2. Maintain well-lit, dust-free and well-ventilated area. Provide controlled ventilation to exterior of the building during application and drying by means of temporary ducting and exhaust fans.
- 1.9.1.3. Comply with coating manufacturer's directions for maintenance of substrate temperatures, ventilation and other conditions required to execute and protect work.

1.10. WARRANTY

- 1.10.1. Manufacturer Warranty: Warrant work of this Section against defects and deficiencies for period of 3 years in accordance with General Conditions of the Contract. Promptly correct defects and deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects shall include, but not be limited to, crazing, blistering, fading, bond failure and softening. Damage due to structural failure of base, surface, water seepage or abnormal abuse is exempted from warranty.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. Benjamin Moore & Co., Limited; www.benjaminmoore.ca
- 2.1.1.2. The Sherwin-Williams Company; www.sherwin-williams.com

2.2. MATERIALS

- 2.2.1. Description:
- 2.2.1.1. Regulatory Requirements:
- 2.2.1.1.1. Conform to the OHSA requirements and ensure that applicators wear appropriate, properly fitted organic vapour respirator during and after application.
- 2.2.1.1.2. Fire Hazard Classification: As determined by ULC testing in accordance with ASTM E84 shall not exceed following:
- 2.2.1.1.2.1. Flame Spread: 0.
- 2.2.1.1.2.2. Fuel Contributed: 15.
- 2.2.1.1.2.3. Smoke Developed: 10.
- 2.2.2. Ensure high-performance coating has built-in chemical provision to prevent and provide resistance to graffiti and of type that can be easily cleaned, maintained, repaired and re-coated.
- 2.2.3. Epoxy Paint (EPT): Provide water-based epoxy coating in accordance with MPI #115. Refer to "Material and Finish Schedule" appended to Section 00 10 20 for colour.
- 2.2.4. Mixes: Mix coatings in accordance with manufacturer's directions.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Ensure surfaces to be coated are sound, clean, non-dusting, cured, free from oil and efflorescence and any other contaminants. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Preinstallation Testing:
- 3.1.2.1. Ensure substrate is free of hydrostatic, capillary or moisture vapour pressure. Ensure substrates in contact with grade have properly installed, effective vapour barrier to prevent damage resulting from hydrostatic, capillary or moisture vapour pressure. Ensure concrete contains less than 3% moisture when tested in accordance with ASTM F1869.
- 3.1.2.2. Testing of Surfaces: Prior to commencement of work, do test installation to ensure wall coating material is not affected physically or chemically by type of chemicals anticipated to be used in area.
- 3.1.2.3. Ensure surface temperature and moisture content of substrate meet minimum environmental requirements outlined herein.
- 3.1.2.4. Test substrate for moisture content using moisture meter. Do not apply coatings over substrate materials that contain over 3% moisture. Obtain approval of coating manufacturer of moisture content of substrate before proceeding with application.
- 3.1.2.5. Test cementitious substrates for alkalinity in accordance with coating manufacturer's recommendations.

- 3.1.2.6. Perform hold point inspection as specified herein. Record data on coating manufacturer's inspection report.
- 3.1.3. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

- 3.2.1. Surface Preparation:
 - 3.2.1.1. Carefully mask adjacent surfaces not scheduled to receive high performance coatings, wall openings for electrical outlets or switches and open ends of piping or conduit. Leave masking intact until application is complete. Ensure masking is type which can be readily removed without damage to surface beneath.
 - 3.2.1.2. Perform a hold point inspection on completion of surface preparation immediately prior to prime coat application.
 - 3.2.1.3. Prepare existing or new surfaces and apply primer to substrate as per manufacturer's recommendations.

3.3. APPLICATION

- 3.3.1. Apply special coatings before adjacent work is painted.
- 3.3.2. Do not apply coating over non-hardening sealants or caulking materials.
- 3.3.3. Apply coatings in accordance with manufacturer's instructions to produce monolithic wearing surface of minimum 0.33 mm (13 mils) DFT indicated to even, uniform in colour and appearance, free from marks, runs, craters or other defects detrimental to appearance or performance. Match reviewed samples.
- 3.3.4. Allow proper cure time between coats as recommended by manufacturer. Protect surface from damage during this time. Ensure smoothness index of completed coatings is at least 50% using a 60 degrees Gardner gloss-meter.
- 3.3.5. Where designated apply decorative finishes in accordance with manufacturer's instructions.
- 3.3.6. Provide watertight seal to pipes and projections coming through wall coating, using sealant.

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5. CLEANING

- 3.5.1. Upon completion, remove masking and clean adjacent surfaces free of overspray.

3.6. PROTECTION

- 3.6.1. Protect adjacent surfaces not scheduled to receive coatings from damage and overspray resulting from work of this Section. If necessary, cover or mask surfaces adjacent surfaces to those receiving coating including fixtures and equipment.
- 3.6.2. Replace at no extra cost, materials soiled by coatings during application and storage and from which soil cannot be completely removed.
- 3.6.3. Post "Wet Coating" and "No Smoking" signs while work is in progress and while coatings are curing. Ensure spark-proof electrical equipment is used in areas where inflammable materials are being applied. Prevent use of open flames or equipment that may cause sparks during this phase of work.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide folding panel operable partitions including but not limited to following:
 - 1.2.1.1. Electrically driven, automatic sealing, top and bottom retractable sealing, sound control, individually stacked panels having metal/gypsum board surfaces factory finished in fabric and inset pass door. Install in full width opening in location indicated on Drawings.
 - 1.2.1.2. pocket accessories and closure panels.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Steel support beams and track support system: Section 05 12 00, Structural Steel.
 - 1.2.2.2. Electrical connections to motor operator and to electro magnetic lock to pass doors: Division 26, Electrical.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. STC: Sound Transmission Class.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM B209/B209M-21 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 1.3.2.2. ASTM B221M-21 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
 - 1.3.2.3. ASTM E90-09(16) - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - 1.3.2.4. ASTM E557-12(20) - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions
 - 1.3.2.5. CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4. SUBMITTALS

- 1.4.1. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Indicate installation requirements including head and jamb conditions, track layout, track support details, clearances, stacking arrangement, switching, hardware, finish pattern and colour, operating mechanism and location. Indicate loads to be imposed on supporting structure.
- 1.4.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.4.2.1. partition finish, minimum 300 mm (12") square.
- 1.4.3. Test and Evaluation Reports: Submit test data indicating compliance with design criteria regarding sound attenuation requirements.

1.5. CLOSEOUT SUBMITTALS

- 1.5.1. Operational and Maintenance Data: Provide data for operation and maintenance of folding panel operable partitions, hardware and surfaces for incorporation into Maintenance Manual.

1.6. QUALITY ASSURANCE

- 1.6.1. Applicator Qualifications:

- 1.6.1.1. Installers: Provide work of this Section, executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with the approval and training of Product manufacturers.

- 1.6.2. Certifications:

- 1.6.2.1. Laboratory Acoustical Performance: Ensure performance of folding panel operable partitions have been tested in an independent acoustical laboratory in accordance with ASTM E90 Test Procedure and have attained a Class H, STC rating of no less than 53.

- 1.6.2.2. Fire Hazard Classification: Ensure folding panel operable partitions are in accordance with requirements of CAN/ULC-S102. Maximum Flame Spread, 20; Fuel Contributed, 10; Smoke Developed, 25.

1.7. WARRANTY

- 1.7.1. Manufacturer Warranty: Warrant work of this Section for period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; non-performance of mechanical and operating components including without limitations tracks, trolley systems, top and bottom sealing mechanism and electrical switches.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:

- 2.1.1.1. "643e Series" by Hufcor Inc.; www.hufcor.com

- 2.1.1.2. "Signature 843" by Moderco Partitions; www.moderco.com

- 2.1.1.3. "Acousti-Seal 933e" by Modernfold Inc.; www.modernfold.com

- 2.1.2. Substitution Limitations: Comparable Products from other manufacturers listed or not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Aluminum Extrusions: ASTM B221M, minimum 3 mm (1/8") wall thickness, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T6 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.

- 2.2.2. Aluminum Sheet: ASTM B209/B209M, minimum thickness 3 mm (1/8") of type and characteristics to match finished extrusions; ensure sheet which is not exposed is Utility Aluminum mill finished; for intricate forming use AA-3003 with specified finish.

- 2.2.3. Sound Seals:
 - 2.2.3.1. Supply manufacturer's standard vertical seals between panels consisting of tongue and groove or similar configuration incorporating vinyl finger and/or bulb acoustical seals. Provide extruded, interlocking bulb type vertical seal on edge of end closer panels.
 - 2.2.3.2. Horizontal stationary top and bottom extruded vinyl seals are not permitted. Ensure horizontal top and bottom seals are retractable seals simultaneously operated by a removable handle located approximately 1067 mm (42") from the floor in panel edge.
 - 2.2.3.3. Ensure operable floor seals are adequate to provide minimum 25 mm (1") vertical adjustment due to deflection or unevenness in floor. Provide for downward pressure to create and acoustical seal and to resist panel movement. Finish exposed seal channel in clear anodized aluminum.
- 2.2.4. Suspension System:
 - 2.2.4.1. Track and trolley system as recommended by folding panel partition manufacturer.
 - 2.2.4.2. Ensure continuous extruded C-channel shaped heavy-duty aluminum track accommodates angular turns and intersections, with intersections welded. Ensure each panel has 2 steel reinforced, low friction polymer discs.
- 2.2.5. Pocket Doors and Mounting Panels:
 - 2.2.5.1. Provide completely finished and operating pocket doors to match operable wall panels. Ensure doors are full height, complete with operating latch sets, hinges and seals and constructed to maintain sound rating of entire assembly.
 - 2.2.5.2. Provide hinged pocket doors by preparing panels with adequate reinforcing to accept hinges and locking system or electrically operated locks for electrically controlled folding partition.
 - 2.2.5.3. Provide rigid electrical conduit for electronically controlled doors consisting of rigid galvanized steel of 19 mm (3/4") diameter with locknuts, bushings and fittings and continuous nylon pull cord.
 - 2.2.5.4. Incorporate provisions for electrical controls and wiring for access doors by forming and welding rigid conduit to interiors of door slabs and adjacent panels only for openings so scheduled.

2.3. MANUFACTURED UNITS

- 2.3.1. Operable Partitions:
 - 2.3.1.1. Description: Electrically operated, hinged pair panels with expanding closure.
 - 2.3.1.2. Partition Weight Maximum: 58 kg/m² (12 lbs/sq ft).
 - 2.3.1.3. Panel Widths: Equal and maximum 1220 mm (48").
 - 2.3.1.4. STC: 53.
 - 2.3.1.5. Finish: Fabric; refer to "Material and Finish Schedule" appended to Section 00 01 20.
 - 2.3.1.6. Options: Porcelain enamel steel white boards.
- 2.3.2. Finishes:
 - 2.3.2.1. Clear Anodized Finish: Ensure aluminum finish is clear anodized in accordance with Aluminum Association; www.aluminum.org, Finish Designation AA-M12C22A31, Class II, minimum 0.01 mm (0.4 mils) thick.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Install system using manufacturer's authorized and factory trained specialists only and in accordance with reviewed Shop Drawings and requirements of ASTM E557.
- 3.2.2. Provide work of this Section in accordance with manufacturer's instructions. Follow manufacturer's detailed installation instructions. Make assembly plumb, level and straight.
- 3.2.3. Coordinate drilling of overhead structural beam flanges for support of suspension rods and fabricated track support with trade providing overhead structural members.
- 3.2.4. Work in close co-operation with metalwork, gypsum board and ceiling trades during installation.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. CLOSEOUT ACTIVITIES

- 3.4.1. Demonstration: Commission and adjust folding partitions, access doors and operating devices in proper operation.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide washroom accessories including but not limited to following:
 - 1.2.1.1. CH - clothing hook.
 - 1.2.1.2. GB - grab bars.
 - 1.2.1.3. BCT - baby change table.
 - 1.2.1.4. MR - mirror.
 - 1.2.1.5. SHELF - shelf.
 - 1.2.1.6. concealed sheet steel reinforcing.
- 1.2.2. Products installed but not supplied under this Section:
 - 1.2.2.1. SC - seat covers.
 - 1.2.2.2. SND - sanitary napkin and tampon disposal unit.
 - 1.2.2.3. SNV - sanitary napkin and tampon vending unit.
 - 1.2.2.4. SD - soap dispenser.
 - 1.2.2.5. PTD - paper towel dispenser unit.
 - 1.2.2.6. TTD - toilet tissue dispenser.
 - 1.2.2.7. BIN - waste bin.
- 1.2.3. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.3.1. Rough-in for recessed or built-in fixtures in masonry: Section 04 20 00, Masonry Units.
 - 1.2.3.2. Provision of frameless and custom sized mirrors: Section 08 80 00, Glass and Glazing.
 - 1.2.3.3. Rough-in for recessed or built-in fixtures and reinforcing requirements for wall mounted accessories in gypsum board: Section 09 21 16, Gypsum Board Assemblies.

1.3. REFERENCES

- 1.3.1. Reference Standards:
 - 1.3.1.1. ASTM A653/A653M-23
 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.1.2. ASTM A666-23
 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - 1.3.1.3. ASTM C1503-18
 - Standard Specification for Silvered Flat Glass Mirror
 - 1.3.1.4. CSA W59:24
 - Welded steel construction

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Coordination: Coordinate location of washroom accessories with other work to prevent interference with clearances required for access, proper installation, adjustment, operation, cleaning and servicing of washroom accessories.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Ensure Shop Drawings are in the form of catalogue cuts and fully illustrate specified materials with description of components, surface finishes, hardware and securement devices.
- 1.5.2. Samples: Submit complete samples of each accessory and modular unit to Consultant for review of construction quality, materials and finish prior to delivery of required quantities of items. Submit sample of each colour where applicable. Remove trademark and/or labels on exposed finishes prior to review.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operational and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00. Submit an accessories schedule, keys and parts manual as part of Project closeout documents. Submit 2 sets of following items of manufacturer's literature:
- 1.6.1.1. Technical Data Sheets of each item used for the Project.
- 1.6.1.2. Service and Parts Manuals.
- 1.6.1.3. Name of local representative to be contacted in the event of need of field service of consultation.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements: Deliver materials in sealed cartons and containers with manufacturer's name and Product description clearly marked thereon.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work of this Section for a period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; deterioration of mirror's silvering.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. ASI Group Canada; www.asigroup-canada.com
- 2.1.1.2. Bobrick Washroom Equipment of Canada Ltd.; www.bobrick.com
- 2.1.1.3. Bradley Corporation; www.bradleycorp.com
- 2.1.2. Provide Products for work of this Section by 1 manufacturer and keyed alike to extent possible.
- 2.1.3. Substitution Limitations: Comparable Products from manufacturers listed or not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Ensure washroom accessories are stainless steel, Type 304 or Type 302, of 1 type throughout, ANSI No. 4 mechanical brushed finish, of contemporary design, with minimum material thicknesses of components as specified herein. Arrange stainless steel sheet so grain of brushed finish runs vertically in finished installation.
- 2.2.1.1. Minimum thickness, any location or component: 0.607 mm (24 ga)
- 2.2.1.2. Hygienic accessory - exposed double pan doors and panels: 0.607 mm (24 ga)
- 2.2.1.3. Hygienic accessory - exposed single pan doors: 1.214 mm (18 ga)
- 2.2.1.4. Reinforcement: 1.214 mm (18 ga)
- 2.2.2. Concealed Sheet Steel Reinforcing: Commercial quality cold rolled galvanized sheet steel to ASTM A653/A653M with zinc coating designation of Z275 (G90) in minimum thickness of 0.912 mm (20 ga); or ASTM A666, Type 304 sheet stainless steel.
- 2.2.3. Provide washroom accessories as specified with options indicated. Model numbers may not reflect all options required.
- 2.2.4. Provide stainless steel collars to accommodate semi-recessed mounting of units whose depth exceeds wall cavity depth.

2.3. MANUFACTURED UNITS

- 2.3.1. Clothing Hook (CH): Supply satin finished stainless steel, double hook type supplied with backplates and screws:
- 2.3.1.1. ASI Group Canada, Model No. ASI-7345-S.
- 2.3.1.2. Bobrick, Model No. B-6727.
- 2.3.1.3. Bradley, Model No. 9124.
- 2.3.2. L-Shaped Grab Bar (GB1): Type 304 satin finished with peened grip stainless steel, 38 mm (1-1/2") od, 1.214 mm (18 ga) wall thickness complete with standard mounting plates, flanges and accessories, 38 mm (1-1/2") standoff from wall. Mount as shown on Drawings:
- 2.3.2.1. Bobrick, Model No. B-6898.99.
- 2.3.2.2. Bradley, Model No. 812-057".
- 2.3.3. Straight Grab Bar (GB2): Type 304 satin finished stainless steel, 38 mm (1-1/2") od, 1.214 mm (18 ga) wall thickness complete with standard mounting plates, flanges and accessories, 38 mm (1-1/2") standoff from wall. Vertically mount as shown on Drawings:
- 2.3.3.1. ASI Group Canada, Model No. ASI-3800 Type 01 x 18".
- 2.3.3.2. Bobrick, Model No. B-6806 x 18.
- 2.3.3.3. Bradley, Model No. 812-2 001-18".
- 2.3.4. Baby Change Table (BCT): Engineered compact design to withstand 150 kg (330 lbs) static load. Ensure unit is complete with shock mechanism to open and brake motion to prevent trapping of fingers and shock mechanism for safe bed retraction. Reinforce unit with heavy steel-on-steel hinges. Chemical-free sanitary liners over change area with sanitary line dispenser and graphic instructions. Horizontal design, wall mounted complete with factory installed lock. Provide unit in colour selected by Consultant. Permitted Products:
- SPEC NOTE:** Following 2 paragraphs are for horizontal style changing stations. Confirm with Project Manager for which style is required on the Project.
- 2.3.4.1. "Horizontal Changing Station" by Koala Corporation www.koalabear.com by KBC Specialty Products, Inc.
- 2.3.4.2. ASI Group Canada: "Model No. ASI-9012 - Horizontal Baby-Changing Station".

- 2.3.5. Mirror (MR): Supply 6 mm (1/4") clear float glass conforming to ASTM C1503, float glass with process deposit of 5 silver coats, 3 copper coats and final protective seal. Supply unit in stainless steel angle framing and minimum 0.457 mm thick (26 ga) galvanized sheet steel backing:
 - 2.3.5.1. ASI Group Canada, Model No. ASI-0600 - 2442.
 - 2.3.5.2. Bobrick, Model No. B-290 - 2442.
 - 2.3.5.3. Bradley, Model No. 780 - 2442.
- 2.3.6. Fabrication:
 - 2.3.6.1. Fabricate accessories true, square, rigid, free from distortion and from defects detrimental to appearance and performance. Assemble sheet metal accessories by welding in accordance with CSA W59. Conceal welds, or grind smooth such as to be undetectable in finished work. Unless approved by Owner, ensure assembly fastenings, hardware fixings and mounting or installation devices are concealed in finished work.
 - 2.3.6.2. Use non-corrosive metal fasteners of expansion type, toggle type or other permitted type of positive, mechanical anchor as required to suit construction to which accessory is to be mounted. Ensure exposed fasteners, where permitted, are finished to match adjacent accessory surface and countersunk. Where accessories are mounted to sheet metal, provide a 3 mm (1/8") thick minimum full-size metal back-up plate drilled and tapped to receive machine screws and finished to match adjacent sheet metal surface.
 - 2.3.6.3. Ensure frameless accessories have 1 piece fronts with 90 degree formed returns at their edges and openings. Ensure returns are continuously welded and ground smooth at corners. Where accessory fronts are framed, ensure frame edges, both inside and outside, have 90 degree formed returns continuously welded and ground smooth at corners. Ensure doors also have 90 degree formed returns.
 - 2.3.6.4. Use concealed stainless steel piano hinges which extend full-length of hinged element. Ensure hinged elements have concealed, mechanically-retained, rubber bumpers for silent closing, and close flush with faces of fronts or frames. Locate hinges to afford easy and unobstructed access to interiors taking into consideration location of accessory relative to surrounding and adjacent items and finishes.
 - 2.3.6.5. Ensure portions of sheet metal accessory interiors visible in completed work are stainless steel. Ensure changes in plane are formed or continuously welded and ground smooth. Ensure sheet metal accessory parts concealed in finished installation are galvanized or stainless sheet steel. Ensure edges of sheet metal accessible by users or maintenance personnel are hemmed for safety with no sharp edges.
 - 2.3.6.6. Ensure lettering or pressure sensitive international symbols on accessories is silk screened with durable paint to withstand wear or is engraved or embossed. Size, location and type face of lettering is subject to review. Ensure edges of letters are straight and sharp.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions:
 - 3.1.1.1. Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
 - 3.1.1.2. Verify gypsum board walls have been reinforced in accordance with Section 09 21 16 for wall mounted accessories.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Provide necessary wall reinforcement for grab bars and towel bars as detailed for 227 kg (500 lbs) downward pull.
- 3.2.2. Install washroom accessories in accordance with manufacturer's printed installation instructions.
- 3.2.3. Provide fastenings and mounting kits for washroom accessories.
- 3.2.4. Verify wall opening for correct dimensions, plumbness of blocking or frames and other preparation that would affect installation of washroom accessories.
- 3.2.5. Verify spacing of plumbing fixtures and toilet partitions that affect installation of washroom accessories.
- 3.2.6. Securely fasten accessories, level and plumb using appropriate fastenings as recommended by manufacturer.
- 3.2.7. Provide corrosion resistant fastenings. Where fasteners are exposed, use tamper-proof fasteners finished to match items secured.
- 3.2.8. Locate washroom accessories where indicated on Drawings and where directed by Consultant. Have Consultant review exact locations.
- 3.2.9. Provide manufacturer's recommended anchoring systems.
- 3.2.10. Fit flanges of accessories snug to wall surfaces.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. ADJUSTING

- 3.4.1. Test mechanisms, hinges, locks and latches.
- 3.4.2. Adjust and lubricate to ensure washroom accessories are in perfect working order.

3.5. CLEANING

- 3.5.1. Clean and polish mirrors, aluminum and stainless steel surfaces.
- 3.5.2. Remove protective coatings and paper including adhesives.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide metal lockers including but not limited to following:
 - 1.2.1.1. three-tier, non-welded flat top lockers.
 - 1.2.1.2. metal trims, end gables, filler panels.
 - 1.2.1.3. galvanized metal bases.
 - 1.2.1.4. screws, bolts and other items to bolt lockers together and to secure same to structure.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of wood blocking: Section 06 10 00, Rough Carpentry.

1.3. REFERENCES

- 1.3.1. Reference Standards:
 - 1.3.1.1. ASTM A653/A653M-23
 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.3.1.2. ASTM B117-19
 - Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 1.3.1.3. CSA G40.20-13(23)
 - General requirements for rolled or welded structural quality steel
 - 1.3.1.4. CSA G40.21-13(23)
 - Structural quality steel
 - 1.3.1.5. CSA W59:24
 - Welded steel construction

1.4. SUBMITTALS

- 1.4.1. Shop Drawings:
 - 1.4.1.1. Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.
 - 1.4.1.2. Prepare Shop Drawings for fabrication and erection of lockers and accessories. Show fabrication details, including exact sizes and description of anchorage and hardware, trim, nature of component parts and interface conditions with other work.
 - 1.4.1.3. Clearly cross-reference components on Shop Drawings to Drawings indicating location, number required and name of unit.
- 1.4.2. Locker Drawings: Submit 3 copies of drawings of each locker room showing arrangement, numbering system and number of lockers in room, for Owner's control purposes. Ensure Drawings are on 215 mm x 280 mm (8-1/2" x 11") sheets.

1.5. QUALITY ASSURANCE

1.5.1. Qualifications:

1.5.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the product manufacturers.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Delivery and Acceptance Requirements:

1.6.1.1. Deliver materials in sequence to meet installation schedule. Provide protection from marring or other damage.

1.6.1.2. Carefully unload materials in a manner to prevent damage.

1.6.2. Storage and Handling Requirements: Carefully handle and store in a manner to prevent damage.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedule and Specifications:

2.1.1.1. ASI Storage Solutions Inc.; www.asigroup-canada.com

2.1.1.2. General Storage Systems, Division of North American Steel Equipment Canada Ltd.; www.generalstoragesystems.com

2.1.1.3. Hadrian Manufacturing, Inc.; www.hadrian-inc.com

2.1.1.4. Shanahan's Limited Partnership; www.shanahans.com

2.1.2. Welded lockers are not permitted.

2.1.3. Substitution Limitations: Comparable Products from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

2.2.1. Sheet Steel: Commercial quality, stretcher leveled standard of flatness; plain commercial galvanized or wipe coated conforming to ASTM A653/A653M. Use galvanized coating designation Z275 (G90) for metal bases. Ensure sheet steel is free from surface imperfections and contaminants which would be detrimental to high grade hybrid epoxy polyester powder finish application.

2.2.2. Bar Stock: Hot rolled, CSA G40.20, CSA G40.21, Grade 300 W, free from mill scale and pitting.

2.2.3. Rivets: 4.5 mm (3/16") aluminum dome head; provide dome with steel shaft to suit design requirements.

2.2.4. Welding Materials: CSA W59.

2.2.5. Bituminous Paint: Heavy duty, emulsion type paint which protects against electrolytic action on metals, recommended by installer and reviewed by Consultant.

2.2.6. Fabrication:

2.2.6.1. Fabricate lockers to sizes and to profiles required from following:

2.2.6.1.1. Lockers: Three-tier type, 305 mm wide x 457 mm deep x 1829 mm total height (12" x 18" x 6'), ventilated, flat top and with metal base.

- 2.2.6.2. Composition:
- 2.2.6.2.1. Bodies: Minimum 0.607 mm thick (24 ga) steel sheet without unnecessary holes unless otherwise specifically required for assembly of lockers and accessories. Form edges to provide strong rigid assembly when bolted or riveted together. Lockers back shall be flanged at right angles providing triple thickness of metal. At back corner connections, backs and rib stiffeners on sides.
- 2.2.6.2.2. Frames: Minimum 1.519 mm thick (16 ga) steel sheet, box channel shape, cross members not less than 1.214 mm (18 ga), welded and ground smooth. Provide 2 air cushioned rubber door silencers on lock side of frame at approximately 38 mm (1-1/2" from top and bottom of door. Form both vertical frame members to offer full length 11 mm (7/16") wide continuous door strike. Latch vertical member shall include welded 3.038 mm (11 ga) padlock hasp. Incorporate ventilated slots into top and bottom frame members. Do not expose fasteners on fronts of locker doors and frames.
- 2.2.6.2.3. Doors: Rigid box construction flush with frames, double pan design consisting of minimum 0.912 mm thick (20 ga) outer face and 0.607 mm thick (24 ga) inner face to form rigid box construction. Outer panel shall be double flanged on all 4 edges and inner panel single flanged on all 4 edges providing rigidity when both panels are welded together. Bond structural sound deadening 25 mm (1") cell honeycomb core to inner surfaces. Incorporate a nickel plated lock pocket recess with matching pull and padlock locking system; padlock by Owner on exterior face. Ensure doors have number plates incorporating non-removable numerals, 1 number designated for each locker.
- 2.2.6.2.4. Hang doors on minimum 1.214 mm thick (18 ga) continuous 1 piece integral hinges. Securely weld hinges to frame and fastened to door. Provide hinges of type which maximize security, resistance to abuse and vandalism. Hold doors in closed position with friction catch.
- 2.2.6.2.5. Ensure friction catch is complete with hidden fasteners and firmly holds plunger when door is in closed position.
- 2.2.6.2.6. Trim, Filler Panels: Minimum 1.519 mm thick (16 ga) steel sheet.
- 2.2.6.2.7. Do not put manufacturer's names on front of lockers.
- 2.2.6.2.8. Ventilation: Provide lockers with unobstructed free flow ventilation at top and bottom of frame or door.
- 2.2.7. Finishes:
- 2.2.7.1. Clean and degrease thoroughly cold rolled steel surfaces and pretreat with iron phosphate corrosion inhibitor. Finish cleaned and degreased cold rolled steel surfaces with abrasion and graffiti resistant coating cured to ensure uniform, smooth, protective tough and durable finish.
- 2.2.7.2. Two coats of polyester powder coating for doors, trim/filler panels, frame, top, including exposed sides and interiors respectively in 1 colour and texture later selected by Consultant from manufacturer's standard colour chart to provide a uniform, smooth protective finish. Ensure finish is scratch and graffiti resistant.
- 2.2.7.3. Finish shall have 60-65% minimum gloss and surfaces meet or exceed salt spray resistance of 400 hours with maximum of 3 mm (1/8") creepage from scribe in accordance with ASTM B117.
- 2.2.7.4. Ensure finished units are free from sharp metal edges, with welds ground smooth.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Install metal lockers on integral metal bases and to wood grounds where such lockers are alongside wall as shown on Drawings. Securely bolt lockers together in banks.
- 3.2.2. For recessed lockers, install metal trim across top and down each battery end and at junctions with other materials.
- 3.2.3. Install end gables and similar trim materials for sloping top lockers; install trim full height at battery end and at junctions with other materials. Where required, provide vertical full height filler panels.

3.3. ADJUSTING

- 3.3.1. Upon completion, test doors and adjust for ease of operation.

3.4. SITE QUALITY CONTROL

- 3.4.1. Non-Conforming Work: Remove unsatisfactory materials and replace to Consultant's satisfaction at no cost to Owner.

3.5. CLEANING

- 3.5.1. Clean and Make Good surfaces soiled or damages. Polish units before final review by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide manual roller window shades including but not limited to following:
 - 1.2.1.1. manually operated roller window sun control shade assemblies.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of gypsum board substrate at bulkhead and accessories: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.2. Provision of motorized roller window shades: Section 12 23 14, Motorized Roller Window Shades.

1.3. REFERENCES

- 1.3.1. Reference Standards:
 - 1.3.1.1. ASTM B209/B209M-21a - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 1.3.1.2. ASTM B221M-21 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
 - 1.3.1.3. CAN/ULC-S109-14(19) - Standard Method for Flame Tests of Flame-Resistant Fabrics and Films

1.4. SUBMITTALS

- 1.4.1. Shop Drawings:
 - 1.4.1.1. Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.
 - 1.4.1.2. Submit Shop Drawings which clearly indicate shade sizes, locations, operation, methods of attachment, and description of components, indicating for each component, size, shape, material, thickness, gauge, finish, methods of joining, joint locations, and methods of attachment and relationship with adjacent components and construction, fastening devices, anchorage components and adjacent materials.
- 1.4.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
 - 1.4.2.1. Submit sample shade fully representing shades to be provided complete with head rail, end caps, gears, sprocket wheels, brackets and similar accessories. Submit samples of fabrics complete with edge reinforcing and finish colours for selection. Fabric sample minimum 300 mm (12") square. Submit samples of roller shade component colours for review. Roller shade components include but are not limited to fascia, guide rails and blackout channels. Do not order material until colour samples have been reviewed with no objections recorded.
- 1.4.3. Certificates: Submit written certification that materials, systems and assemblies have been installed in accordance with manufacturer's requirements.
- 1.4.4. Test and Evaluation Reports: Submit test data substantiating proposed shade fabric meets performance criteria specified herein. Submit independent test results showing properties and permitted fire hazard classification of shade fabric.

1.5. CLOSEOUT SUBMITTALS

- 1.5.1. Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
- 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.6.2. Mock-Ups: Erect 1 full size site mock-up of roller window shade at designated location for review. Once reviewed with no objections recorded mock-up sets standard for balance of work. Mock-up may be left as work of this Contract.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements:
- 1.7.1.1. Deliver materials to site only when work of this Section can be started.
- 1.7.1.2. Before delivery to site verify each assembly for proper operation. Clean each assembly of marks and smudges prior to providing wrap up protective covering.
- 1.7.1.3. Provide necessary crating and bundling for shipment of components to site including protection against weather likely to impair adequacy or appearance of material in finished assembly.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to deformation of members, mechanical failure, failure of system to operate as designed or faulty or poor quality of work.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. ALTEX; www.altexdesign.com
- 2.1.1.2. Elite Pro Shading Systems™; www.eliteproshading.com
- 2.1.1.3. Hunter Douglas Contract; www.hunterdouglascontract.com
- 2.1.1.4. Lutron Electronics Co., Inc.; www.lutron.com
- 2.1.1.5. Solarfactive Products Limited; www.solarfactive.com
- 2.1.1.6. Sun Glow Window Covering Products of Canada Ltd.; www.mysunglow.com
- 2.1.2. Substitution Limitations: This Specification is based on surface mounted manually operated using "ZeroGravity™", fully factory assembled sun control shade unit consisting of 2 end brackets that facilitate easy removal and replacement of blinds, shade tube, extruded fascia, hembar and sun control fabric as specified, "Roller Shades" by Sun Glow Window Covering Products of Canada Ltd. Comparable systems from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

2.2.1.1. Design with final determination of limitation on site to meet requirements indicated on Drawings.

2.2.1.2. Design manually operated roller window shade system for easy lifting, fingertip control, with infinite positioning so shade is capable of stopping and holding at any position within window opening. Provide assemblies to suit adjacent ceilings and finishes. Ensure removal does not require disassembly of shade unit. Left- or right-hand operative option available to suit design requirements.

2.2.1.3. Ensure design indicated on Drawings consists of factory assembled roller window shade units consisting of surface mounted on face of mullions or at ceiling with 2 end brackets, shade roller tube, extruded fascia, hembar, fabric, fastenings, anchorages and accessories specified and required.

2.2.1.4. Ensure manual roller window shades match motorized roller window shades in appearance and quality.

2.2.2. Formed Aluminum: ASTM B221M, Aluminum alloy 6063-T5. Ensure surfaces are free from defects impairing appearance, strength and durability.

2.2.3. Extruded Aluminum: ASTM B209/B209M, Aluminum alloy 6063-XT6 for roll tube; 6060 for horizontal tracks; and 6063-T5 elsewhere.

2.2.4. Blackout Side and Bottom Channels: Extruded aluminum channels minimum 28 mm (1-1/8") by 38 mm (1-1/2") complete with 12 mm (1/2") fuzz to reduce light infiltration around sides and sills of shades.

2.2.5. Custom Trim: Extruded aluminum to shapes and profiles indicated, where adjacent finishes abut shade assembly and to provide attachment for adjacent finish, finished to match fascia/soffit.

2.2.6. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.

2.2.7. Fabrication:

2.2.7.1. Coordinate and verify job site dimensions affecting this work. Submit in writing dimensions or conditions which vary from those on reviewed Shop Drawings or detrimental to installation. Obtain corrective measures from Consultant prior to fabrication. Ensure suitability of adjacent building components in relationship to work of this Section.

2.2.7.2. Roller Window Shade Assembly:

2.2.7.2.1. Design and fabricate heavy-duty roller window shade assembly to keep maintenance to minimum.

2.2.7.2.2. Ensure roller window shade assembly operates smoothly having capability to control rate of fall, to adjust stop and hold at an infinite number of positions as required.

2.2.7.2.3. Ensure assembly at highest and lowest shade position has an automatic stop to prevent over winding or unrolling.

2.2.7.2.4. Ensure assembly mechanism has structural capacity to accommodate specified shades in window sizes required for this Project. Design assembly mechanism to suit size of windows and mass of system.

2.2.7.3. Shade Mounting Brackets:

2.2.7.3.1. Always locate chain fall away from an abutting partition to avoid marking of partition.

2.2.7.3.2. Provide mounting in accordance with reviewed Shop Drawings as required to keep brackets totally concealed from view when fully assembled. Provide means of attaching fabric without exposed hardware.

2.2.7.3.3. Provide assembly to prevent accidental dislocation of tube and shade.

- 2.2.7.4. Roller Tube:
 - 2.2.7.4.1. Design extruded aluminum alloy roller tube to suit assembly design with either end of tube to engage drive system through internal or external extruded keyway. Ensure extruded roller tube has wall thickness to suit design requirements with minimum wall thickness of 1.39 mm (0.0547") with reinforcement for fabric to provide anti-deflection support for wide span shades. Formed aluminum tube is not permitted.
 - 2.2.7.4.2. Design tubes to be removable without removing drive assembly, block resetting, or readjusting pre-set stops. Ensure shade tube is self-aligning.
 - 2.2.7.4.3. Ensure roller tube is sized and reinforced internally as necessary to prevent excessive deflection in span of tube. Excessive deflection is defined by observation whereby shades in their open position reveal puckering, sagging or billowing, or where tube deflects beyond 4% of roller length.
 - 2.2.7.4.4. Identify each roller tube to its location in accordance with reviewed Shop Drawings.
- 2.2.7.5. Fabric Mounting Spline: Fabricate snap-in-place spline of extruded vinyl with asymmetrical insertion locking channels and embossed fabric guide. Ensure spline has sufficient capacity to hold shades when spline is snapped and locked into the tube. Ensure fabric shade is readily removable without removing tube from retainer brackets or removing brackets from wall.
- 2.2.7.6. Snap-In-Place Fascia:
 - 2.2.7.6.1. Provide rectangular formed metal fascia where shown of minimum 1.29 mm (0.0507") thick formed aluminum or extruded aluminum of minimum 2 mm (0.078") thick housing.
 - 2.2.7.6.2. Ensure finished fascia returns back at bottom to permit a maximum opening of 50 mm (2"). Supply in lengths of up to 3000 mm (10' - 0") unsupported without any visible sag or distortion.
 - 2.2.7.6.3. Fascia members are not required for overhead concealed application.
 - 2.2.7.6.4. Where shades are face mounted to faceted window arrangement, provide matching closure section and bridging clips between ends of abutting units.
- 2.2.7.7. Shade Fabric Hem Tube: Hem tube may be extruded aluminum, rectangular in shape, designed to hang perfectly perpendicular and to totally conceal any heat-set or sewn seams within tube. Ensure internal spline secures fabric evenly across its full width. Provide a separate port within tube to allow storage of non-corrosive weight.
- 2.2.7.8. Shade Fabrication:
 - 2.2.7.8.1. Do necessary cutting and sewing of fabric to produce finished Product having neat, even appearance and meeting performance requirements specified.
 - 2.2.7.8.2. Fabricate shades with no vertical seams and with a maximum of 2 horizontal seams per shade. Supply fabric in adequate width to avoid horizontal seams at spacings of less than 1900 mm (75"). Ensure seams are straight, even and offer minimum visual obstruction.
 - 2.2.7.8.3. Ensure fabric tracks perfectly straight in its movement to within +/-1% of its width from fully open to fully closed position and when rolled onto tube, ensure it is stacked in layers to within +/-3 mm (+/-1/8") of edge alignment.
 - 2.2.7.8.4. Hang bottom edge straight and true, with hem weights totally enclosed in extruded hem tube. Heat sealing alone is not permitted.
 - 2.2.7.8.5. Ensure sewing incorporates heavy denier polyester yarn and machine stitching is straight and neatly finished with no loose threads visible in finished work. Heat seaming is not permitted in areas in which fabric is exposed.
- 2.2.8. Finishes
 - 2.2.8.1. Roller Shade Components: Colour to be selected later by Consultant.

- 2.2.8.2. Shading Fabric (Openness): Shade cloths shall be 22% Polyester and 78% Vinyl minimum 1600 mm (63") and 2130 mm (84") widths; standard roll length 27.4 m (30 yd); diameter 0.018" warp, 0.022" fill. Tension fabric in finishing range prior to heat setting to keep wrap ends straight and minimize or eliminate weave distortion to keep fabric flat. Ensure fabric is dimensionally stable, moisture and solar heat resistant and non-flammable with colour fastness with following characteristics:
- 2.2.8.2.1. Shade Fabric: GlacierScreen HD2003, White/Bronze:
- 2.2.8.2.1.1. Openness Factor 3%.
- 2.2.8.2.1.2. Thickness 0.028".
- 2.2.8.2.1.3. Weight per sq yd 13.3 oz.
- 2.2.8.3. Shading Fabric (Blackout): Shade cloths shall be 100% Polyester with acrylic foamed backing, minimum 1600 mm (63") and 2130 mm (84") widths; standard roll length 27.4 m (30 yd); diameter 0.018" warp, 0.022" fill. Tension fabric in finishing range prior to heat setting to keep wrap ends straight and minimize or eliminate weave distortion to keep fabric flat. Ensure fabric is dimensionally stable, moisture and solar heat resistant and non-flammable with colour fastness with following characteristics:
- 2.2.8.3.1. Shade Fabric: Phifer SheerWeave 7000, Graphite:
- 2.2.8.3.1.1. Openness Factor 0%.
- 2.2.8.3.1.2. Thickness 0.026".
- 2.2.8.3.1.3. Weight per sq yd 13.41 oz.
- 2.2.8.4. Fabric Colour: Ensure shade fabric on any 1 floor is from same dye lot.
- 2.2.8.5. Fabric Performance: Hang flat shade fabric without buckling or distortion. When trimmed, hang edge straight without ravelling. Ensure unguided roller shade cloth rolls true and straight without shifting sideways more than 3 mm (1/8") in either direction due to wrap distortion or weave design.
- 2.2.8.6. Flame Retardance: Ensure fabric is certified by an independent laboratory to pass the Small Scale Vertical Burn Requirements of CAN/ULC-S109.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Coordinate installation and fastenings with trades providing adjacent components. Coordinate location of support framing and blocking for installation of roller window shades.
- 3.2.2. Provide, as part of work of this Section, custom trim components including gypsum board and tee bar trim items to accommodate adjacent ceiling systems and finishes for Consultant's review.
- 3.2.3. Install shades in accordance with manufacturer's instructions in accordance with reviewed Shop Drawings and as indicated, in true, flat planes.
- 3.2.4. Securely attach installation fittings to their mounting surfaces with screws of correct length and type and with compatible plugs or anchors where required.

- 3.2.5. Hang shades to substrate in a rigid and secure manner using fastener types and arrangements shown on Shop Drawings. Ensure shades have a 16 mm (5/8") air space at sill.
- 3.2.6. Ensure penetrating fastener do not interrupt continuity of air/vapour barrier integrity.
- 3.2.7. Ensure shades and their fabrics hang flat at vertical installation without buckling or distortion. Ensure edge when trimmed, hang straight without curling or ravelling.
- 3.2.8. Ensure unguided roller shade cloth rolls true and straight without shifting sideways more than +/- 3 mm (+/- 1/8") in either direction due to warp distortions or weave design.
- 3.2.9. Provide blackout channels at blackout shade locations.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. ADJUSTING

- 3.4.1. Adjust shades for smooth operation and correct alignment. Perform system operation, service and replacements methods in presence of Owner's personnel.

3.5. CLEANING

- 3.5.1. Remove protective coating. Clean shades and remove finger marks and smudges from shades and adjacent surfaces.
- 3.5.2. Leave shades in raised position at completion of work of this Section.
- 3.5.3. Upon completion of work of this Section, remove Products, materials, debris and equipment from site.
- 3.5.4. Leave site in a neat and tidy condition.
- 3.5.5. Do touch-up required for Consultant's review until no objections are recorded.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide motorized roller window shades including but not limited to following:
 - 1.2.1.1. electrically operated roller window sun control shade assemblies.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Provision of gypsum board substrate at bulkhead and accessories: Section 09 21 16, Gypsum Board Assemblies.
 - 1.2.2.2. Provision of manual roller shades: Section 12 24 13, Manual Roller Window Shades.
 - 1.2.2.3. Provision of electrical connections and wiring: Division 26, Electrical.

1.3. REFERENCES

- 1.3.1. Abbreviations and Acronyms:
 - 1.3.1.1. CSA: Canadian Standards Association; www.csagroup.org.
 - 1.3.1.2. RTS: Radio Transmitting Signal.
 - 1.3.1.3. ULC: Underwriters Laboratories of Canada; www.canada.ul.com.
- 1.3.2. Reference Standards:
 - 1.3.2.1. ASTM B209/B209M-21a - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 1.3.2.2. ASTM B221M-21 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
 - 1.3.2.3. CAN/ULC-S109-14(19) - Standard Method for Flame Tests of Flame-Resistant Fabrics and Films

1.4. SUBMITTALS

- 1.4.1. Shop Drawings:
 - 1.4.1.1. Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.
 - 1.4.1.2. Submit Shop Drawings which clearly indicate shade sizes, locations, operation, methods of attachment, and description of components, indicating for each component, size, shape, material, thickness, gauge, finish, methods of joining, joint locations, and methods of attachment and relationship with adjacent components and construction, fastening devices, anchorage components and adjacent materials.

- 1.4.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:
- 1.4.2.1. Submit sample shade fully representing shades to be provided complete with head rail, end caps, gears, sprocket wheels, brackets and similar accessories. Submit samples of fabrics complete with edge reinforcing and finish colours for selection. Fabric sample minimum 300 mm (12") square. Submit samples of roller shade component colours for review. Roller shade components include but are not limited to fascia, guide rails and blackout channels. Do not order material until colour samples have been reviewed with no objections recorded.
- 1.4.3. Certificates: Submit written certification that materials, systems and assemblies have been installed in accordance with manufacturer's requirements.
- 1.4.4. Test and Evaluation Reports: Submit test data substantiating proposed shade fabric meets performance criteria specified herein. Submit independent test results showing properties and permitted fire hazard classification of shade fabric.

1.5. CLOSEOUT SUBMITTALS

- 1.5.1. Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00.

1.6. QUALITY ASSURANCE

- 1.6.1. Qualifications:
- 1.6.1.1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- 1.6.2. Mock-Ups: Erect 1 full size site mock-up of roller window shade at designated location for review. Once reviewed with no objections recorded mock-up sets standard for balance of work. Mock-up may be left as work of this Contract.

1.7. DELIVERY, STORAGE AND HANDLING

- 1.7.1. Delivery and Acceptance Requirements:
- 1.7.1.1. Deliver materials to site only when work of this Section can be started.
- 1.7.1.2. Before delivery to site verify each assembly for proper operation. Clean each assembly of marks and smudges prior to providing wrap up protective covering.
- 1.7.1.3. Provide necessary crating and bundling for shipment of components to site including protection against weather likely to impair adequacy or appearance of material in finished assembly.

1.8. WARRANTY

- 1.8.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years for shades and 5 years for motors against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to deformation of members, mechanical failure, failure of system to operate as designed or faulty or poor quality of work.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. ALTEX; www.altexdesign.com

- 2.1.1.2. Elite Pro Shading Systems™; www.eliteproshading.com
- 2.1.1.3. Hunter Douglas Contract; www.hunterdouglascontract.com
- 2.1.1.4. Lutron Electronics Co., Inc.; www.lutron.com
- 2.1.1.5. Solarfactive Products Limited; www.solarfactive.com
- 2.1.1.6. Sun Glow Window Covering Products of Canada Ltd.; www.mysunglow.com
- 2.1.2. Substitution Limitations: This Specification is based on "RB 500 Series" by Hunter Douglas Contract. Comparable systems from manufacturers listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MATERIALS

- 2.2.1. Performance/Design Criteria:
 - 2.2.1.1. Design with final determination of limitation on site to meet requirements indicated on Drawings.
 - 2.2.1.2. Design motorized roller window shade system with solenoid activated disc brake mechanism with upper, mid and lower positioning so shade is capable of stopping and holding at any position within window opening, controlled from wall mount RTS lockable switches. Provide assemblies to suit adjacent ceilings and finishes. Ensure removal does not require disassembly of shade unit. Left- or right-hand operative option available to suit design requirements.
 - 2.2.1.3. Ensure design indicated on Drawings consists of factory assembled roller window shade units consisting of surface mounted on face of mullions or at ceiling with 2 end brackets, shade roller tube, extruded fascia, switches, brake, motor, gearbox, hembar, fabric, fastenings, anchorages and accessories specified and required.
 - 2.2.1.4. Ensure motorized roller window shades match manual roller window shades in appearance and quality.
 - 2.2.1.5. Ensure motorized roller window shades can be:
 - 2.2.1.5.1. capable of connecting to a 3rd party AV control system.
 - 2.2.1.5.2. ganged together to control multiple shades on single switch or device.
 - 2.2.2. Formed Aluminum: ASTM B221M, Aluminum alloy 6063-T5. Ensure surfaces are free from defects impairing appearance, strength and durability.
 - 2.2.3. Extruded Aluminum: ASTM B209/B209M, Aluminum alloy 6063-XT6 for roll tube; 6060 for horizontal tracks; and 6063-T5 elsewhere.
 - 2.2.4. Spline Tape: Spline tape shall have sufficient capacity to support fabric shade.
 - 2.2.5. End Brackets: 3.2 mm (1/8") steel to be mounted to wall jamb as required and installed to accept fascia.
 - 2.2.6. End Plug: End cap shall have steel pin which permits up to 7.9 mm (5/16") lateral adjustments in tube width.
 - 2.2.7. Fascia: Provide extruded 6063-T5 aluminum fascia with minimum thickness recommended by manufacturer to suit design that shall clip on to extruded aluminum mounting clips and brackets without any exposed fastening devices. Fascia shall not cover top of bracket when in place to ensure airflow over top of shade and bracket assembly.
 - 2.2.8. Provide break formed 1.2 mm (18 ga) closure hanger and 0.9 mm (20 ga) closure cover.
 - 2.2.9. Blackout Side and Bottom Channels: Extruded aluminum channels minimum 28 mm (1-1/8") by 38 mm (1-1/2") complete with 12 mm (1/2") fuzz to reduce light infiltration around sides and sills of shades.
 - 2.2.10. Centre Support Assembly: Steel bracket 3.2 mm (1/8") shall have vertically adjustable plastic saddle and aluminum connector axle.

- 2.2.11. Hembar: Extruded aluminum profile with hollow section, single lengths for each shade panel. Insert in fabric pocket and sew both ends.
- 2.2.12. Hembar: Extruded aluminum with steel inserts and exposed endcaps, in lengths for each shade panel.
- 2.2.13. Motors: Provide as per manufacturer's recommendation to suit design requirements.
- 2.2.14. Custom Trim: Extruded aluminum to shapes and profiles indicated, where adjacent finishes abut shade assembly and to provide attachment for adjacent finish, finished to match fascia/soffit.
- 2.2.15. Dielectric Separator: Provide best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type.
- 2.2.16. Fabrication:
 - 2.2.16.1. Coordinate and verify job site dimensions affecting this work. Submit in writing dimensions or conditions which vary from those on reviewed Shop Drawings or detrimental to installation. Obtain corrective measures from Consultant prior to fabrication. Ensure suitability of adjacent building components in relationship to work of this Section.
 - 2.2.16.2. Roller Window Shade Assembly:
 - 2.2.16.2.1. Design and fabricate heavy-duty roller window shade assembly to keep maintenance to minimum.
 - 2.2.16.2.2. Ensure assembly at highest and lowest shade position has an automatic stop to prevent over winding or unrolling.
 - 2.2.16.2.3. Ensure assembly mechanism has structural capacity to accommodate specified shades in window sizes required for this Project. Design assembly mechanism to suit size of windows and mass of system.
 - 2.2.16.3. Shade Mounting Brackets:
 - 2.2.16.3.1. Provide mounting in accordance with reviewed Shop Drawings as required to keep brackets totally concealed from view when fully assembled. Provide means of attaching fabric without exposed hardware.
 - 2.2.16.3.2. Provide assembly to prevent accidental dislocation of tube and shade.
 - 2.2.16.4. Roller Tube:
 - 2.2.16.4.1. Design extruded aluminum alloy roller tube to suit assembly design with either end of tube to engage drive system through internal or external extruded keyway. Ensure extruded roller tube has wall thickness to suit design requirements with minimum wall thickness of 1.39 mm (0.0547") with reinforcement for fabric to provide anti-deflection support for wide span shades. Formed aluminum tube is not permitted.
 - 2.2.16.4.2. Design tubes to be removable without removing drive assembly, block resetting, or readjusting pre-set stops. Ensure shade tube is self-aligning.
 - 2.2.16.4.3. Ensure roller tube is sized and reinforced internally as necessary to prevent excessive deflection in span of tube. Excessive deflection is defined by observation whereby shades in their open position reveal puckering, sagging, "V-bagging" or billowing, or where tube deflects beyond 4% of roller length.
 - 2.2.16.4.4. Provide dual roller tubes for dual shading systems at locations shown on Drawings.
 - 2.2.16.4.5. Identify each roller tube to its location in accordance with reviewed Shop Drawings.
 - 2.2.16.5. Fabric Mounting Spline: Fabricate snap-in-place spline of extruded vinyl with asymmetrical insertion locking channels and embossed fabric guide. Ensure spline has sufficient capacity to hold shades when spline is snapped and locked into the tube. Ensure fabric shade is readily removable without removing tube from retainer brackets or removing brackets from wall.

- 2.2.16.6. Snap-In-Place Fascia:
 - 2.2.16.6.1. Provide rectangular formed metal fascia where shown of minimum 1.29 mm (0.0507") thick formed aluminum or extruded aluminum of minimum 2 mm (0.078") thick housing.
 - 2.2.16.6.2. Ensure finished fascia returns back at bottom to permit a maximum opening of 50 mm (2"). Supply in lengths of up to 3000 mm (10' - 0") unsupported without any visible sag or distortion.
 - 2.2.16.6.3. Fascia members are not required for overhead concealed application.
 - 2.2.16.6.4. Where shades are face mounted to curtain wall, provide matching closure section and bridging clips between ends of abutting units.
 - 2.2.16.6.5. Fascia members are required on both front and back of shading unit.
- 2.2.16.7. Shade Fabric Hem Tube: At manufacturer's option, hem tube may be extruded aluminum, rectangular in shape, designed to hang perfectly perpendicular and to totally conceal any heat-set or sewn seams within tube. Ensure internal spline tape secures fabric evenly across its full width. Provide a separate port within tube to allow storage of non-corrosive weight.
- 2.2.16.8. Shade Fabrication:
 - 2.2.16.8.1. Do necessary cutting and sewing of fabric to produce finished Product having neat, even appearance and meeting performance requirements specified.
 - 2.2.16.8.2. Fabricate shades with no vertical and horizontal seams. Supply fabric in adequate width and height to suit design requirements.
 - 2.2.16.8.3. Ensure fabric tracks perfectly straight in its movement to within +/-1% of its width from fully open to fully closed position and when rolled onto tube, ensure it is stacked in layers to within +/-3 mm (+/-1/8") of edge alignment.
 - 2.2.16.8.4. Hang bottom edge straight and true, with hem weights totally enclosed in extruded hem tube. Heat sealing alone is not permitted.
 - 2.2.16.8.5. Ensure sewing incorporates heavy denier polyester yarn and machine stitching is straight and neatly finished with no loose threads visible in finished work. Heat seaming is not permitted in areas in which fabric is exposed.
- 2.2.17. Finishes:
 - 2.2.17.1. Roller Shade Components: Colour to match "Medium Bronze #312" by PPG Industries; www.ppgideascales.com.
 - 2.2.17.2. Shading Fabric (Openness): Shade cloths shall be 22% Polyester and 78% Vinyl minimum 1600 mm (63") and 2130 mm (84") widths; standard roll length 27.4 m (30 yd); diameter 0.018" warp, 0.022" fill. Tension fabric in finishing range prior to heat setting to keep wrap ends straight and minimize or eliminate weave distortion to keep fabric flat. Ensure fabric is dimensionally stable, moisture and solar heat resistant and non-flammable with colour fastness with following characteristics:
 - 2.2.17.2.1. Shade Fabric: GlacierScreen HD2003, White/Bronze:
 - 2.2.17.2.1.1. Openness Factor: 3%.
 - 2.2.17.2.1.2. Thickness: 0.028".
 - 2.2.17.2.1.3. Weight per sq yd: 13.3 oz.

- 2.2.17.3. Shading Fabric (Blackout): Shade cloths shall be 100% Polyester with acrylic foamed backing, minimum 1600 mm (63") and 2130 mm (84") widths; standard roll length 27.4 m (30 yd); diameter 0.018" warp, 0.022" fill. Tension fabric in finishing range prior to heat setting to keep wrap ends straight and minimize or eliminate weave distortion to keep fabric flat. Ensure fabric is dimensionally stable, moisture and solar heat resistant and non-flammable with colour fastness with following characteristics:
- 2.2.17.3.1. Shade Fabric: Phifer SheerWeave 7000, Graphite:
- 2.2.17.3.1.1. Openness Factor: 0%.
- 2.2.17.3.1.2. Thickness: 0.026".
- 2.2.17.3.1.3. Weight per sq yd: 13.41 oz.
- 2.2.17.4. Fabric Colour: Ensure shade fabric on any 1 floor is from same dye lot.
- 2.2.17.5. Fabric Performance: Hang flat shade fabric without buckling or distortion. When trimmed, hang edge straight without ravelling. Ensure unguided roller shade cloth rolls true and straight without shifting sideways more than 3 mm (1/8") in either direction due to wrap distortion or weave design.
- 2.2.17.6. Flame Retardance: Ensure fabric is certified by an independent laboratory to pass the Small Scale Vertical Burn Requirements of CAN/ULC-S109.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Coordinate installation and fastenings with trades providing adjacent components. Coordinate location of support framing and blocking for installation of roller window shades.
- 3.2.2. Provide, as part of work of this Section, custom trim components including gypsum board and tee bar trim items to accommodate adjacent ceiling systems and finishes for Consultant's review.
- 3.2.3. Install shades in accordance with manufacturer's instructions in accordance with reviewed Shop Drawings and as indicated, in true, flat planes.
- 3.2.4. Securely attach installation fittings to their mounting surfaces with screws of correct length and type and with compatible plugs or anchors where required.
- 3.2.5. Lock the drive end wheel of the motor to the tube, using screws. A notched section in the tube turns the ring which activates the shade assembly. Upper and lower stop positions are adjusted with hex key limit switches located on motor end.
- 3.2.6. Maximum two motors to be operated by single position rocker switch control, located remotely as directed by Consultant. Where required, motor to be hooked up to "Motor Group Control" (MGC) located as shown on manufacturer's wiring diagrams. Manufacturer to supply switch and MGC for installation and hook-up by electrical contractor, CSA or ULC approved. Brushed stainless steel switch cover plates (1, 2, 3 or 4 gang) available.
- 3.2.7. Shade to be controlled from single switch. Install signal repeaters as required.
- 3.2.8. Hang shades to substrate in a rigid and secure manner using fastener types and arrangements shown on Shop Drawings. Ensure shades have a 16 mm (5/8") air space at sill.
- 3.2.9. Ensure penetrating fastener do not interrupt continuity of air/vapour barrier integrity.

- 3.2.10. Ensure shades and their fabrics hang flat at vertical installation without buckling or distortion. Ensure edge when trimmed, hang straight without curling or ravelling.
- 3.2.11. Ensure unguided roller shade cloth rolls true and straight without shifting sideways more than +/- 3 mm (+/-1/8") in either direction due to warp distortions or weave design.
- 3.2.12. Coordinate installation with building automation system and/or audio/visual systems.
- 3.2.13. Provide blackout channels at locations where blackout shades are present.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. ADJUSTING

- 3.4.1. Adjust shades for smooth operation and correct alignment. Perform system operation, service and replacements methods in presence of Owner's personnel.

3.5. CLEANING

- 3.5.1. Remove protective coating. Clean shades and remove finger marks and smudges from shades and adjacent surfaces.
- 3.5.2. Leave shades in raised position at completion of work of this Section.
- 3.5.3. Upon completion of work of this Section, remove Products, materials, debris and equipment from site.
- 3.5.4. Leave site in a neat and tidy condition.
- 3.5.5. Do touch-up required for Consultant's review until no objections are recorded.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and conform to:
 - 1.1.1.1. CCDC 2 - 2020, Stipulated Price Contract as amended in the Contract Documents.
 - 1.1.1.2. Division 1 requirements and documents referred to therein.

1.2. SUMMARY

- 1.2.1. Section Includes: Provide entrance floor grilles including but not limited to following:
 - 1.2.1.1. recessed entrance foot grilles with drain pans.
- 1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1.2.2.1. Installation of frames for foot grilles and trench cover frames: Section 03 30 00, Cast-In-Place Concrete.
 - 1.2.2.2. Provision of pipe drains in drained foot grilles: Division 22, Plumbing.

1.3. REFERENCES

- 1.3.1. Reference Standards:
 - 1.3.1.1. ASTM D2047-17 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine

1.4. ADMINISTRATIVE REQUIREMENTS

- 1.4.1. Sequencing: Coordination with Section 03 30 00. For proper installation, concrete recess must be flat and smooth throughout. Pour dimensions may require leveling grout to achieve proper depth and a smooth finish. Ensure final recess depth matches specified Product and field verified. Ensure side walls of concrete recess are straight and smooth. Correct inconsistencies with recess and side walls prior to recessed floor grille installation.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Submit Shop Drawings or catalogue sheets in accordance with Section 01 30 00 to fully illustrate the work of this Section. Ensure Shop Drawings or manufacturer's catalogue sheets illustrate layout of grid and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.
- 1.5.2. Samples: Submit samples in accordance with Section 01 30 00. Submit an assembled section of floor grid and frame members with selected tread insert showing each type of colour for exposed floor grid, frame and accessories required.

1.6. CLOSEOUT SUBMITTALS

- 1.6.1. Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00. Submit manufacturer's printed instructions for cleaning and maintaining floor grids.

1.7. QUALITY ASSURANCE

- 1.7.1. Qualifications:
 - 1.7.1.1. Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Delivery and Acceptance Requirements: Deliver packaged materials in original, undamaged containers with manufacturer's labels and seals intact fabricated in as large sections and assemblies as practical.
- 1.8.2. Storage and Handling Requirements: Handle and store materials in accordance with manufacturer's and Supplier's recommendations to prevent damage thereto.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturer List: Products of following manufacturers are permitted subject to conformance to requirements of Drawings, Schedules and Specifications:
- 2.1.1.1. C/S Construction Specialties, Inc.; www.c-sgroup.com
- 2.1.1.2. Grillage Bolar Canada Inc.; www.bolar.com
- 2.1.1.3. K.N. Crowder Manufacturing, Inc.; www.kncrowder.com
- 2.1.1.4. M.W. McGill & Associates Ltd.; www.mcgillarchitectural.com
- 2.1.2. Substitution Limitations: Comparable Products from other manufacturers not listed herein may be reviewed provided they meet requirements of this Specification.

2.2. MANUFACTURED UNITS

- 2.2.1. Performance/Design Criteria:
- 2.2.1.1. Slip Resistance: Ensure coefficient of friction in minimum 0.60 for accessible routes in accordance with ASTM D2047.
- 2.2.1.2. Rolling Loads: Standard rolling load performance is 227 kg (500 lb) per wheel (load applied using a solid 125 mm x 50 mm (5" x 2") wide polyurethane wheel, 1000 passes without damage).
- 2.2.2. Recessed Entrance Foot Grilles:
- 2.2.2.1. Carpet surfaced, recessed type, in extruded 6063-T52 aluminum alloy framing, mill finish, with anchors for concrete. Provide "Pedigrid Model G1-DP-HD" by C/S Construction Specialties, Inc., "Ken-A-Grille Model FG-8 Carpet Grille with GA frame" by K.N. Crowder Manufacturing, Inc. or "AG-2000-SNC-DP" by M.W. McGill & Associates Ltd.
- 2.2.2.2. Aluminum surfaced, recessed type, in extruded 6063-T52 aluminum alloy framing, mill finish, with anchors for concrete. Provide "Serrated Aluminum Pedigrid, SA G8-DP [SA G8-LB]" by C/S Construction Specialties, Inc., "Ken-A-Grille Model FG-5 with [GA] [GB] [GC] frame" by K.N. Crowder Manufacturing, Inc. or "AG-7000-CA Corrugated Aluminum" by M.W. McGill & Associates Ltd.
- 2.2.2.3. Ensure pans are 1.3 mm (0.05") aluminum with drain. Use cadmium plated strainers in drained pans.
- 2.2.2.4. Paint aluminum surfaces in contact with concrete with zinc chromate primer.
- 2.2.3. Lock Down Mechanism: Hidden lock down is a 32 mm (1-1/4") x 32 mm (1-1/4") x 3 mm (1/8") type 304 stainless steel hold down plate securing grille to concrete surface.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

- 3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

- 3.2.1. Install recessed floor grilles in accordance with manufacturer's printed directions.
- 3.2.2. Set grid type at height recommended by manufacturer for most effective cleaning action.
- 3.2.3. Coordinate top of grid surfaces with bottom of doors that swing across to provide ample clearance between door and grid.
- 3.2.4. Defer installation of floor grids until near Date of Substantial Performance.

3.3. SITE QUALITY CONTROL

- 3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.4. PROTECTION

- 3.4.1. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Date of Substantial Performance.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies the supply and installation of all site furnishings including benches, waste receptacles, and all other site furnishings.
- 1.1.2. Comply with all requirements for the General Requirements – Section 01 00 00.

1.2. SHOP DRAWINGS

- 1.2.1. Submit detailed shop drawings. Indicate sizes, materials and fastening methods.

1.3. QUALITY ASSURANCE

- 1.3.1. All installation of site furnishings will be carried out by experienced personnel under the direction of a skilled foreman and in strict accordance with all drawings, and manufacturer's specification.

1.4. SUBMITTALS

- 1.4.1. The contractor will make available a color and finish sample of all site furnishings for approval by the Owner or Landscape Architect.

1.5. PRODUCT DELIVERY, STORAGE & HANDLING

- 1.5.1. Protect all materials from harmful exposure during transportation to the site.
- 1.5.2. Upon delivery, store all materials off the ground and protect from adverse conditions to prevent deterioration, damage, or impairment of structural or other essential properties.
- 1.5.3. All damaged or deteriorated materials will be rejected and must be removed from the site immediately.

1.6. SITE EXAMINATION

- 1.6.1. The contractor shall report to the Landscape Architect, in writing, of any conditions or defects encountered on the site during or before construction, upon which the work of this section depends and which may adversely affect its performance.
- 1.6.2. Do not commence work until such conditions or defects have been investigated and corrected.
- 1.6.3. Where required, layout all furniture locations on the site and give timely notice to the Landscape Architect to allow for inspections before commencing work.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. All furnishings are to be as specified on drawings. Confirm colors with the Landscape Architect prior to ordering.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. All site furnishings to be installed as per the manufacturer's specifications and details.
- 3.1.2. Layout as per drawings and subject to the approval of the Owner or Landscape Architect.

END OF SECTION

PART 1 - GENERAL

1.1. Scope

- 1.1.1. Provide labour, materials, products and services necessary for the following work at U of T - Health and Wellness at Koffler, 214 College Street, Toronto, ON:
 - 1.1.1.1. Installation of a single machine-room-less traction passenger elevator in accordance with Section 14 21 23.
 - 1.1.1.2. Installation of one partially-enclosed barrier-free platform lift in accordance with Section 14 41 00.

1.2. Maintenance: warranty period

- 1.2.1. Provide labour, materials, products, equipment and services necessary for the maintenance of the elevating devices in accordance with Section 14 01 20.
- 1.2.2. This maintenance to begin at Substantial Performance and end 12 months after Substantial Performance.
- 1.2.3. Costs for this maintenance are to be included in the project costs.

1.3. Definitions of terms

- 1.3.1. The term "Owner" as used herein, refers to University of Toronto.
- 1.3.2. The term "architect", as used herein, refers to ENFORM Architects Inc..
- 1.3.3. The term "consultant", "elevator consulting engineer", "consulting engineer" or "engineer", as used herein, refers to KJA Consultants Inc.
- 1.3.4. The term "elevator contractor" or "contractor", as used herein, refers to any person, partners, firm or corporation having a contract with the Owner to furnish labour and materials for the execution of the work herein described.
- 1.3.5. The term "sub-contractor", as used herein, refers to any person, partners, firm or corporation having a contract with the contractor to furnish labour and materials for the execution of the work herein described.
- 1.3.6. The term "inspecting authorities", as used herein, refers to authorized agents of governments and of insurance groups which are charged with the responsibility of carrying out periodic inspections and tests on vertical transportation equipment.
- 1.3.7. The term "provide", as used herein, means to supply and install new equipment.
- 1.3.8. The term "Code", as used herein, refers to the latest edition of the CAN/CSA-B44 Safety Code for Elevators and Escalators and the B355-19 Code for Platform Lifts and Stair Lifts for Barrier-Free Access, with updates and including Nonmandatory Appendices (which are deemed mandatory herein), as adopted by the Authority Having Jurisdiction.
- 1.3.9. All terms in the specifications that are not otherwise defined shall have the definitions as given in the Code.

1.4. Operation and maintenance manual

- 1.4.1. Supply to the Consultant and Owner prior to the Substantial Performance inspection, operation and maintenance manuals.
- 1.4.2. The project shall not be deemed to have reached Substantial Performance until the complete operation and maintenance manuals have been approved by the Consultant or Owner.

- 1.4.3. Upon acceptance by the Consultant or Owner, provide three copies of the operation and maintenance manuals per group in one of the following formats, as selected by the Owner.
- 1.4.3.1. Print and bind hard copies of which two will be given to the Owner and one will be placed in the respective machine room; OR
- 1.4.3.2. Provide an electronic copy in PDF format on an unprotected digital storage device (such as a USB).
- 1.4.4. The operation and maintenance manual shall incorporate, at a minimum:
 - 1.4.4.1. A cover page including project title, address;
 - 1.4.4.2. An index;
 - 1.4.4.3. Contact details for the respective parties;
 - 1.4.4.4. A warranty letter signed by a representative of the contractor having authority to bind the company;
 - 1.4.4.5. Controller and drive manuals, including:
 - 1.4.4.5.1. A description of the controller user interface;
 - 1.4.4.5.2. The installation and user's manuals;
 - 1.4.4.5.3. A list of fault and error codes, including an explanation of meanings and corrective actions;
 - 1.4.4.5.4. Troubleshooting and diagnostic procedures, methods of use and the adjustment of programmable parameters together with their settings at the time of final adjustment.
- 1.4.4.6. As-built wiring diagrams;
- 1.4.4.7. The operation of the equipment including special features, dispatching sequences, and such items as intercom systems and security systems;
- 1.4.4.8. Step-by-step instructions for the operation for special features such as Firefighters' Emergency Operation, Independent service and Emergency Power service;
- 1.4.4.9. As-built diagrams and drawings of operating panels (e.g. car panels, central control consoles) with descriptions of the function of switches and indicators;
- 1.4.4.10. A copy of the final submission to the Authority Having Jurisdiction;
- 1.4.4.11. A copy of the final inspection report from the Authority Having Jurisdiction;
- 1.4.4.12. Operation and maintenance manuals for other major components where applicable, including:
 - 1.4.4.12.1. Door operator;
 - 1.4.4.12.2. Emergency brake;
 - 1.4.4.12.3. Communication system;
 - 1.4.4.12.4. Safeties & governor;
 - 1.4.4.12.5. Hoist machine & motor;
 - 1.4.4.12.6. Cylinders;

- 1.4.4.12.7. Hydraulic pump machine and internal components;
- 1.4.4.12.8. Hall kiosks, including step-by-step instructions for re-programming;
- 1.4.4.12.9. In-car monitors, position indicators and display screens, including step-by-step instructions for re-programming;
- 1.4.4.12.10. Hall kiosk special screen features and codes (i.e. to call a specific car to a floor, to call a specific car to a floor for cleaning or other maintenance functions, etc.).
- 1.4.4.13. Supplier and part name for other parts (ex: travelling cable, restrictors, retainers, interlocks, car top inspection station, guide means, etc.), excluding minor or generic items such as screws, bolts, hinges, etc;
- 1.4.4.14. Full instructions for any special maintenance procedure, repair protocol, adjustment or test not addressed by Code (including the A17.2 and the Elevator Industry Field Employee's Safety Handbook);
- 1.4.4.15. Manufacturer's recommended maintenance intervals for each major component.
- 1.4.4.16. A copy of the Maintenance Control Program.
- 1.5. Coordination with other trades**
 - 1.5.1. Where the work joins another trade, provide drawings showing the actual dimensions and the method of joining the work to the work of the other trade and information such as anchors, templates and details for cast-ins.
 - 1.5.2. Provide access and assistance as required, at no extra charge, in relation to work by other trades.
- 1.6. Fixture type**
 - 1.6.1. Provide, unless otherwise indicated in the Specifications or Drawings, signal fixtures and position indicators, from your standard range of products.
 - 1.6.2. Provide US91 BB car and hall buttons.
 - 1.6.3. Provide, unless otherwise indicated in the Specifications or Drawings, signal fixtures in an illumination colour selected by the Owner.
 - 1.6.4. Submit illustrations of those types available and provide at least one physical button sample of the type selected by the Owner for final approval.
- 1.7. Finishes: stainless steel**
 - 1.7.1. Provide, unless otherwise indicated in the Specifications or Drawings, stainless steel number four finish for visible natural metal finishes.
 - 1.7.2. Arrange, unless otherwise indicated in the Specifications or Drawings, that the brush or grain direction of finishes of visible natural metals be in the vertical direction (for horizontal sections the brush or grain shall be in the direction of the longer surface dimension).
 - 1.7.3. Remove all protective film prior to turnover of the unit to the Owner.

1.8. Progress payments

- 1.8.1. Progress payments will be based on the percentage of the work complete as determined by the Consultant.
- 1.8.2. Ten percent of the contract value will be assigned to the provision of manuals and close-out documents and the correction of deficiencies.
- 1.8.3. A 10% holdback will apply to payments, this holdback to be released within a period as set out in the applicable legislation.

1.9. Acceleration of the Work

- 1.9.1. If the Work falls behind the schedule, take action as necessary to meet the schedule, including, but not limited to, extra personnel and overtime work.
- 1.9.2. Pay any costs associated with this action unless the delay is caused by acts of government, riot, civil commotion, war, malicious mischief, act of God or any cause beyond the control of the contractor.

1.10. Acknowledgments

- 1.10.1. The proposer acknowledges that the proposer has found no discrepancies nor any ambiguities in the specifications.

1.11. Assignments

- 1.11.1. Do not assign nor sublet the contract without the written consent of the Owner.
- 1.11.2. Do not assign any payment due or to become due as a result of this contract without the written consent of the Owner.

1.12. Certificates of inspection

- 1.12.1. Obtain and pay for certificates of approval and all other necessary permits and inspections.
- 1.12.2. Prior to Substantial Performance, arrange and pay for an acceptance inspection of the equipment by a government authority or, if that is not available, by a recognized independent private professional inspection organization.
- 1.12.3. Submit, prior to Substantial Performance, the acceptance inspection report.
- 1.12.4. Should more than one inspection for a licence or approval be required due to deficient work by others give sufficient advance notice of such deficient work to allow the Work to be completed prior to the time of the subsequent inspection.
- 1.12.5. If sufficient advance notice of such deficient work has not been given, assume the cost of the additional inspections.

1.13. Changes in Work

- 1.13.1. The Owner, without invalidating the contract, may order extra work or make changes by altering, adding to, or deducting from the Work, the contract sum being adjusted as agreed.
- 1.13.2. Execute all such work under the conditions of the original contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change.
- 1.13.3. The Consultant shall have authority to make minor changes in the Work, not involving extra cost and not inconsistent with the purpose of the contract.
- 1.13.4. Otherwise do no extra work nor make any change unless in pursuance of written order from the Owner.

1.14. Clean-downs

- 1.14.1. Provide clean-downs of all construction dust and debris (i.e. control/machine room, hoistway, cab, escalator interior, etc.) to occur as follows:
 - 1.14.1.1. Prior to turnover inspection of an individual elevator by the Authority Having Jurisdiction;
 - 1.14.1.2. Once upon building substantial completion, at the commencement of the warranty period.

1.15. Claims for extra cost

- 1.15.1. Provide any claims for extra cost due to instructions or otherwise, to the Owner in writing within a reasonable time after the instructions and in any event before proceeding with the work.
- 1.15.2. No such claim shall be valid unless so made and authorized in writing by the Owner.

1.16. Codes and ordinances

- 1.16.1. Supply equipment and do work in accordance with building codes, by-laws, regulations and requirements of the local, provincial and federal authorities in effect at the time of the execution of the work.
- 1.16.2. Supply equipment and do work in accordance with the Code, and any other code which may govern the requirements of the installation.
- 1.16.3. Provide labour and material, whether or not specifically mentioned in this specification, that may be necessary to provide an installation conforming to the applicable codes and regulations.
- 1.16.4. Prior to submission of the proposal and throughout the duration of work, give prompt notification in writing of any regulations or requirements known to be in process which might affect the acceptability of the work.
- 1.16.5. If changes in codes or regulations result in extra costs, those taking effect subsequent to the date of proposal submission shall be treated as an extra to the contract.
- 1.16.6. Requirements of the Authority Having Jurisdiction applicable at the time of proposal submission shall be deemed to be included in the contract, unless specifically excluded herein.
- 1.16.7. Should changes in codes, changes in legislative requirements or changes to the requirements of the Authority Having Jurisdiction be announced prior to the date of proposal submission but with a delayed adoption date, those changes shall be deemed to be included in the contract, unless specifically excluded herein.

1.17. Completion schedule

- 1.17.1. Submit with the proposal, a detailed schedule including specific dates for equipment delivery times, start of site work, completion of each unit and resolution of all noted deficiencies.
- 1.17.2. During the construction period give the following information to the Consultant:
 - 1.17.2.1. Revisions, if necessary, to the completion schedule;
 - 1.17.2.2. A progress report every month showing the progress being made and the percentage of the job completed;
 - 1.17.2.3. Two weeks advance notice for inspection by the Consultant.
- 1.17.3. Schedule a job site meeting every two weeks during the construction period.

1.18. Contract Documents

- 1.18.1. The Contract Documents shall consist of general conditions, instructions to bidders, the Drawings, Specifications (including alternates and addenda) and completion schedules.
- 1.18.2. Execute the work in accordance with the Owner's contract documents, any supplemental conditions and these specifications.
- 1.18.3. Where there is a conflict between the documents the Owner's contract documents will take precedence over the other documents and any supplemental conditions will take precedence over these specifications.

1.19. Defective work and non-performance

- 1.19.1. The Owner reserves the right to correct any defective work and to charge the cost to the contractor.
- 1.19.2. Should the contractor fail to execute any of the Work set out in the contract the Owner reserves the right to do the Work and to charge the cost to the contractor.
- 1.19.3. The Owner reserves the right to withhold payment in the event of non-performance or to pay only for that portion of the Work that has been executed.
- 1.19.4. The Owner will give reasonable notice in writing prior to taking such action unless the defective work or non-performance prejudice the safety of people or the installation.

1.20. Drawing and sample submittals

- 1.20.1. Drawing and sample submittals are required for exposed finishes and fixtures.
- 1.20.2. Submit for review samples of metals, glass, paint colours, plastic laminates and finishes, of 200 mm (8") by 300 mm (12") approximate size, properly identified as to project, location and material.
- 1.20.3. Submit for review, as a minimum, the following:
 - 1.20.3.1. General arrangements;
 - 1.20.3.2. Details of areas where the work joins the work of other trades;
 - 1.20.3.3. Machine room layouts showing the location of the equipment;
 - 1.20.3.4. Hoistway layouts showing the location of the equipment, car platform dimensions, cab interior dimensions and net inside cab area;
 - 1.20.3.5. Hoistway sections showing overhead, pit equipment, car and frame and entrances;
 - 1.20.3.6. Cab details including the cab shell, platform, interior panels, ceiling, entrance, lighting and finishes;
 - 1.20.3.7. Details of control panels such as central control consoles or fire control panels showing the layout and detailing the design of switches and indicator lights;
 - 1.20.3.8. Details of intercom system station types detailing the controls;
 - 1.20.3.9. Details of any display devices complete with examples of proposed displays, symbols and layout;
 - 1.20.3.10. Fixture brochures.
- 1.20.4. Show on the general arrangement or separately, details of frames, doors, sills and supports,

lanterns and gongs, including views showing the relationship of hall stations, lanterns and entrances.

1.20.5. Provide as built information at job completion prior to Substantial Performance.

1.20.6. Reviews do not include the checking of measurements and do not imply approval of variations from the specifications.

1.21. Electrical diagrams

1.21.1. Supply wiring diagrams and data as required for the execution of the Work including schematics for speed control, dispatching system, interfaces, printed circuit boards.

1.21.2. Incorporate, as part of the schematic diagrams, a reference index ('road map') giving the location of electrical components and wiring interconnections for relay coils, relay contacts, field equipment, integrated circuits and other such devices, so that the position on the schematics of any of these items can be readily determined.

1.21.3. Supply, prior to the Substantial Performance inspection, three prints and one reproducible of the wiring and schematic diagrams revised to show changes that have been made.

1.21.4. If changes are subsequently made to the wiring or control, supply an additional two sets of marked-up prints of the schematics and field wiring diagrams showing the changes.

1.22. Environmental considerations

1.22.1. Where practicable, recycle material replaced in the course of the work.

1.22.2. Provide a list of materials to be removed from site and their proposed recycling or disposal location for approval prior to commencing work.

1.22.3. Where practicable, provide new materials manufactured by methods that do not adversely affect the environment by, for example, generating residual deposits of heavy elements and greenhouse gases.

1.22.4. Use materials on site, such as low VOC (Volatile Organic Compound) adhesives and paint, that will not negatively affect the in-building environment.

1.23. Equipment insurance

1.23.1. The Owner's insurance policy covers equipment already installed in the building and accepted by the Owner.

1.23.2. All other material and equipment is not included in the Owner's policy and such material and equipment is stored at the Contractor's own risk.

1.24. Equipment moving

1.24.1. Provide floor protection and bracing so that equipment moving causes no damage to the building.

1.25. Failure to perform

1.25.1. If the contractor shall neglect to prosecute the work properly or fail to perform any provision of the contract, the Owner after ten days written notice to the contractor may, without prejudice to any other remedy the Owner may have, make good such deficiencies and may deduct the cost therefrom from payment due to the contractor.

1.26. Generic maintenance

- 1.26.1. Arrange that the equipment can be maintained and adjusted by any competent elevator company without the use of proprietary tools, information or equipment or, if such tools, information or equipment are required, provide them (these shall become the property of the Owner).
- 1.26.2. Do not incorporate any running time, cycle counters or trip counters that would cause the equipment to shut down or alter its operation in any way.

1.27. Group inspection by the Consultant

- 1.27.1. Advise the Consultant in writing two weeks prior to the completion of a group so as to arrange an inspection by the Consultant at a mutually convenient time.
- 1.27.2. Assist the Consultant in the performance of this inspection to verify that group programming and dispatching systems are in compliance with the Specifications.
- 1.27.3. Provide a team of competent persons to assist the Consultant in making the necessary tests and inspections.

1.28. Hoistway protection

- 1.28.1. Provide, maintain and, after the Work is complete, remove any partitions required in the hoistway.
- 1.28.2. Provide, maintain and, after the Work is complete, remove protective hoarding required at openings into the hoistway.

1.29. Inability to complete contract

- 1.29.1. Should there be a reasonable doubt that the work will be completed within the scheduled time because of labour disputes or any other cause, the Owner reserves the right, at the Owner's option, to cancel the contract.
- 1.29.2. In the event this option is exercised, the payments for the work shall be made on a pro rata basis for materials and labour supplied to the time of cancellation and such material and work performed shall become the property of the Owner.
- 1.29.3. Prior to exercising this option, the Owner shall give two weeks notice in writing of intention to cancel.

1.30. Information with proposal

- 1.30.1. Provide the following information, where relevant, with the proposal:
 - 1.30.1.1. The model and manufacturer of such items as solid state drives, fixtures, control systems, door operators and other purchased material (with the exception of miscellaneous minor items);
 - 1.30.1.2. The current rating of the solid state drives;
 - 1.30.1.3. The KVA rating of the transformers feeding the solid state drives;
 - 1.30.1.4. Certification from an independent testing laboratory detailing the line pollution generated by the solid state drives;
 - 1.30.1.5. Certification from an independent testing laboratory detailing the extent to which the control systems are protected against external electromagnetic radiation;
 - 1.30.1.6. Brochures, descriptions and manuals (where applicable) for the major items;

- 1.30.1.7. Renderings or samples of the fixtures and exposed materials;
- 1.30.1.8. Detailed completion schedule for the work;
- 1.30.1.9. A copy of your health and safety policy as issued to your employees;
- 1.30.1.10. Mechanic and team regular and overtime hourly rates.

1.31. Inspection and acceptance

- 1.31.1. Furnish a team of competent personnel to assist the Consultant with an inspection of each elevating device prior to Substantial Performance to verify that the work is in compliance with the Specifications.
- 1.31.2. If the results of these inspections do not meet the requirements of the Specifications, make the appropriate corrections, and provide, as set out above, for another inspection.

1.32. Key switches

- 1.32.1. Where possible supply switches and keys compatible with the vertical transportation equipment portfolio of the Owner, unless otherwise noted herein.
- 1.32.2. Engrave or mechanically fasten collar rings to clearly mark key-switch functions, positions and key required.
- 1.32.3. Prior to placing any units into service for the public, provide to the Owner six copies of each key-switch key type defined in the Code as being Security Group 2, 3 and 4.
- 1.32.4. Engrave the key number on each key provided to the Owner and group the keys by Security Group and key type.

1.33. Labour laws

- 1.33.1. Comply with applicable provisions of federal, provincial and local labour laws and with applicable union regulations.

1.34. Liability insurance

- 1.34.1. Provide, during the period this contract is in force, premises liability, including public liability insurance and property damage insurance in the amount of \$5,000,000 inclusive, to be covered against any claims for damage to property or for personal injury, including death, which may arise from operation under this contract, whether such operation is by yourself or by any sub-contractor or anyone directly or indirectly employed by you.
- 1.34.2. Upon completion of the contract, have in force a completed operations and products liability insurance, in the amount of \$5,000,000 inclusive, to be covered against any claims for damages to property or for personal injury, including death, which may arise after the premises liability is terminated.
- 1.34.3. Maintain the insurance in force for a minimum period of two years after completion of the contract.
- 1.34.4. List the Owner as an additional insured.
- 1.34.5. The certificates shall state that the insurance will not become ineffective without sufficient written notice to the Owner.
- 1.34.6. Submit certificates of such insurance with the Owner before work is begun.

1.35. Liens and affidavits

- 1.35.1. The final payment and any part of the retained percentage shall not become due until a complete release of liens arising out of this contract or receipts in full in lieu thereof have been delivered to the Owner.
- 1.35.2. Furnish an affidavit to the Owner that the release or receipts include labour and materials for which a lien could be filed.
- 1.35.3. If any lien remains unsatisfied after all payments are made, refund to the Owner monies that the Owner may be compelled to pay in discharging such a lien, including costs and reasonable legal fees.

1.36. Maintenance tasks

- 1.36.1. Perform and bring all routine maintenance tasks required by the Inspecting Authorities up to date (i.e. monthly, quarterly, semi-annual, annual, 5-year, Category 1, Category 3, Category 5 requirements, etc.) prior to turning over the elevator for public use.
- 1.36.2. Arrange for Category 5 test bench marking with the Henning alternative testing tool or approved equivalent tools.
- 1.36.3. Complete the Category 5 test bench marking at the same time that full speed and full load testing is performed.
- 1.36.4. Provide electronic records confirming the successful completion of the tests.

1.37. Materials and workmanship

- 1.37.1. Provide all new materials and equipment.
- 1.37.2. Install equipment in a neat, accurate, workmanlike manner.

1.38. Measurements

- 1.38.1. In the execution of the work, verify all dimensions with the actual conditions in order to do a perfect job.

1.39. Operation by persons with physical disabilities

- 1.39.1. Ensure that controls and fixtures comply with Appendix E of the Code.

1.40. Operating environment

- 1.40.1. Provide material and equipment to function normally within the requirements of the specifications when the ambient temperature is between 5.0 and 32.0 degrees Celsius (41 and 90 degrees Fahrenheit).
- 1.40.2. Provide material and equipment to function normally and within the requirements of the specifications when the ambient relative humidity is between 25% and 95% non-condensing.
- 1.40.3. Provide material and equipment to function normally and within the requirements of the specifications when the supply voltage is within minus 10% and plus 10% of the nominal voltage and the frequency is within 5% of the nominal frequency.
- 1.40.4. Provide equipment needed to meet the specified voltage operating parameters (e.g. filters, isolation transformers, transient voltage surge suppression, etc.).
- 1.40.5. Arrange that the equipment meet the seismic requirements.
- 1.40.6. Perform necessary equipment adjustments related to building compression up to and including building compression of 2mm (0.08 in.) over a 4,000 mm (157.5 in.) floor-to-floor

height.

1.41. Organization chart

1.41.1. Provide to the Owner an organization chart from the local supervisory level up.

1.41.2. Provide to the Owner the names, positions and experience of the field and supervisory personnel associated with this project.

1.41.3. During the course of the work when organization changes are made, provide the Owner with updated information.

1.42. Overtime premium

1.42.1. In the event that the Owner, for whatever reason, pays for overtime worked to complete the work as set out in the Specifications, the Owner will pay the added cost of the overtime.

1.42.2. The added cost shall be the difference between the overtime cost and straight time cost at contract rates.

1.42.3. Obtain from the Owner prior written authorization for overtime to be worked and chargeable, as described above, to the Owner, this authorization to be for specific amounts and for specific times.

1.42.4. Submit time sheets for such overtime worked for approval to the Owner or the designated representative of the Owner within 48 hours of the time that such overtime is worked.

1.42.5. If the procedures as set out above are not followed, assume the costs of the time worked.

1.43. Owner's General Terms and Conditions

1.43.1. Abide by the Owner's General Terms and Conditions.

1.43.2. Where there is a conflict between the Owner's General Terms and Conditions and these specifications the Owner's Terms and Conditions take precedence.

1.44. Parts

1.44.1. Supply parts on request for a period of fifteen years subsequent to Substantial Performance of the project, at then prevailing prices.

1.44.2. Where purchased components are used, ensure that the original manufacturer's name and component designation are clearly marked on the part or in the parts catalogue.

1.45. Patents

1.45.1. Hold and save the Owner and its officers, agents, servants and employees harmless from liability due to patent or copyright infringement arising from the use of, in the performance of the work or in the completed installation, any invention, process, article, or appliance.

1.46. Payment withheld

1.46.1. Approval for payment may be withheld to such extent as may be necessary on account of:

1.46.1.1. Defective work not remedied;

1.46.1.2. Claims filed or reasonable evidence indicating probable filing of claims;

1.46.1.3. Failure of contractor to make payments properly to sub-contractors or for material and labour;

1.46.1.4. Failure to work to schedule;

- 1.46.1.5. A reasonable doubt that the contract can be completed for the balance then unpaid;
- 1.46.1.6. Damage to the building or another contractor by the elevator contractor or one of their subcontractors.
- 1.46.2. When the above grounds are removed, payment will be made for amount withheld.
- 1.47. Personnel**
 - 1.47.1. Supervise personnel so that they present a neat appearance and their movement in the building is within the requirements of their work.
 - 1.47.2. Provide uniforms and photo identification for personnel.
 - 1.47.3. The Owner reserves the right to reject or refuse access to personnel or contractors at its sole discretion.
 - 1.47.4. Assign and maintain a dedicated service representative to the work, this representative to be responsible for liaison with the Owner and the Consultant.
 - 1.47.5. Assign and maintain a dedicated service supervisor to the work, this supervisor to be responsible for technical communications with the Owner and the Consultant.
- 1.48. Pre-inspection check list**
 - 1.48.1. Upon completion of each group, review each page of the specifications and initial each page at the bottom left to indicate that the work has been completed in compliance with the Specifications.
 - 1.48.2. Submit this initialled copy of the Specifications to the Consultant prior to requesting an inspection by the Consultant.
- 1.49. Preliminary information**
 - 1.49.1. Submit, within 30 working days after awarding of contract, the information and details, including reactions, power requirements, ventilation requirements, cutouts, access requirements, light and outlet locations, quantity, location and size of external wires required to inter-connect the equipment, and all other information required to complete the work to be performed by others in conjunction with the installation of the equipment.
- 1.50. Protection of the Work and property**
 - 1.50.1. Maintain protection of the Work and protect the Owner's property from injury or loss arising out of the execution of this contract.
 - 1.50.2. Make good any injury or loss caused by the Contractor's agents or employees.
 - 1.50.3. Take all necessary precautions to ensure that the Work is done in a manner that does not endanger any person.
- 1.51. Removal of rubbish**
 - 1.51.1. Remove rubbish, keep the building and premises clean during the progress of the work, and leave the premises at completion in perfect condition as far as the work under the specifications is concerned.
- 1.52. Request for payment**
 - 1.52.1. Submit applications for payment with the necessary data, information, waivers and affidavits including certificates of compliance and appropriate statutory declaration.

1.53. Singular and plural

- 1.53.1. In all cases singular and plural shall be interchangeable and shall be applied as required to meet the sense and intent of the Specifications.
- 1.53.2. Where the singular is employed it shall be interpreted as necessary, unless otherwise indicated, to apply to all equipment and devices required to produce a complete installation.

1.54. Special tools and access codes

- 1.54.1. If any special tools (i.e. tools that are not readily purchased from a hardware supplier) are used to maintain or adjust the equipment or are required for any aspect of the work on the equipment, list these tools with details on the proposal form and provide such tools to the Owner prior to Substantial Performance.
- 1.54.2. If any access codes are used to maintain or adjust the equipment or are required for any aspect of the work on the equipment (including the reading and resetting of error codes and logs) list these access codes with details on the proposal form and provide such access codes to the Owner prior to Substantial Performance.
- 1.54.3. Do not change the access codes without the written consent of the Owner and, when changed, provide to the Owner the new access codes.

1.55. Subcontractors

- 1.55.1. Bind subcontractors to all applicable portions of the Specifications.
- 1.55.2. The contractor shall be responsible for all actions and all work performed by its subcontractors to the same extent as the contractor is itself responsible under the Specifications.

1.56. Submission of proposal

- 1.56.1. Submission of a proposal will be considered presumptive evidence that the proposer is conversant with local facilities and conditions, requirements of the Contract Documents and of pertinent provincial and local codes, state of labour and material markets, and in the proposal has made due allowance for all contingencies.

1.57. Taxes

- 1.57.1. Include applicable local, provincial and federal taxes or assessments in effect at the time of the signing of the contract.
- 1.57.2. Show on the proposal form the amount of each tax included.
- 1.57.3. The Contractor is liable for the above mentioned taxes or assessments whether or not specifically mentioned in his proposal or in the final contract document.
- 1.57.4. In the event new taxes or assessments, to become due on completion of the contract, are imposed after the signing of the contract these are to be paid, in addition to the original contract amount, by the Owner to the Contractor, who in turn is to pay them to the proper authorities.
- 1.57.5. In the event taxes or assessments in effect at the signing of the contract should be revoked before consummation of the contract rebate to the Owner the amount of such taxes and assessments included in the original contract.

1.58. Technical seminar

- 1.58.1. Before the time of Substantial Performance, arrange with the Owner to provide a seminar for the Owner's staff.
- 1.58.2. Include in the seminar a complete review of the documentation, operation of the equipment and demonstration of any special features including programming of any display devices.

1.59. Trade marks

- 1.59.1. Do not apply trade marks visible to the general public on any piece of equipment.

1.60. Unit inspection by the Consultant

- 1.60.1. Advise the Consultant in writing two weeks prior to the completion of a unit so as to arrange an inspection by the Consultant at a mutually convenient time.
- 1.60.2. Assist the Consultant in the performance of this inspection to verify that performance figures, workmanship and equipment furnished are in compliance with the Specifications.
- 1.60.3. Provide the necessary test weights to carry out full load tests and a team of competent persons to assist the Consultant in making the necessary tests and inspections.

1.61. Warranty of work

- 1.61.1. Warrant that the materials, performance and workmanship are in accordance with the industry standard in every respect.
- 1.61.2. Make good defects not due to improper use which may develop within one year from the date of Substantial Performance of the project.
- 1.61.3. Warrant that the equipment performs to the standards set out herein.
- 1.61.4. Neither the final payment nor any provision of the Contract Documents diminishes the responsibility for negligence or faulty materials or workmanship within the extent and period provided by law.
- 1.61.5. Upon written notice remedy defects and pay expenses for damage to others resulting from defects.

1.62. Withdrawal or rejection of proposals

- 1.62.1. The Owner reserves the right to reject any or all proposals or to waive any conditions.
- 1.62.2. Proposals may not be withdrawn until sixty days after the scheduled date for the receipt of the proposals.

1.63. Work by other trades

- 1.63.1. In the event that work by other trades is required and work by others as set out herein is in conflict with or inadequate for your equipment or design, so state on the proposal form with all necessary details.
- 1.63.2. If no exceptions are noted on the proposal form, pay the costs of all modifications necessary to suit your equipment and design.

1.64. Work completion and maintenance turnover

- 1.64.1. At the completion of the work and prior to turning over the unit for public use:
 - 1.64.1.1. So as to ensure a smooth and harmonious turnover, arrange with the existing elevator maintenance provider a walkthrough of the installation, this walkthrough to be carried out

jointly by your supervisor and the existing elevator maintenance provider's maintenance supervisor.

- 1.64.1.2. Provide to the Owner and Consultant the Test Data Forms signed by both your supervisor and the existing elevator maintenance provider's supervisor together with a signed confirmation that the work has been checked by both parties and both parties are in agreement that the work has been completed satisfactorily and poses no problems for ongoing maintenance.

1.65. Work site protection

- 1.65.1. Provide, maintain and, after the work is complete, remove protective hoarding around the work site.

- 1.65.2. Arrange the protective hoarding so as to prevent public access to the work site.

1.66. Work under division 02 (Site Preparation)

- 1.66.1. A lockable storage space during the installation period.

1.67. Work under division 03 (Concrete)

- 1.67.1. Properly framed hoistways with a variation from nominal well dimensions of not more than +25 mm (1").

- 1.67.2. A structure designed for the following estimated reactions (including a provision for impact) generated by each device:

| Reactions at (per unit): | car buffer | | counterweight buffer | | overhead | |
|-----------------------------|------------|--------|----------------------|--------|----------|--------|
| | kN | lb | kN | lb | kN | lb |
| LiftElevator | 169 | 38,000 | 140 | 31,500 | 171 | 38,500 |

| Reactions at: (per unit) | car buffer | | on the pit floor under each jack (2 jacks) | |
|-----------------------------|------------|-------|---|-------|
| | kN | lbf | kN | lbf |
| Lift | 14 | 3,200 | 14 | 3,200 |

- 1.67.3. Gross openings for hoistway entrances exceeding the clear door dimensions by 250 mm (10") on each side and above.

- 1.67.4. Blocking in of entrance frames following installation.

- 1.67.5. Supports for the sill support angles, flush with the inside hoistway wall, a minimum of 150 mm (6") in depth, capable of sustaining a minimum unit load equivalent to the capacity of the elevator.

- 1.67.6. Adequate support for the guide rail fastenings and installation of guide rail bracket inserts where required.

- 1.67.7. Sleeves and coring for electric ducts in the hoistway, machine space and control space as required.

- 1.67.8. Pockets, as required, to permit fastening of rail brackets to building structure. Pockets to be filled after brackets installed.

- 1.67.9. Fire-resistant control/machine room with a concrete floor and access door.

1.68. Work under division 04 (Masonry)

1.68.1. Grouting under hoistway sills.

1.69. Work under division 05 (Metals)

1.69.1. Supports for the guide-rails at each floor and in the overhead.

1.69.2. For machine -room-less elevators, for hoistway walls not made of concrete, intermediate supports for the guide-rails where guide-rail reinforcement cannot be installed by the elevator contractor and where floor heights exceed 3650 mm (12' 0").

1.69.3. A hoisting beam at the top of the hoistway parallel to the hoistway doors and located in the middle of the hoistway plan, and capable of sustaining a 35 kN (7,500 lb) load.

1.69.4. An access ladder in the elevator pit.

1.70. Work under division 07 (Thermal and Moisture Protection)

1.70.1. Means to limit the presence of water, gases and odours in the pit.

1.70.2. Waterproofing of the pit.

1.71. Work under division 08 (Doors and Windows)

1.71.1. For the elevator control/machine room, a full height self-locking and self-closing access door.

1.72. Work under division 09 (Finishes)

1.72.1. Initial painting of the control/machine room floors.

1.72.2. Sealing of the control/machine room ceilings and walls to reduce dust.

1.72.3. Painting of the hoistway entrances, where required.

1.72.4. Flooring for the elevator cab.

1.73. Work under Division 22 (Plumbing)

1.73.1. A pit drain with connection to the building drainage system, drains to have a capacity of 11.3 m³/h (3,000 gal/h) per shared elevator hoistway having a positive means to prevent water, gases and odours from entering the hoistway.

1.73.2. A cover for the pit drains secured to and level with the pit floor.

1.73.3. Any sprinkler systems employing water if installed in the machine rooms, control rooms or hoistway to be arranged to operate at a higher temperature (approximately 20% higher) than the fire alarm sensors.

1.73.4. If required by the applicable regulations, means to limit the presence of smoke in the hoistway of the designated firefighters' elevator.

1.74. Work under Division 23 (Mechanical)

1.74.1. Heating and cooling in order to maintain continuously (i.e. 24 hours a day) a temperature of greater than 13 degrees Celsius and less than 29 degrees Celsius based on the estimated heat generated by the elevator equipment as follows:

| Heat generated (per elevator): | control/machine room | | hoistway | |
|-----------------------------------|----------------------|-------|----------|-------|
| | kW | BTU/h | kW | BTU/h |
| Elevator | 1.0 | 3,500 | 1.0 | 3,250 |

- 1.74.2. Do not locate ventilation equipment directly above elevator equipment and ensure air conditioning exhaust ducts do not direct conditioned air directly onto elevator wire ropes.

1.75. Work under division 26 (Electrical)

- 1.75.1. A grounded power supply sufficient to start and run each unit at rated speed and capacity, and including the following:
- 1.75.1.1. A disconnect means located in view of the elevator controller at the proximity of the top landing door jamb.
- 1.75.1.2. For machine-room-less elevators, a disconnect means located in view of the elevator equipment at the top of the hoistway.
- 1.75.1.3. A disconnect means located in view of the lift lower entrance.
- 1.75.1.4. Wiring between the disconnect and the elevator power input point (elevator transformer or controller).
- 1.75.1.5. Protection of the feeder cables for designated firefighters' elevators.
- 1.75.1.6. The power supply should be capable of absorbing the regenerated power from the system where necessary.
- 1.75.2. A power supply capable of supplying for each unit the following estimated starting and running currents in amperes based on the power supply noted:

| Full load up currents (per elevator) | power supply | starting current | running current |
|--|--------------|------------------|-----------------|
| | Volts | Amps | Amps |
| Elevator | 600 | 45 | 20 |
| Lift | 120 | 20 | - |

- 1.75.3. At the proximity of the top landing elevator door jamb, one 15 A 120 V, single phase circuit breaker for each elevator to power cab ventilation and lighting equipment, the power for the lighting circuit being derived from the emergency power supply if available.
- 1.75.4. At the proximity of the top landing elevator door jamb, one 15 A 120 V, single phase circuit breaker for each elevator to power the cab interior duplex GFCI receptacle and auxiliary equipment (e.g. camera).
- 1.75.5. For elevators and lifts where a battery rescue device is provided, an auxiliary disconnect contact with wiring to the controller, to indicate if the disconnect is on or off.
- 1.75.6. At the proximity of the top landing elevator door jamb, protected LED lights located at approximately 2500 mm (8') from floor level as required to give a minimum illumination of 200 lx at floor level and within the controller, the power for the lighting circuit being derived from the emergency power supply if available.
- 1.75.7. At the proximity of the top landing elevator door jamb, duplex GFCI receptacles.
- 1.75.8. In elevator and lift pits, duplex GFCI receptacles mounted on the wall, spaced at approximately 5000 mm (16') intervals and located clear of equipment.

- 1.75.9. In elevator and lift pits, protected LED lights, controlled by a light switch located adjacent to the pit entrance, located clear of elevator equipment to give a minimum illumination of 100 lx at pit level, the lowest lamps to be within 500 mm (20") of the pit floor. The power for the lighting circuit to be derived from the emergency power supply if available.
- 1.75.10. In the elevator overhead of machine-room-less elevators, protected LED lights, located in front of and behind the machine and associated equipment as required to give a minimum illumination of 200 lx on the equipment. The light switch to be located in the hoistway at the point of entry. The power for the lighting circuit to be derived from the emergency power supply if available.
- 1.75.11. In the elevator overhead of machine-room-less elevators, duplex GFCI receptacles mounted on the wall and spaced at approximately 5000 mm (16') intervals.
- 1.75.12. Fire alarm initiating devices (FAIDs) on the recall floor.
- 1.75.13. Fire alarm initiating devices (FAIDs) on all other floors.
- 1.75.14. Fire alarm initiating devices (FAIDs) at the top of the hoistway.
- 1.75.15. Fire alarm initiating devices (FAIDs) in the pit.
- 1.75.16. A connection from the fire alarm initiating devices (FAIDs) on the recall floor to the elevator controller.
- 1.75.17. A connection from the fire alarm initiating devices (FAIDs) on all other floors to the elevator controller.
- 1.75.18. A connection from the fire alarm initiating devices (FAIDs) at the top of the hoistway to the elevator controller.
- 1.75.19. A connection from the fire alarm initiating devices (FAIDs) in the pit to the elevator controller.
- 1.75.20. An active telephone line to the controller location, capable of operating during a power failure for a minimum of four hours.
- 1.75.21. An internet connection to the controller location, capable of operating during a power failure for a minimum of four hours.
- 1.75.22. Do not mount auxiliary equipment such as security controllers or elevator telephone cabinets on elevator controller cabinets.
- 1.75.23. Where applicable, a security system for the elevator and associated car and hall card readers.
- 1.75.24. Where applicable, a closed circuit camera system for the elevator.
- 1.75.25. Conduit between the elevator hoistway, control/machine room and any remote equipment locations, terminated outside the hoistway at the basement level (or other level designated by the Owner) at a junction box (junction box to be provided by the elevator contractor).
- 1.75.26. Pulling of wire between the elevator hoistway, control/machine room and any other remote equipment locations.
- 1.75.27. Coordinate with the elevator contractor any controller interconnections needed for the security system and associated card readers.
- 1.75.28. Electric power during erection, for illumination, operations of tools and hoist, starting, testing and adjusting.

PART 2 - SEPARATE PRICES

2.1. Separate price submission requirements

2.1.1. Submit prices to provide the following:

2.2. Maintenance: five years

2.2.1. Provide full maintenance of the equipment for a period of five years beginning at the end of the maintenance included in the contract.

2.2.2. The services agreement will continue on a month-to-month basis at the expiration of the original term unless notice in writing is provided by either party, at least 60 days in advance of the expiration date, notifying the other party of their intent to not continue with the services agreement beyond the original term mandate or any subsequent monthly mandates.

2.2.3. Provide this service at a flat monthly price without escalation.

2.2.4. Provide this service in conformity with the Maintenance Specifications.

PART 3 - ALTERNATIVE PRICES

3.1. Alternative price submission requirements

3.1.1. Submit prices (extras or credits) to provide the following equipment in lieu of the equipment set out in the base proposal:

3.2. OEM controls

3.2.1. Provide controls manufactured by your firm.

END OF SECTION

Section 14 21 23 MRL PASSENGER ELEVATOR

PART 1 - GENERAL

1.1. General requirements

1.1.1. Conform to Section 14 20 00.

1.2. Type

1.2.1. Installation of a single machine-room-less traction passenger elevator.

1.3. Data

| MRL Passenger Elevator | | |
|-------------------------------|----------------------------|------|
| number of units | 1 | |
| designation | - | |
| application | passenger | |
| rated speed (m/s, fpm) | 0.76 | 150 |
| capacity (kg, lb) | 1590 | 3500 |
| motor power (kW, HP) | 7.7 | 10 |
| operation | selective collective | |
| machine type | machine-room-less traction | |
| machine location | within hoistway | |
| drive type | solid state regenerative | |
| emergency brake | provide | |
| car governor | provide | |
| counterweight governor | none | |
| roping ratio | 2:1 | |
| control system | microprocessor | |
| control location | top landing door jamb | |
| front entrances | *1, 2, 3 | |
| rear entrances | 1R, 2R, 3R (catty-corner) | |
| door type | single speed side opening | |
| hoistway door fire resistance | 1.5 hours | |
| lobby sill material | aluminum | |
| cab sill material | aluminum | |
| entrance width (mm, ") | 1070 | 42 |
| entrance height (mm, ") | 2130 | 84 |
| entrance markings | provide | |
| cab width (mm, ") | 2030 | 80 |
| cab depth (mm, ") | 1650 | 65 |
| cab height (mm, ") | 2590 | 102 |
| car door restrictor | provide | |

| | |
|------------------------------------|-----------------------|
| door safety retainers | provide |
| entrance protection | B44-19 compliant |
| door operator | closed-loop |
| interlocks | provide |
| main car station | applied |
| auxiliary car station | none |
| verbal annunciation | provide |
| car position indicator | digital |
| cab emergency lighting | provide |
| cab communication | hands-free telephone |
| two-way video communication | provide |
| in-cab video display system | none |
| car closed circuit camera | provisions |
| car call security | provisions |
| hall call security | none |
| hall stations (typical) | single riser |
| hall stations (main floor) | single riser |
| hoistway access switches | provide |
| cab ventilation | two-speed fan |
| cab finishes | provide |
| hall door finish (typical) | stainless steel |
| hall door finish (main floor) | stainless steel |
| car door finish | stainless steel |
| hall lanterns | provide |
| in-car lanterns | none |
| hall position indicator | digital at all floors |
| lobby panel | none |
| CACF panel | none |
| central control monitor | none |
| car top inspection station | provide |
| load weighing device | provide |
| car guiding | roller guides |
| counterweight guiding | roller guides |
| guide rails | provide |
| compensation | none |
| emergency recall (phase I) | automatic |
| firefighter's operation (phase II) | provide |
| emergency power | battery rescue device |

| | |
|-------------------|--------------|
| car top railing | provide |
| operating time | 14.4 seconds |
| acceleration rate | 0.8 m/s/s |

1.4. Dimensions

- 1.4.1. Provide equipment to suit the machine room, hoistway, pit and overhead dimensions.

PART 2 - PRODUCTS

2.1. Third party equipment

- 2.1.1. Provide third party controls from MCE or GAL.
- 2.1.2. Provide proven components that have been used during the last two years as a minimum.
- 2.1.3. Provide a written guarantee from the control manufacturer that over the life of the installation software and firmware updates will be provided at no charge to the Owner.

2.2. Prone stretcher requirement

- 2.2.1. Arrange the elevator to meet the requirement for accommodating and providing adequate access for a patient stretcher 2010 mm (79") long by 610 mm (24") wide in the prone position.

2.3. Speed

- 2.3.1. Arrange the elevators to run under any condition of loading, except the case of overload, within 1.5 percent of the rated speed.

2.4. Machine: MRL (Machine-Room-Less)

- 2.4.1. Provide a machine of the single-wrap traction type including an AC motor, electromechanical brake, sheave shaft and traction sheave properly aligned.
- 2.4.2. Mount the machine in the hoistway.
- 2.4.3. Provide a machine with a proven record, over a period of at least seven years, of satisfactory operation on other installations of the same speed, capacity and counterweighting.
- 2.4.4. Provide equipment which will deliver its rated output continuously with a temperature rise not to exceed 50 degrees C (122 degrees F).
- 2.4.5. Provide, as a minimum, Class B insulation.
- 2.4.6. Submit with the proposal the horsepower and torque ratings of the elevator motor.
- 2.4.7. Provide a traction sheave to suit the suspension means.
- 2.4.8. Provide a brake actuated switch to indicate to the control system the state of the brake: that is, lifted or applied.
- 2.4.9. Provide sound and vibration isolation pads or springs arranged so that there is no solid contact between the machine and the building structure.

2.5. Brake spring

- 2.5.1. After the brake is adjusted for correct operation and prior to the performance of safety tests and checks by the inspecting authorities, seal it with a numbered seal so as to prevent unauthorized re-adjustment and record the date and seal number in the log book.

2.6. Elevator suspension means

- 2.6.1. Provide elevator suspension means such that the addition of 50 per cent of the rated load to the car cab will cause no more than a 0.04 per cent elongation in the suspension means.
- 2.6.2. Where multiple suspension elements are used in parallel to share a load, ensure that the elements are all from one manufacturing run.
- 2.6.3. Provide sufficient removable counterweight buffer blocking to allow adjustment for suspension means stretch without requiring shortening of the suspension means.
- 2.6.4. Where the suspension means do not permit for measurement of wear or visual observation of replacement conditions, provide a method to establish the preventative replacement condition(s).
- 2.6.5. Where wire hoist ropes are utilized:
- 2.6.5.1. Provide means during and after installation to prevent the ropes turning; do not use swivel connections.
- 2.6.5.2. Ensure that the number of rope twists do not exceed the manufacturer's recommendations.
- 2.6.5.3. Adjust the rope tension of each rope to the average of the set plus or minus 5%.
- 2.6.5.4. Use wedge type cable clamps.
- 2.6.6. Where combustible suspension means are utilized (such as noncircular elastomeric-coated or polyurethane-coated steel belts):
- 2.6.6.1. Provide suspension means meeting not less than an FT-1 rating when tested to the vertical burn test requirements of UL 62, CSA C22.2 No 49 or approved equivalent.
- 2.6.7. Suspension means shall be designed for not less than 2,500,000 trips based on site-specific equipment and arrangement.
- 2.6.8. Where suspension means replacement criteria are based on trip counts, the replacement criteria shall be not less than 2,000,000 trips.
- 2.6.9. A "trip" shall be defined as travel starting at one floor and ending at any other floor, with no stops at intervening floors.

2.7. Solid state motor drive: regenerative

- 2.7.1. Provide a regenerative solid state drive to control the speed of the elevator.
- 2.7.2. Provide circuits to cause the elevator to regenerate power, under negative load conditions, to the building power supply with a minimum 0.95 power factor.
- 2.7.3. Provide a drive system to meet the EN12015 standards and the recommended guidelines of IEEE-519 for generated harmonics and power factor measured at the disconnect switch.
- 2.7.4. Provide pre-torquing.
- 2.7.5. Arrange that the system in responding to a unit step function does not overshoot by more than 21 percent.

- 2.7.6. Arrange that the error signal does not, in normal operation, exceed 2.5 percent.
- 2.7.7. Provide means to shut down the unit in the event that the error signal exceeds 5.0 percent.
- 2.7.8. Provide means to limit the increase in noise level during acceleration to less than 12 decibels (A scale) as measured in the centre of the machine room.
- 2.7.9. Provide electronic feedback circuits to limit the current through the motor and the solid state power devices.
- 2.7.10. Arrange that under low voltage conditions the unit does not exceed the current limits.
- 2.7.11. Provide safety circuits to prevent runaway in the event of closed loop feedback circuit failure.
- 2.7.12. Arrange these circuits so that:
 - 2.7.12.1. With a partial or complete loss of the feedback signal the elevator will come to a stop before the governor jaws are tripped;
 - 2.7.12.2. If the elevator is in the levelling zone with the door interlock circuit open, the elevator will come to a stop prior to leaving the levelling zone.
- 2.7.13. Test these circuits by opening the feedback circuit while the elevator is running at contract speed no load up and while the elevator is levelling into the floor no load up.
- 2.7.14. Provide means for dissipating the heat generated by solid state devices.
- 2.7.15. Provide safety circuits to shut down the unit in the event of overheating.
- 2.7.16. Design the equipment so that power loss or power fade (brownout) does not cause fuses to blow.
- 2.7.17. Provide means to protect the solid state power devices against surge currents.
- 2.7.18. Provide filters and circuits to reduce the line pollution so that the distortion generated by the solid state power device is within the following limits as measured at the disconnect switch:
 - 2.7.18.1. The 5th harmonic voltage does not exceed 6 percent;
 - 2.7.18.2. The 5th harmonic current does not exceed 20 percent;
 - 2.7.18.3. The total harmonic voltage does not exceed 10 percent;
 - 2.7.18.4. The total harmonic current does not exceed 25 percent;
 - 2.7.18.5. Line voltage notching of duration greater than 1 millisecond is less than three per cent of the peak sine wave voltage measured from zero reference;
 - 2.7.18.6. The notch depth is less than 10 per cent;
 - 2.7.18.7. The notch duration is less than 2 milliseconds.
- 2.7.19. Provide filters and circuits to reduce the electromagnetic noise level at any frequency with the elevator running, to not more than 0.1 db above the ambient electromagnetic noise level (with the elevator stopped), as measured in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.
- 2.7.20. Provide filters and circuits to reduce the electromagnetic noise level at 10 KHz with the elevator running, to not more than 0.01 db above the ambient electromagnetic noise level

(with the elevator stopped), as measured in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.

- 2.7.21. Arrange the equipment so that any vibration generated is not transmitted directly to the building structure.

2.8. Solid-state hardware

- 2.8.1. Mount solid-state devices, except for high power silicon controlled rectifiers, on removable printed circuit boards.
- 2.8.2. Gold plate the contact points of edge connectors.
- 2.8.3. Use G10 glass epoxy with minimum equivalent 57 gram (2 ounce) copper.
- 2.8.4. Coat the circuits with tin-lead.
- 2.8.5. Provide a solder resist screen.
- 2.8.6. Provide plated through holes for double sided boards.
- 2.8.7. Make all connections to the printed circuits on the printed circuit boards by means of properly dimensioned pads.
- 2.8.8. Do not provide "patched" connections.
- 2.8.9. Design solid-state devices for a high level of noise immunity.
- 2.8.10. Incorporate electrical noise suppression devices in the power supplies and the inputs and outputs associated with the solid-state circuits.
- 2.8.11. Provide filters and circuits to limit the generated electromagnetic noise level at any frequency to not more than 0.1 db above the ambient electromagnetic noise level, as measured in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.
- 2.8.12. Provide filters and circuits to limit the generated electromagnetic noise level at 10 KHz to not more than 0.01 db above the ambient electromagnetic noise level, as measured in the centre of the machine room using a calibrated radio frequency receiver designed in accordance with CSA Standard C108.1.1 together with a calibrated rod or loop antenna.

2.9. Auxiliary slowdown devices

- 2.9.1. Provide auxiliary slowdown devices compatible with the solid state speed control and so arranged that, if the normal slowdown devices fail to operate correctly, the elevator will be brought to a controlled stop at the terminal landing with an acceleration not exceeding 0.3 g.
- 2.9.2. Arrange the control circuits so that, if the auxiliary slowdown devices were required to act to stop the elevator, the elevator parks at the terminal landing until the system is checked by a maintenance technician.

2.10. Position transducer

- 2.10.1. Provide a position transducer device to transmit to the control system the position of the elevator.
- 2.10.2. Arrange that the device transmit a minimum of 10 counts per 25 mm (1") of travel.
- 2.10.3. Provide a device having an overall precision within ± 1.0 mm (± 0.04 ").

- 2.10.4. Arrange the elevator controls so that the output from this device is read at least every 5 ms.
- 2.10.5. Transmit the signal from this device either in serial format using a standard protocol (e.g, CAN) or in parallel format using low impedance (less than 10 kilohms) inputs.
- 2.10.6. If the transducer is a relative (pulse counter) type rather than an absolute encoder type:
 - 2.10.6.1. Provide gray encoding so as to indicate the direction of movement of the car and to offset 'false' counts caused by vibration;
 - 2.10.6.2. In the event of a counter error reset the position with an accuracy within ± 2.5 mm (± 0.1 "") by returning the car at low speed to a fixed point in the hoistway.
- 2.11. Emergency machine dual brake**
 - 2.11.1. Provide an emergency braking device to prevent uncontrolled movement of the elevator.
- 2.12. Governor: automatic reset**
 - 2.12.1. Provide an automatic reset governor located so that it can be maintained from the top of the elevator car and tested without special access arrangements.
 - 2.12.2. Arrange that the governor, once tripped, will be reset when the car is moved up off the car safeties.
- 2.13. Controller**
 - 2.13.1. Provide a micro-processor based controller designed to give the required operation as herein specified.
 - 2.13.2. Mount panels securely on substantial, self supporting steel frames designed for floor or wall mounting.
 - 2.13.3. Provide completely enclosed controllers with covers.
 - 2.13.4. Do not mount equipment on the covers unless:
 - 2.13.4.1. Its wiring is designed to support bending caused by opening and closing the cover;
 - 2.13.4.2. Its wiring is protected against damage;
 - 2.13.4.3. If damage happens to the equipment mounted on the cover or the wiring of this equipment, the unit will continue to operate normally.
 - 2.13.5. Provide a two-position key switch on the exterior of the controller cabinet labelled "SECURITY SYSTEM OVER RIDE" to enable/disable security card reader functionality.
 - 2.13.6. Where relays are used, provide those having a design electrical life and mechanical life equivalent to thirty years operation in the given application, with their contacts designed for maximum conductivity and wiping action.
 - 2.13.7. Provide electronic time delay devices which employ stable capacitors or crystals as the time base.
 - 2.13.8. Install wiring on the controller, whether control or field wiring, in a neat workmanlike order and make connections to studs and terminals by means of solder or solderless lugs, or similar connecting devices.
 - 2.13.9. Mark relays, contactors, fuses, printed circuit boards and other components clearly and permanently with designations as shown on the schematics.

- 2.13.10. Mount the designations for plug in components on the controller adjacent to the component; do not mount the designation on the plug in component.
- 2.13.11. Provide a written guarantee from the control manufacturer that over the life of the installation software and firmware updates will be provided at no charge to the Owner.
- 2.13.12. Install the controller in a dedicated control room and not within the hoistway.
- 2.14. Computing devices**
 - 2.14.1. Where computing devices are used, such as micro-processors or mini-computers, along with associated devices, design to the following requirements:
 - 2.14.1.1. Isolate the inputs from external devices (such as push-buttons) and isolate the outputs to external devices (such as indicators) by means of relays or optical devices;
 - 2.14.1.2. Provide the control program on read-only-memory with spare capacity to allow for future programming modifications and extensions;
 - 2.14.1.3. Provide crystal regulation of frequency;
 - 2.14.1.4. Provide for separate regulated power supplies to serve each micro-processor system.
- 2.15. Speed control: regenerative**
 - 2.15.1. Provide a closed loop negative feedback control system.
 - 2.15.2. Include in the system the following features:
 - 2.15.2.1. A pattern generator to give a velocity input signal modified by position with constant peak acceleration and constant peak change of acceleration;
 - 2.15.2.2. A digital or analog tachometer generator to provide a velocity feedback signal;
 - 2.15.2.3. A digital transducer to provide a position feedback signal;
 - 2.15.2.4. A current transformer to provide a current feedback signal.
 - 2.15.3. Provide the following safety devices:
 - 2.15.3.1. Means to stop the elevator in the event the error exceeds five percent of the signal;
 - 2.15.3.2. Means to stop the elevator in the event the acceleration exceeds the normal acceleration by more than fifteen percent;
 - 2.15.3.3. A circuit to cut off power in the event of excessive power module switching time;
 - 2.15.3.4. Means to cut off power in the event of overheating of the solid state components;
 - 2.15.3.5. A circuit to initiate a slowdown and stop at the next floor in the event of a disagreement between the position as derived from the digital transducer and the position as derived from the integration of the velocity feedback signal.
 - 2.15.4. Arrange the response of the system so that the elapsed time between the detection of a fault and the cut off of power does not exceed 100 milliseconds.
 - 2.15.5. Provide protective devices so arranged that any one fault will not cause risk of injury to the passengers.
 - 2.15.6. Arrange that, if a fault occurs such that a subsequent fault could cause an unsafe condition, the fault will be detected and the elevator shut down.

2.15.7. Provide invertors and associated controls arranged to return to the electrical supply system the power produced by the machine under negative loads.

2.15.8. Arrange the control system so that the power factor is not less than 96%.

2.16. Power interruption restart

2.16.1. Provide means so that the elevator system will restart automatically in the event of power interruption.

2.16.2. Where volatile memories are provided for position and other data necessary to the continuing operation of the elevators, provide means of preserving this data on power failure or fading ('brownout') for a minimum of four hours and means of automatic recovery upon restoration of normal power.

2.17. Control circuits grounding

2.17.1. Arrange the control circuits so that one side of the control power supply for external circuits is grounded to facilitate testing and trouble shooting.

2.17.2. An external circuit is defined as one wired outside micro-processors or solid-state devices, as for example, buttons, relays, lights, display screens, position indicators, lanterns, kiosks, limits, locks and such similar devices.

2.17.3. Arrange that accidental grounding in the control system will not defeat the safety circuits.

2.18. Main floor elevator markings

2.18.1. Provide at the main floor, for each elevator designated as a Firefighter's Elevator, a suitable symbol such as a Firefighter's Hat.

2.18.2. Provide at the main floor for each elevator alphanumeric symbols indicating the designation of the elevator.

2.18.3. Provide markings as selected by the Owner.

2.18.4. Provide samples for review.

2.19. Entrance floor markings

2.19.1. Provide, on each hall entrance jamb, raised tactile and braille metallic markings to designate the floor.

2.19.2. Provide markings as selected by the Owner.

2.19.3. Provide samples for review.

2.20. Floor marking: hoistway

2.20.1. Identify each landing by means of markings on the inside of the hoistway.

2.20.2. Use a stencil to ensure that the floor markings are neat and uniform in appearance.

2.20.3. Provide numerals and letters approximately 100 mm (4") high and of a clearly contrasting colour to the colour of the doors and fascias.

2.21. Door type: single speed side opening

2.21.1. Provide car and hoistway doors of the single-speed side opening, horizontal sliding type.

2.22. Door friction

2.22.1. Adjust the doors so that with the door closing device disconnected, the doors can be started into motion, from any position, with a force of less than 25 newtons (six pounds) per door panel applied horizontally at the mid-point of the door in line with the direction of movement of the door.

2.23. Entrance: fire rating

2.23.1. Provide entrances bearing a 1.5 hours fire rating approved by authorities having jurisdiction.

2.23.2. Provide a closure, including interlock mechanism and associated wiring, capable of operating for a period of at least one hour when the assembly is subjected to the standard fire exposure tests.

2.24. Entrances

2.24.1. Provide entrances consisting of frames, jambs, sills, sill support angles and brackets, struts, headers, fascias, toe guards, and sight guards and doors of approved design and size complete with guides and bumpers and all other items necessary to provide a completed installation.

2.24.2. Construct the doors of sheet steel a minimum of 1.3 mm (18 gauge) thick.

2.25. Entrance installation

2.25.1. Assume undivided responsibility for the entire installation of the entrances.

2.25.2. Handle, store, protect, install the entrances and associated equipment.

2.25.3. Set door frames in perfect alignment with the elevator car platform.

2.25.4. Fasten frames and headers to structural supports.

2.25.5. Set frames and sills in place prior to building walls.

2.25.6. Install frames within 1 mm (0.04") of plumb and sills within 2 mm (0.08") of level over the entrance width.

2.25.7. Fasten frames securely at the sill and header.

2.25.8. Fasten sills securely to the building structure by means of a support angle or substantial brackets.

2.25.9. Install struts, fascias, toe guards and other associated equipment required to complete the installation of the entrances.

2.26. Entrance finish: stainless steel

2.26.1. Provide stainless steel entrances finished so that spot welds or other surface defects will not show under reflected light.

2.27. Entrances: door hardware

- 2.27.1. Supply hoistway door hardware consisting of door hangers and tracks, interlocks, door closers, relating mechanism, operating linkages, gibs, and all other hardware necessary for the installation and operation of the hoistway doors.
- 2.27.2. Provide heavy duty constant force door closers at the main floor to minimize stack-effect from impacting elevator door operation and provide heavy duty constant force door closers at any other high stack-effect elevator lobbies.
- 2.27.3. Supply, for each sliding panel, sheave type, two point suspension hangers.
- 2.27.4. Supply sheaves not less than 75 mm (3") in diameter with ball bearings, properly sealed to retain grease lubrication, and mounted on stands arranged for direct attachment to the panels.
- 2.27.5. Equip hangers with adjustable ball bearing rollers to take the up-thrust of the doors.
- 2.27.6. Arrange the tracks and sheaves so that there is no metal to metal contact, and so that the doors operate properly without any regular lubrication.
- 2.27.7. Design all door hardware for a minimum of noise.

2.28. Car door restrictor

- 2.28.1. Provide a car door restrictor to mechanically prevent the opening of the car door from inside the cab unless the elevator is in the door unlocking zone.
- 2.28.2. Provide a device that does not require electrical or electronic components to function.

2.29. Car and hoistway door safety retainers

- 2.29.1. Provide safety retainers at the top and bottom of horizontally sliding doors to retain the closed door panel in position if the primary guiding means fail.
- 2.29.2. Provide retainers that will prevent the displacement of the door panel top and bottom by more than 20 mm (0.8") when the door panel is subjected to a force of 5 000 N (1130 lbf) applied towards the hoistway at right angles to the panel over an area of 300 mm by 300 mm (12" by 12") at the centre of the panel.
- 2.29.3. Provide retainers that will withstand, without detachment or permanent deformation, a force of 1 000 N (225 lbf) applied upward at any point along the width of the door panel together with an additional concurrent force of 1 100 N (250 lbf) applied at right angles to the door at the centre of the panel over an area of 300 mm by 300 mm (12" by 12").
- 2.29.4. Arrange that the retaining means are not involved in the guiding of the panel and are not subjected to wear or stress during normal door operation.

2.30. Hoistway entrance lunar key access

- 2.30.1. Provide lunar key access for each hoistway entrance.
- 2.30.2. Provide a protective metal sleeve for each circular lunar key hole (where applicable).

2.31. Reopening devices and detection of objects

- 2.31.1. Provide a reopening device and entrance protection capable of detecting objects in the door path and objects approaching the doors.
 - 2.31.1.1. In jurisdictions that have adopted B44-19 or earlier, provide equipment in accordance with B44-19 Section 2.13.5.

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- 2.31.1.2. In jurisdictions that have adopted B44-22, provide equipment in accordance with B44-22 Section 2.13.5.
- 2.31.2. Arrange the doors to reopen (or remain open) when an object is detected.
- 2.31.3. Position detection receivers and emitters, when installed on the door, at least 25 mm (1") back from the leading edge of the doors to prevent accidental damage.
- 2.31.4. Provide a signal on the unit or in the machine room to indicate that a failure has occurred.
- 2.31.5. Supply a device, reliable and consistent in operation, not affected by dust or temperature changes, and having inherent long term reliability with minimum maintenance.
- 2.31.6. Arrange that the operation of the devices will not be affected by adjacent reflective, shiny or glass surfaces.
- 2.31.7. For a transom-mounted reopening device, if new cab interiors are being provided, install the device recessed into the transom substantially flush with the surface (i.e. do not surface mount).
- 2.32. Door operator (harmonic)**
- 2.32.1. Provide a GAL MOVFR heavy duty door operator to open and close the car and hoistway doors simultaneously.
- 2.32.2. Mount the operator on the cab above the car doors.
- 2.32.3. Provide event logging with non-volatile memory so as to retain the event log under power-off conditions.
- 2.32.4. Provide fully automatic installation algorithm profiles that self-adjust the motion profile for the relevant parameters.
- 2.32.5. Provide an output from the door control for a pre-start command to the elevator speed control system.
- 2.32.6. Provide optical isolation for input and output signals.
- 2.32.7. Provide signal line short circuit protection.
- 2.32.8. Provide a serial input to the door control to allow adjustment of speed, acceleration, torque and pre-start point using a notebook computer or keypad.
- 2.32.9. Provide the keypad or software for a standard notebook computer.
- 2.32.10. Arrange that the settings for the door operator can be uploaded to the keypad or notebook computer and then downloaded to another identical operator.
- 2.32.11. Provide an average door closing speed of 300 mm (12") per second, respecting the parameters for door force and door inertia as set out in the elevator code.
- 2.32.12. Provide an average door opening speed of 700 mm (28") per second.
- 2.32.13. Provide, either in the door operator control or in the main elevator control, means to automatically recycle the doors in the event that they stall during the opening or closing operations.
- 2.32.14. Design the door operator and associated components for a minimum of noise.

2.33. Car door equipment

- 2.33.1. Provide car door header, hangers and tracks, door closers, door electrical contacts, master door operators, and all incidental devices necessary for the correct operation of the doors.
- 2.33.2. Provide, for each sliding car door panel, sheave type, two point suspension hangers.
- 2.33.3. Provide sheaves not less than 80 mm (3.25") in diameter with ball bearings, properly sealed to retain grease lubrication, and mounted on stands directly attached to the panels.
- 2.33.4. Equip hangers with adjustable ball bearing rollers to take the up-thrust of the doors.
- 2.33.5. Arrange the tracks and sheaves so that there is no metal to metal contact, and so that the doors operate properly without any regular lubrication.
- 2.33.6. Design all door equipment and associated components for a minimum of noise.

2.34. Car station

- 2.34.1. Provide one main car operating panel.
- 2.34.2. Provide in the panel the devices required for normal automatic operation, including the following:
 - 2.34.2.1. Floor push buttons;
 - 2.34.2.2. Door open button;
 - 2.34.2.3. Door close button;
 - 2.34.2.4. Alarm button;
 - 2.34.2.5. Emergency communication button.
- 2.34.3. Number the car call buttons to correspond to the floor served.
- 2.34.4. Provide in conjunction with the car buttons a call registered light for each button to be lighted when the button is pressed and extinguished when the car stops at the selected floor.
- 2.34.5. Secure tactile markings using hidden fasteners.
- 2.34.6. Provide a Firefighters' Emergency Operation cabinet on the main car station in accordance with the Code.
- 2.34.7. Provide a locked service cabinet, its size and location to match the Firefighters' Emergency Operation cabinet, containing the following:
 - 2.34.7.1. Light key switch;
 - 2.34.7.2. Fan key switch;
 - 2.34.7.3. Independent service key switch;
 - 2.34.7.4. Inspection key-switch;
 - 2.34.7.5. Voice annunciation on/off key-switch;
 - 2.34.7.6. Emergency lighting test switch;

- 2.34.7.7. GFCI duplex receptacle (Run the wires for this receptacle separately from the wires for the other car light and ventilation equipment and connect it to a separate breaker in the machine room).
- 2.34.8. Provide, only when required by the prevailing codes, a stop switch located in the service cabinet, arranged to stop the elevator and to duplicate the functions of the alarm button.
- 2.34.9. Engrave the car station with markings and signage such as car capacity, elevator number and other markings required by the prevailing codes and local regulations including remote location of device licenses where available.
- 2.34.10. Ensure that engravings and button designations are easily read when viewed at an angle from any normal standing position in the elevator cab within arms reach of the car station.
- 2.34.11. Hinge the car station faceplate so that it can be swung open towards the adjacent cab side wall to allow access for servicing of the inner components of the car station.
- 2.34.12. Provide a hinge capable of supporting without distortion a test weight of minimum 11 kg resting on the panel non-hinged edge with the panel swung open.
- 2.34.13. Secure the car station in the closed position using countersunk spanner head fasteners or approved equivalent.
- 2.34.14. Arrange the car station so that it can be swung open without interference from the cab flooring, cab wall, cab handrails or other cab appurtenances.

2.35. Signal lights

- 2.35.1. Provide LED position indicators and call registered lights having a minimum contrast ratio of 8:1 throughout a life expectancy greater than 100,000 hours.
- 2.35.2. The contrast ratio is to be determined by subtracting the brightness of the indicator background from the brightness of the marking and then dividing the result by the brightness of the background.
- 2.35.3. Arrange that the variation in intensity and contrast ratio between position indicators does not exceed 5 percent.
- 2.35.4. Arrange that the variation in intensity and contrast ratio between call registered lights does not exceed 5 percent.
- 2.35.5. All measurements are to be made in ambient lighting conditions meeting Code requirements.

2.36. Automatic cab lighting and fan control

- 2.36.1. Arrange that the cab lights and fan are turned off in not more than five minutes when:
 - 2.36.1.1. The elevator is level at a floor;
 - 2.36.1.2. The elevator doors are closed;
 - 2.36.1.3. The elevator has not been selected to answer a call;
 - 2.36.1.4. The elevator is on automatic operation;
 - 2.36.1.5. The elevator safety circuit (including interlocks) is intact.
- 2.36.2. Ensure cab lighting has an efficacy of not less than 35 lumens per Watt.
- 2.36.3. Should any of the above conditions no longer obtain or when emergency communication devices are initiated, turn the car lights and fan on within 0.5 seconds.

2.37. Car position annunciator

- 2.37.1. Provide automatic verbal announcement to announce the floors and to provide floor passing tones.
- 2.37.2. Provide a unit to meet the requirements of the Code.
- 2.37.3. Provide means in the service cabinet to adjust the volume over a range from 55 and 70 decibels.
- 2.37.4. Use a female voice for the announcements.

2.38. Car position indicator

- 2.38.1. Provide a digital car position indicator mounted in each car operating panel.
- 2.38.2. Arrange the indicator to display a number or symbol at least 50 mm (2") high.
- 2.38.3. Indicate the position of the car at all times, corresponding to the landing through which the car is passing or at which it is stopped.
- 2.38.4. Provide an LCD position indicator screen or a segmented display using light emitting diodes with a minimum of 16 segments per character.
- 2.38.5. Arrange the circuits so as to provide continuous indication of car position.

2.39. Emergency lighting

- 2.39.1. Provide a back-up battery power system for alarm bell operation and emergency cab lighting.
- 2.39.2. Install the emergency lighting lamp at the top or upper reaches of the car station unless otherwise required by the site Architectural cab design.
- 2.39.3. Provide a lighting level of at least 11 lux of illumination at the car operating panels for a minimum period of four hours, using at least four LED lamps of equal rating.
- 2.39.4. Cause the lamps to be immediately energized in the event of a power failure or electrical fault de-energizing the normal elevator lighting circuit.
- 2.39.5. Provide for the automatic disconnection of the lamps and the automatic recharging of the lighting unit when normal power is restored to the elevator lighting circuit.
- 2.39.6. Provide a rechargeable battery of the hermetically sealed type, or of a type which provides a reserve of electrolyte, capable of operating unattended and requiring no addition of water or electrolyte for a period of not less than ten years, with provision for visual checking of the electrolyte level without opening the battery or removing caps or fittings.
- 2.39.7. Arrange the battery charging to operate automatically upon restoration of normal power to the unit, to remain in operation until the battery is fully recharged and to maintain the battery at full rated capacity at all times when the unit is not in operation.
- 2.39.8. Provide a pilot lamp to indicate that the normal power supply to the unit and battery charging is in operation.
- 2.39.9. Arrange that the unit can be conveniently tested and operated manually.
- 2.39.10. Install the unit as part of the car so that it is not readily removed.
- 2.39.11. Do not provide portable equipment.

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- 2.39.12. Install the lamp fixture above the car station.
- 2.39.13. Provide an emergency lighting test switch in the car service cabinet or behind the car swing return.
- 2.40. Telephone: hands-free operation**
- 2.40.1. Provide a WEBB hands-free telephone with automatic dialer capable of initiating and receiving calls.
- 2.40.2. Integrate the telephone into the car station.
- 2.40.3. Provide a push button to initiate the telephone connection.
- 2.40.4. Arrange that the telephone connection can be initiated by an external call.
- 2.40.5. Provide an indicator light to confirm that communication has been established.
- 2.40.6. Pierce the car station for the push button and indicator light with the indicator light mounted flush with the panel.
- 2.40.7. Provide a speaker/microphone for communication.
- 2.40.8. Pierce the car station in front of the speaker with multiple holes 3 mm (1/8") in diameter to allow passage of sound to and from the speaker.
- 2.40.9. Identify the telephone and the button with a raised symbol and Braille.
- 2.40.10. Provide wiring for the telephone from the cab to the machine room.
- 2.40.11. Provide a communication station in the machine room.
- 2.40.12. Connect the wiring on the car to a terminal block mounted in or adjacent to the telephone box.
- 2.40.13. Terminate the wiring in the machine room at a separate enclosed external terminal block mounted on the controller.
- 2.40.14. Provide the terminal block and its enclosure and locate it so that personnel other than elevator mechanics can easily run their conduit and wiring to these terminals without interfering with or touching the elevator wiring or controls.
- 2.40.15. Where more than one controller is in a common machine room bring wiring to one common terminal block.
- 2.40.16. Clearly mark the terminal block.
- 2.40.17. Provide wiring of the twin conductor shielded type with grounded shields.
- 2.40.18. Provide equipment and wiring compatible with and acceptable to the telephone company providing service to the project.
- 2.40.19. Provide material and labour as necessary so as to ensure that the communication system meets the requirements of the Code.
- 2.41. Two-way communication system: verbal and non-verbal**
- 2.41.1. Provide a two-way emergency communication system that permits verbal and non-verbal communication.
- 2.41.2. Provide a VoIP system (Voice over Internet Protocol) or approved alternative.

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- 2.41.3. Integrate the system into the car station.
 - 2.41.4. For verbal communication:
 - 2.41.4.1. Provide a speaker/microphone for communication.
 - 2.41.4.1.1. Utilization of the hands-free telephone system, including speaker/microphone, is acceptable provided it is compatible and all requirements are met.
 - 2.41.5. For non-verbal communication:
 - 2.41.5.1. Provide a camera inside the elevator cab to permit authorized persons to observe the entire surface area of the elevator cab floor.
 - 2.41.5.2. Provide the video coverage required to meet the Code via a streaming service.
 - 2.41.5.3. Ensure that the video streaming service is only initiated by the operator and that streaming is stopped once terminated by the operator.
 - 2.41.5.4. Ensure that video recordings are not stored off-site (including "cloud"-based servers).
 - 2.41.5.5. If buffering of the video (or any other temporary storage for streaming purposes) is required, ensure that the video is immediately deleted at the end of the video streaming session.
 - 2.41.5.6. Install the camera in the elevator ceiling or in the car station and protect it from damage caused by impact.
 - 2.41.5.6.1. Utilization of existing closed circuit camera systems installed inside the elevator is acceptable provided it is compatible and all requirements are met.
 - 2.41.5.7. Provide a LCD display screen in the car station.
 - 2.41.5.7.1. Utilization of the car position indicator for the LCD screen is acceptable provided it is compatible and capable of displaying the car position during communication.
 - 2.41.5.8. Arrange the display screen to show authorized personnel when an emergency communication call is placed.
 - 2.41.5.9. Arrange the display screen to display the elevator cab floor surface area, text messages transmitted by authorized personnel and text messages transmitted by passengers inside the elevator.
 - 2.41.5.10. Provide means for the passengers inside the elevator to communicate non-verbally with authorized personnel by:
 - 2.41.5.10.1. A QWERTY style button input on the car station; or
 - 2.41.5.10.2. YES or NO buttons on the car station.
 - 2.41.6. Provide a back-up battery power system for the communication system capable of operating the system for 4 hours in the event of a power failure.
 - 2.41.7. Initiate the emergency communication system when the push-button on the car station for two-way emergency communication is pressed.
 - 2.41.8. Arrange that the emergency communication system connection can be initiated by an external call.

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- 2.41.9. Provide an indicator light to confirm that communication has been established.
- 2.41.10. Arrange the emergency communication system to dial to a location within the building staffed by authorized personnel when activated and, if not answered within 45 seconds, automatically forward the call to an off-site location staffed 24 hours per day by authorized personnel.
- 2.41.11. Provide, to authorized personnel, information that identifies where the call is coming when an emergency communication call is made.
- 2.41.12. Provide audible and visual communication failure signals within the same housing as the emergency recall switches and indicators and provide a key-switch in this housing to allow authorized personnel to temporarily deactivate the audible signal.
- 2.41.13. Supply wiring as necessary to connect the system to the elevator system.
- 2.41.14. Connect the wiring on the car to a terminal block mounted in or adjacent to the telephone box.
- 2.41.15. Terminate the wiring in the machine room at a separate enclosed external terminal block mounted on the controller.
- 2.41.16. Provide the terminal block and its enclosure and locate it so that personnel other than elevator mechanics can easily run their conduit and wiring to these terminals without interfering with or touching the elevator wiring or controls.
- 2.41.17. Where more than one controller is in a common machine room bring wiring to one common terminal block.
- 2.41.18. Clearly mark the terminal block.
- 2.41.19. Provide wiring of the twin conductor shielded type with grounded shields.
- 2.41.20. Provide equipment and wiring compatible with and acceptable to the telephone/IT company providing service to the project.
- 2.41.21. Provide material and labour as necessary so as to ensure that the communication system meets the requirements of the Code.
- 2.41.22. Provide any incidental elevator material and elevator work necessary to obtain a complete functioning communication system.
- 2.41.23. Do not ground the system to an alternating current circuit.
- 2.41.24. If the connecting wiring requires conduit external to the elevator hoistways and machine rooms coordinate with and assist as necessary the trades executing this work (these other trades are responsible for the provision of the conduit and the pulling of the wiring supplied by the elevator contractor).
- 2.41.25. Provide standard, readily available hardware components.
- 2.41.26. Submit for review brochures, details, wiring diagrams and description of the communication system.
- 2.42. Web-based monitoring service**
- 2.42.1. Provide a web-based monitoring service to enable authorized personnel to initiate cab video monitoring or initiate non-verbal two-way communication.
- 2.42.2. Provide this monitoring service to the Owner for the maintenance period included herein (whether in the base scope or as an itemized or separate price).

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- 2.42.3. If the web-based monitoring service requires fees for continued usage beyond the maintenance period included herein, such fees shall not exceed \$15 per device per month (adjusted annually from the date of substantial performance by an amount not to exceed the previous year's "all items" percentage change in the Consumer Price Index).
- 2.42.4. Ensure that the monitoring system does not require any other special licences, services, subscription or fees to remain functional.
- 2.42.5. Ensure that the monitoring service functions with the current version of all major operating systems and browsers.
- 2.42.6. Ensure that the monitoring system does not require the installation of any proprietary software.
- 2.42.7. Make the web-based monitoring service available to any call answering service selected by the Owner (including other elevator contractors), regardless of which company maintains the elevator equipment.
- 2.42.8. Guarantee that the web-based service shall be provided and maintained for not less than 15 years.
- 2.43. Closed circuit camera security system**
- 2.43.1. Provide necessary wiring and hardware for the future installation of a closed circuit camera in the elevator cab.
- 2.43.2. Provide wiring terminated in a junction box on the elevator car top labelled "Elevator CCTV Provisions" from the elevator to a separate junction box in the elevator machine room (location to be determined by Owner) labelled "Elevator CCTV Provisions".
- 2.43.3. Provide one RG6/U stranded centre conductor coaxial cable and one pair 18 gauge stranded conductor cable within an overall braided shield or such other interconnections as may be required by the CCTV contractor.
- 2.43.4. Provide an excess loop of 3050 mm (10') of cable at either end.
- 2.43.5. Provide a 110 vac power source labelled "Elevator CCTV Power" on the cab to power the camera.
- 2.44. Security system**
- 2.44.1. Provide for the future installation of an elevator card reader security system.
- 2.44.2. Provide accessible space, mounting supports and wiring for a security antenna in the cab main front return panel.
- 2.44.3. Provide a free space 100 mm (4") in height, 175 mm (7") in width and 75 mm (3") in depth centred behind the car panel insert for the security antenna installation.
- 2.44.4. Provide in front of the security antenna a translucent polycarbonate cover.
- 2.44.5. Provide an elevator security interface box in the machine room, complete with terminal blocks and wiring space for the interconnection of the security system to the elevator control system.
- 2.44.6. Provide wiring from the car station card reader to the security interface box using standard connectors.
- 2.44.7. Provide a two-position key switch on the exterior of the controller cabinet labelled "SECURITY SYSTEM OVER RIDE" to enable/disable security card reader functionality.

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- 2.44.8. Interface with the security system using serial data transfer.
- 2.44.9. Provide a signal, unique for each car call, to the security system when a car call "request" (which could either be by means of a button or touch screen) is entered and enter the car call when a return signal is received from the security system validating the request.
- 2.44.10. Arrange that the elevator system functions without restriction by the security system when Firefighters' Emergency Operation or independent service is operative.
- 2.44.11. Until such time as the security system is installed, arrange that the elevator system functions without restriction by the security system.
- 2.44.12. Provide any incidental elevator material and elevator work necessary to obtain a complete functioning elevator security system.
- 2.44.13. Submit for review, interface box drawings, location drawings and electrical schematics.
- 2.45. Hall push button stations: single riser**
- 2.45.1. Provide a single riser of hall push button stations.
- 2.45.2. Provide one station for each floor.
- 2.45.3. Provide at the intermediate floors, for each station, up and down push buttons located one above the other and call registered lights.
- 2.45.4. Provide at the upper terminal and lower terminal, for each station, a single button and call registered light.
- 2.45.5. Illuminate the call registered light only when there is an elevator in service to respond to the call.
- 2.45.6. Provide communication, emergency power and firefighters' switches, indicators and devices as necessary in the stations.
- 2.45.7. Secure the hall push button stations to the wall using countersunk spanner head fasteners or approved equivalent.
- 2.46. Hoistway access switch**
- 2.46.1. Provide hoistway access switches in accordance with the Code.
- 2.46.2. Locate the switches in the entrance frame or in the sight guard in an inconspicuous place.
- 2.46.3. Locate the switches on the same side of the entrance frame as the pick-up roller assembly.
- 2.47. Cab ventilation**
- 2.47.1. Provide an exhaust fan capable of developing 30 pascals (0.1" H₂O) static pressure differential with a minimum capacity of 165 litres per second (350 cfm).
- 2.47.2. Provide a two speed motor for the fan with the speed control located in the car operating panel.
- 2.47.3. Ensure that the cab ventilation does not consume over 0.33 W/cfm at maximum speed.

2.48. Cab: standard finishes

- 2.48.1. Provide a cab including the following items:
 - 2.48.1.1. A reinforced metal cab shell allowing the use of the elevator without interior finishes;
 - 2.48.1.2. A ceiling finished in white baked enamel;
 - 2.48.1.3. Returns, transom, car door jamb, and lintel finished in stainless steel;
 - 2.48.1.4. Front return and car door in textured stainless steel;
 - 2.48.1.5. Aluminum car sill;
 - 2.48.1.6. A 3 mm (1/8") thick aluminum plate over a wooden sub-floor;
 - 2.48.1.7. For non-access walls, 19 mm (3/4") thick plywood panels covered with plastic laminate chosen by the Owner, with stainless steel reveals and binders;
 - 2.48.1.8. A solid suspended ceiling made of stainless steel panels, the number and dimensions of ceiling panels to correspond with the number and width of panels on adjacent cab walls and located to provide a minimum of 2440 mm (96") minimum clear height from the cab finished floor;
 - 2.48.1.9. A LED light fixture in each suspended ceiling panel;
 - 2.48.1.10. Recess for tile flooring to be installed by others, flush with the car sill;
 - 2.48.1.11. Polished stainless steel flat bar handrails of a thickness of at least 6 mm (1/4"), a height of 50 mm (2"), located at the maximum height allowed by Appendix E of the Code;
 - 2.48.1.12. Hooks for protective pads.
- 2.48.2. Provide vandal-resistant finishes.
- 2.48.3. Where texturized stainless steel is specified, provide 5WL Rigid-tex or an approved equivalent.
- 2.48.4. Supply any other material and labour necessary to provide a completed, installed cab including mounting strips, stay plates, base and sound-deadening material.
- 2.48.5. Provide cut-outs to accommodate the elevator equipment.
- 2.48.6. Submit for review shop drawings showing the finishes and design.

2.49. Protective pads

- 2.49.1. Provide protective pads covering all exposed wall surface, attached to inconspicuous pad hooks at the top of the cab and reaching to within 100 mm (4") of the car floor.
- 2.49.2. Provide stitched cut-outs within the pads to provide visibility and access to fixtures.

2.50. Hall lanterns and gongs

- 2.50.1. Provide hall lanterns complete with electronic gongs at each entrance to indicate the future direction of the elevator.
- 2.50.2. Provide hall lanterns which provide a 180 degree viewing angle (i.e. do not provide a digital display with the hall position indicator).
- 2.50.3. Provide a single light for the fixture at the upper terminal.

- 2.50.4. Provide a single light for the fixture at the lower terminal.
- 2.50.5. Provide separate up and down lights for the fixture at the intermediate landing.
- 2.50.6. Arrange the lanterns so that as soon as a car has reached a predetermined distance from the floor, and is going to stop at the floor, the corresponding hall lantern illuminates and the gong operates.
- 2.50.7. Arrange the controls so that the hall lantern provides a minimum five second advance notice of the arrival of a car.
- 2.50.8. Maintain the hall lantern illuminated until the car has stopped and the door open time has elapsed.
- 2.50.9. Do not illuminate the hall lantern on a door re-open unless the re-open is caused by a reversal of direction of travel of the car.
- 2.50.10. Arrange the operation of the lanterns and gongs to comply with requirements of Appendix E of the Code.
- 2.50.11. Sound the tone once to indicate the up direction and twice to indicate the down direction.
- 2.50.12. Provide LEDs for illumination.
- 2.50.13. Design the fixture so that the lamps may be readily changed.
- 2.50.14. Do not mount any equipment to the covers; arrange that the covers can be removed completely without disturbing the electric wiring.
- 2.50.15. Locate the centre-line of the fixture a minimum of 1830 mm (72") above the floor.
- 2.50.16. Provide lanterns of minimum 60 mm (2.4") size in the smallest direction.
- 2.50.17. Provide means to adjust the gong volume in a range from 55 and 70 decibels.
- 2.51. Hall position indicator and lantern: all floors**
- 2.51.1. Provide a combined digital position indicator and hall lantern mounted above each entrance.
- 2.51.2. Arrange the indicator to display a number or symbol at least 50 mm (2") high.
- 2.51.3. Indicate the position of the car at all times, corresponding to the landing through which the car is passing or at which it is stopped.
- 2.51.4. Provide an LCD position indicator screen or a segmented display using light emitting diodes with a minimum of 16 segments per character.
- 2.51.5. Arrange the circuits so as to provide continuous indication of car position.
- 2.51.6. Provide lanterns complete with electronic gongs to indicate the future direction of the elevator.
- 2.51.7. Do not mount any equipment to the covers; arrange that the covers can be removed completely without disturbing the electric wiring.
- 2.51.8. Provide lanterns of minimum 50 mm (2") size in the smallest direction.
- 2.51.9. Provide means to adjust the gong volume in a range from 55 and 70 decibels.

2.52. Car inspection devices

- 2.52.1. Provide, on the top of the car, a fixed lamp receptacle, with switch, outfitted with wire clamp guards, and a GFI duplex receptacle with safety ground connection.
- 2.52.2. Provide, on the top of the car, an inspection station consisting of an emergency stop button, up, down and common inspection running buttons, on-off switch for the door operator and other devices necessary for top-of-car inspection operation.

2.53. Load weighing device

- 2.53.1. Provide means to measure the load in the car within an accuracy of $\pm 4\%$ of the elevator capacity.
- 2.53.2. Provide one of the following types of devices:
 - 2.53.2.1. A device consisting of four strain gauge load cells located at each corner of the car platform and supporting a free floating car platform and cab with summing circuits to calculate the actual load under varying conditions of eccentric loading;
 - 2.53.2.2. If a flexible material is used for the car floor covering, a device consisting of membrane or similar switches located under the floor covering so as to indicate pressure at every 150 mm (6") by 150 mm (6") square of the floor with summing circuits to calculate from these switches the actual load in the car;
 - 2.53.2.3. A strain gauge device located on the crosshead arranged to measure the deflection of the crosshead and thus determine the load in the car;
 - 2.53.2.4. A device consisting of four strain gauge load cells supporting the weight of the elevator machine with summing circuits to calculate the actual load under varying load conditions;
 - 2.53.2.5. A device consisting of strain gauges mounted in the brake shoe pins so arranged as to measure the torque acting on the brake with summing circuits to calculate the actual load under varying load conditions;
 - 2.53.2.6. A Hall-effect device to measure the vertical movement of the cab on the supports as the load in the cab changes;
 - 2.53.2.7. A device to measure the tension in the elevator lift ropes and thus determine the load in the car.
- 2.53.3. Arrange that the output signal from the load weighing device be connected as an input to the speed control system.
- 2.53.4. Arrange the speed control system so that the output from this device is read, for purposes of pre-torque, after the doors are sufficiently closed that no further passengers can enter or leave and prior to the interlock circuit closing.
- 2.53.5. Transmit the signal from this device either in serial RS232C or current loop format or in parallel format using low impedance (less than 10 kilohms) inputs.
- 2.53.6. Arrange that the speed control system provide to the elevator motor sufficient torque, immediately prior to and during movement of the elevator, to offset the unbalanced load as determined by the load weighing device.
- 2.53.7. Arrange the speed control so that the elevator when leaving a floor does not move in the reverse direction for more than 3 mm (1/8").
- 2.53.8. Arrange that the load weighing device automatically resets itself when the control logic determines with certainty that the car is empty.

2.53.9. Arrange that the automatic reset occurs at least once every 24 hours.

2.54. Roller guides: car

2.54.1. Equip the car with roller guides mounted at both the top and the bottom of the car frame.

2.54.2. Spring load or flexibly mount the roller guides.

2.54.3. Provide rollers of 150 mm (6") minimum diameter.

2.54.4. Provide neoprene or polyurethane rollers as required to suit the load and application.

2.54.5. Provide these rollers with prelubricated sealed ball bearings.

2.54.6. Design the roller to secure good contact with the rail.

2.54.7. Provide rollers true and free from deformations of the surface so as to provide a smooth and even ride of the elevator.

2.54.8. Grind the rollers within a tolerance of 0.05 mm (0.002") total indicator reading.

2.54.9. Provide brightly-coloured cover plates for the roller guides.

2.55. Roller guides: counterweight

2.55.1. Equip the counterweight with roller guides mounted at both the top and the bottom of the counterweight frame.

2.55.2. Spring load or flexibly mount the roller guides.

2.55.3. Provide rollers of 70 mm (3") minimum diameter, designed to secure good surface contact with the rail, with prelubricated sealed ball bearings.

2.55.4. Provide rollers true and free from deformations of the surface so as to provide a smooth and even ride of the elevator.

2.55.5. Provide neoprene or polyurethane rollers as required to suit the load and application. Grind the rollers within a tolerance of 0.05 mm (0.002") total indicator reading.

2.55.6. Provide brightly-coloured cover plates for the roller guides.

2.56. Guide rails

2.56.1. Provide standard section guide rails with tongued and grooved joints.

2.56.2. Provide guide rails of structural strength and rigidity sufficient to limit the horizontal deflection of the guide at any point to less than 0.6 mm (0.025") under normal conditions of operation.

2.56.3. Use substantial machined finished plates to form the rail joints.

2.56.4. Erect guide rails with a variation of not more than 1.6 mm (0.06") over any 6 m (20') section and with a maximum variation of not more than 0.8 mm (0.03") in 25 mm (1").

2.56.5. Install guide rails in a strong and substantial manner using brackets affixed to the building structure.

2.56.6. Clamp the guides to the bracket with clips.

2.56.7. Arrange each clip so as to resist a vertical force of less than 4500 N (1000 pounds) and so as to allow the rail to slide if the vertical force exceeds 9000 N (2000 pounds).

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- 2.56.8. Arrange the clips to prevent any horizontal movement of the rail.
- 2.56.9. Extend rails to within less than 300 mm (12") and more than 150 mm (6") of the underside of the overhead slab.
- 2.56.10. Use all standard length rails unless shorter lengths are required to avoid bracket locations or to complete the rail run at the top of the hoistway.
- 2.56.11. Install and locate the rails so that joints do not interfere with the supporting brackets and clamps.
- 2.57. Fascias**
- 2.57.1. Provide fascias to meet, as a minimum, the requirements of the Code.
- 2.57.2. Unless a car door interlock is provided and the strength of the car door meets the applicable requirements of the Code:
- 2.57.2.1. Provide fascias from the header of one entrance to the sill of the entrance above for the complete travel of the elevator including any express zone;
- 2.57.2.2. Provide fascias extending below the sill of the lowest landing and above the header of the highest landing.
- 2.57.3. Provide fascia plates extending on each side at least 75 mm (3") beyond the clear openings.
- 2.57.4. Provide fascia plates of sheet steel of minimum 1.5 mm (16 gauge) thickness.
- 2.57.5. Reinforce fascia plates properly.
- 2.57.6. Provide all necessary supports required to secure fascia plates in place.
- 2.58. Car platform**
- 2.58.1. Provide a car platform of sufficient size to accommodate the cab and to give the required inside net area assuming typical 50 mm (2") wall thickness and 180 mm (7") for doors, sill and return.
- 2.58.2. Provide a car platform with a structural steel frame filled with wood, aluminum or steel flooring having a depression to receive the finished floor.
- 2.58.3. Mount the car platform on isolating pads to prevent the transmission of noise and vibration from the car frame to the car platform.
- 2.58.4. Install the equipment in such a way that there is no direct metal connection between the car platform or the car cab and the car frame except metallic flex, where required, run in such a way as to provide vibration isolation.
- 2.59. Car frame**
- 2.59.1. Provide a car frame of steel channels and angles securely welded, bolted or riveted and substantially reinforced and braced so as to relieve the car enclosure of all strains.
- 2.60. Cab installation**
- 2.60.1. Assume undivided responsibility for the entire installation of the cab.
- 2.60.2. Handle, store, protect and install the cab and all associated equipment.
- 2.60.3. Install the elevator cab on the platform plumb and in alignment with the hoistway entrances.

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- 2.60.4. Sound isolate the cab from the car frame.
- 2.60.5. Provide additional material and labour as required for handling, storing and installing the cab so as to provide a complete job.
- 2.61. Traction elevator emergency power device**
- 2.61.1. Provide a device to automatically move the elevator to a floor in the event of power failure.
- 2.61.2. Arrange that when normal power fails, sufficient power is provided by the device to lift the brake, cause the elevator to move to a floor, open the doors and then remove the elevator from service until normal power is restored.
- 2.61.3. Provide batteries complete with charging system to power the unit.
- 2.61.4. Provide batteries having a minimum life expectancy of ten years.
- 2.62. Car top guard**
- 2.62.1. For the safety of the technicians working on the top of the car, provide a car top guard consisting of the following.
- 2.62.2. Provide car top guard to meet, as a minimum, the requirements of the Code.
- 2.62.3. Provide a continuous guard around the sides and rear of the car top.
- 2.62.4. Provide a solid kickplate at the bottom of the guard rail extending from the car top to a height of 150 mm to prevent objects on the car top from falling over the side of the car.
- 2.62.5. Bolt the car top guard components together so that, if necessary, the guard can be temporarily removed.
- 2.62.6. Finish the guard with two coats of rust inhibiting primer and one finished coat of enamel.
- 2.62.7. So as to preserve the cab isolation affix the car top guard either to the cab top or to the car sling and frame but not to both.
- 2.62.8. If the car top guard is affixed to the car sling provide, where necessary, supports to the cab using vibration isolated mountings so arranged as to preserve the cab isolation.
- 2.62.9. If the car top guard is affixed to the cab provide, where necessary, supports to the car sling and uprights using vibration isolated mountings so arranged as to preserve the cab isolation.
- 2.62.10. Ensure that the installation of the car top guard does not reduce the overhead clearances to less than allowed by Code.
- 2.63. Counterweight balance**
- 2.63.1. Statically balance the counterweight so that, at the centre of the travel, with the top guiding means removed, the counterweight hangs in the centre of the rails.
- 2.63.2. Arrange the equipment so that there is, in this position, with the guiding means properly adjusted, no pressure upon the guides.
- 2.63.3. Adjust the guiding means so that the pressure upon any guide at any point in the travel does not exceed 110 Newtons (25 pounds).

2.64. Counterweight

- 2.64.1. Provide a counterweight to counterbalance the elevator for smooth and economical operation.
- 2.64.2. Contain the weights in a structural steel frame.
- 2.64.3. Make the counterweight equal to the weight of the complete elevator car plus between 40 percent and 50 percent of the rated load.
- 2.64.4. In the elevator pit, where required by Code, provide counterweight guards as follows:
 - 2.64.4.1. Provide metal guards on all open sides of the counterweight except for:
 - 2.64.4.1.1. The side facing the elevator car where there is no space greater than 500 mm (20 in.).
 - 2.64.4.1.2. In the pit where the bottom of the counterweight resting on its compressed buffer is 2130 (84 in.) or more above the pit floor.
 - 2.64.4.2. Provide guards extending from the lowest part of the counterweight assembly, when the counterweight is resting on the fully compressed buffer, to not less than 2100 (83 in.) and not more than 2450 (96 in.) above the pit floor.
 - 2.64.4.3. Provide guards for the full width of the area being guarded.
 - 2.64.4.4. Provide guards fastened to a metal frame and braced to be equal in strength and stiffness to 2 mm (0.074 in.) thick sheet steel.
 - 2.64.4.5. Where perforated metal guards are provided, they shall reject a ball 25 mm (1 in.) in diameter.
- 2.64.5. In the elevator hoistway, where required by Code, provide counterweight guards as follows:
 - 2.64.5.1. Provide metal guards, where a counterweight is located between elevators, on the side next to the adjacent elevator.
 - 2.64.5.2. Provide guards that will not reduce the clearance between the guard and the counterweight below 25 mm (1 in.) when subjected to a force of 450 N (100 lbf) applied over an area of 100 mm x 100 mm (4 in. X 4 in.) at any location.
 - 2.64.5.3. Where perforated metal guards are provided, they shall reject a ball 25 mm (1 in.) in diameter and be made from material equal to or stronger than 1.110 mm (0.0437 in.) diameter wire.

2.65. Car balance

- 2.65.1. Statically balance the car so that, at the centre of the travel, with the top guiding means removed, the car hangs in the centre of the rails.
- 2.65.2. Arrange the equipment so that there is, in this position, with the guiding means properly adjusted, no force upon the guides.
- 2.65.3. Make this test with empty car and car doors closed.
- 2.65.4. Locate and adjust devices such as the compensating devices, travelling cable hangers and cab balancing weights so that the force upon any guide at any point in the travel does not exceed 110 Newtons (25 pounds) with empty car and car doors closed.

2.66. Sheaves and supporting beams

- 2.66.1. Provide sheaves, together with supporting beams or channels, necessary to obtain proper lead of the ropes to car and counterweight, accurately machined and grooved for the diameter of the ropes used.
- 2.66.2. Design and arrange the sheaves so that they can be readily serviced or removed.
- 2.66.3. Provide sound and vibration isolation pads or springs arranged so that there is no solid contact between the sheaves and the building structure.

2.67. Pit equipment

- 2.67.1. Provide buffer extensions, support beams, work platform with ladder as necessary to accommodate the pit depth.
- 2.67.2. Where there is space below the hoistway that is accessible to persons, conform to section 2.6 or 3.6 of the Code.

2.68. Limit switch dowelling

- 2.68.1. After the final limit switches are adjusted and prior to the performance of safety tests and checks by the inspecting authorities, fasten, by throughbolting or dowelling, the final limit switches and final limit switch brackets so as to minimize the possibility of future incorrect adjustment.

2.69. Car ride

- 2.69.1. Arrange that the horizontal acceleration front to rear or side to side measured in the car with the elevator travelling, with a load of less than 10 per cent of capacity, from top to bottom and bottom to top does not exceed 0.15 m/s^2 (0.5 ft/s^2) measured between two consecutive points of opposite value.
- 2.69.2. Arrange that the vertical acceleration measured in the car with the elevator travelling, with a load of less than 10 per cent of capacity, from top to bottom and bottom to top at contract speed, does not exceed 0.10 m/s^2 (0.3 ft/s^2) measured between two consecutive points of opposite value.

2.70. Painting

- 2.70.1. Ensure that machine room and hoistway equipment, except for machined surfaces and non-rusting surfaces, is protected with two coats of a rust inhibiting primer of a neutral colour, each coat of 25 micron minimum thickness.
- 2.70.2. Paint the pit floor.

2.71. External connections

- 2.71.1. Provide a junction box on the external wall of the hoistway at a point to be designated later for connections for such items as telephones, CCTV, lobby panels, monitor systems, to external locations such as the CACF Room.
- 2.71.2. Locate this box as instructed and provide clearly marked terminal blocks for the wiring connections.
- 2.71.3. Supply the required wiring for the connections from this box to the external locations (provision of external conduit and pulling of wiring by others).

2.72. Travelling cable

- 2.72.1. Provide travelling cables with flame-retarding and moisture-resisting outer covers and stranded conductors.
- 2.72.2. Supply cables approved for elevator use.
- 2.72.3. Provide in the travelling cables:
 - 2.72.3.1. 14 AWG (1.5 square mm) conductors for current-carrying circuits;
 - 2.72.3.2. 18 AWG (0.75 square mm) conductors for signal circuits;
 - 2.72.3.3. 20 AWG (0.5 square mm) shielded pair conductors with shielding for telecommunications circuits and data circuits;
 - 2.72.3.4. one RG6/U stranded centre conductor coaxial cable and one pair 18 gauge stranded conductor cable within an overall braided shield for closed-circuit television.
- 2.72.4. Provide ten percent additional minimum spare signal and current-carrying wires in each cable.
- 2.72.5. Terminate cables using terminal blocks or suitable connectors having identifying numbers to facilitate replacement and service.
- 2.72.6. Suspend light weight cables using a wire mesh sleeve to relieve strain in the individual conductors and heavier cables using a steel supporting strand if the suspended weight exceeds 35 kg (seventy-five pounds).

2.73. Electric wiring

- 2.73.1. Provide wiring required to interconnect the equipment.
- 2.73.2. Provide copper wire.
- 2.73.3. Provide insulated wiring having a flame retarding and moisture resisting outer cover.
- 2.73.4. Where flexible conduit is used, supply it in aluminium.
- 2.73.5. Provide travelling cable to connect car operating panels and other car operating devices to the controller in the machine room.
- 2.73.6. Where shielded wire is specified, provide wire of not less than 0.52 mm² area (20 gauge) having individually shielded pairs with 100% shielding.
- 2.73.7. Provide colour or number coded wires in multiwire cables.
- 2.73.8. Provide waterproof terminal labels.
- 2.73.9. Provide stranded field wire except for the individual wires in multiwire cables which may be either stranded or solid.

PART 3 - EXECUTION

3.1. Operation: simplex

- 3.1.1. Provide a micro-processor based simplex control for the elevator.

3.2. Operation: call response

- 3.2.1. Store all hall and car calls in the control memory until answered.
- 3.2.2. Cancel a call when it is answered by a car.
- 3.2.3. Stop a running car at the first landing for which a car call is registered.
- 3.2.4. Stop a running car for a hall call registered for the same direction as the car is travelling, subject to higher priority assignments and to load in the car.

3.3. Operation: dispatch recovery

- 3.3.1. If a hall call remains registered for longer than 60 seconds and within that period the cars are not running, dispatch all cars and run without dispatch delay or assignment until all registered hall calls are cancelled.

3.4. Operation: car call anti-nuisance feature

- 3.4.1. Arrange the control circuits to cancel all car calls when an unreasonable number of car calls has been registered relative to the number of passengers in the car.
- 3.4.2. Prevent nuisance car calls by:
- 3.4.2.1. Not allowing car calls to be registered below the current position of an up travelling car;
- 3.4.2.2. Not allowing car calls to be registered above the current position of a down travelling car;
- 3.4.2.3. Or, by cancelling car calls when the car reverses direction.

3.5. Operation: call initiation

- 3.5.1. Control the elevator automatically by buttons in the car, marked to correspond with the respective landings served, and by the call buttons at the landing stations.
- 3.5.2. Register a call by momentary pressure of a button.

3.6. Operation: high & low call return

- 3.6.1. Cause the car to proceed to the calls until it has come to the limit of calls placed in the direction in which it is travelling, and having done this, subject to the assignment of the dispatch system, to reverse direction.
- 3.6.2. Do not stop the car, except in the case of high and low return, for hall calls in the opposite direction to the direction of the car.

3.7. Operation: coincident calls

- 3.7.1. Assign a hall call to an elevator with a car call at the same floor if the elevator is travelling in the same direction as the hall call.

3.8. Operation: direction reversal

- 3.8.1. Cause a car without registered car calls, arriving at a floor where both up and down hall calls are registered, to initially respond to the hall call in the direction that the car was travelling.
- 3.8.2. If, subsequent to the stop at this landing, there are no car or hall calls registered such as to require immediate travel in the same direction as before stopping at that landing, cause the car to close its doors, immediately reopen them and respond to the hall call in the opposite direction.

3.9. Operation: fault recovery

- 3.9.1. Provide a recovery circuit arranged to take the elevator at low speed to the next floor in the event of an overspeed condition, overload trip, or other similar fault condition.
- 3.9.2. Do not implement the recovery circuit if the movement of the car would endanger the passengers in the car.
- 3.9.3. Provide a circuit separate from the normal speed control circuits, with power derived through separate controls and limited in power by resistance or fixed devices to an appropriate low level.
- 3.9.4. Do not use, in this circuit, any solid state or other device which could fail in a mode that would allow an increase in applied power.
- 3.9.5. Upon arrival of the car level at the next floor, cause the doors to open and remain open, and turn off the car lights.
- 3.9.6. Leave the elevator in this state until the fault is corrected and the car restored to service.

3.10. Operation: independent service

- 3.10.1. Provide independent service.
- 3.10.2. On independent service:
 - 3.10.2.1. Remove the car from the automatic supervisory control system;
 - 3.10.2.2. Arrange the circuits so that the car does not respond to hall calls;
 - 3.10.2.3. Render the hall lanterns (if provided) inoperative;
 - 3.10.2.4. Cause the car to park with its doors open;
 - 3.10.2.5. Arrange the controls so that the car responds to any car calls registered if a button is held until the doors are closed and the interlocks made-up;
 - 3.10.2.6. Cause the doors to reopen if the button is released at any time up to the point at which the elevator starts to move;
 - 3.10.2.7. Render inoperative the normal door protective devices;
 - 3.10.2.8. Arrange the controls so that the attendant can select direction of travel;
 - 3.10.2.9. Cancel all registered car calls when the direction reverses or a car call is answered.
 - 3.10.2.10. Arrange the independent service operation so that it does not override security features or security systems.

3.11. System clock

- 3.11.1. Where operations or functions are subject to clock control or require clock input, provide a solid state clock.
- 3.11.2. Provide, in the machine room or at the central control console, means to indicate the current clock time.
- 3.11.3. Provide, in the machine room or at the central control console, means to readily reset the clock time.
- 3.11.4. Provide crystal regulation of frequency and voltage control adequate to maintain the time within an accuracy of plus or minus five seconds per month.
- 3.11.5. Provide software to automatically adjust the time for changes from standard to daylight saving time and from daylight saving time to standard time.
- 3.11.6. Provide battery back-up to maintain for a period of at least 24 hours accurate clock time in the event of power loss.

3.12. Door protective device by-pass (nudging)

- 3.12.1. Should a door protective device be operated continuously for more than 20 seconds after the elapse of the normal door open time, cause the doors to close slowly under reduced power and operate a buzzer in the car panel as a warning to the person obstructing the door.
- 3.12.2. Cause the 20 seconds to be reduced to 6 seconds until a normal door cycle is performed.

3.13. Door open pause time

- 3.13.1. Arrange the circuits so that when the car is stopped in response to a hall call the doors remain open a predetermined length [approximately 5 seconds for an elevator whose entrances are within 3 metres (10') of the hall push button and approximately 6 seconds for an elevator whose entrances are further than 3 metres (10') from the hall push button].
- 3.13.2. Arrange that this predetermined length of time is reduced to approximately 0.7 seconds if a person moves through the entrance (as indicated by the actuation of the door protective device).
- 3.13.3. Unless otherwise specified (e.g. to allow for advance hall lantern warning), arrange the circuits so that when the car is stopped in response to a car registered call the doors remain open a predetermined length of time (approximately 3 to 4 seconds).
- 3.13.4. Make the times separately adjustable over a range from 0.25 seconds to 15 seconds.
- 3.13.5. Arrange the circuits so that the door open pause time is cancelled if a car call button is pressed or the door close button is pressed.

3.14. Operation: door protective device

- 3.14.1. Arrange the door protective device so that, should it detect a person or any object in its path, at any point during the door closing operation, it will cause the doors to return to the open position.
- 3.14.2. Adjust both the detection device and the door operation so that an object or person in the way of the door will cause the doors to reverse without the door panel of either hall or car doors actually striking the object or person.

3.15. Noise level: hoistway

- 3.15.1. During an elevator operating cycle, including brake lift and brake application, arrange that the noise level in the hoistway is not more than 63 dBA measured at no closer than 1 m (3.3') from the hoist machine, and not more than 58 dBA measured at no closer than 1 m (3.3') outside the hoistway at the top landing.
- 3.15.2. Measure this noise level using an ANSI type 2 sound level meter on the "A" scale with an "F" response.

3.16. Noise level: door operation

- 3.16.1. Arrange the equipment so that the noise level, as measured within the cab, does not exceed 60 decibels at any time during a full door open, door close and door reversal cycle.
- 3.16.2. Initiate the door reversal by triggering the door protective device.
- 3.16.3. Measure the noise level using an ANSI type 2 sound level meter on the "A" scale with an "F" response.

3.17. Noise level: cab

- 3.17.1. Arrange that, with the elevator travelling from one end of the hoistway to the other, the noise level as measured within the elevator cab does not exceed 55 dBA for traction elevators and 58 dBA for hydraulic elevators.
- 3.17.2. Measure this noise level with an ANSI type 2 sound level meter on the "A" scale with an "F" response.

3.18. Cab fan: operation

- 3.18.1. Arrange that there is no discernible vibration in the car with the fan operating.
- 3.18.2. Arrange that the noise level developed by the fan, measured in the car with the fan running, does not exceed 55 dBA.
- 3.18.3. Measure this noise level with an ANSI type 2 sound level meter on the "A" scale with an "F" response.

3.19. Noise level: control and machine room

- 3.19.1. Design the equipment so that the noise level with the elevator running, as measured by a meter positioned in the centre of the control and machine rooms, does not exceed 80 decibels.
- 3.19.2. Measure this noise level using an ANSI type 2 sound level meter on the "A" scale with an "F" response.

3.20. Transmitted vibration

- 3.20.1. Arrange that the dose value of the transmitted vibration generated by the machine and associated sheaves in the frequency range from 0 to 100 Hz is less than 0.2 in any single axis and that the average of the dose values of the three axes is less than 0.15.
- 3.20.2. Measure the vibration over a period of ten seconds in both directions of travel at contract speed with empty car.
- 3.20.3. Record the vibration using an accelerometer transducer mounted on the machine beam adjacent to the machine.

-
- 3.20.4. Process the accelerometer output through a low pass digital or analogue filter to delete frequencies above 100 Hz.
- 3.20.5. Record the accelerations from 0 Hz to a minimum 200 Hz in the vertical axis and the two horizontal axes.
- 3.20.6. Calculate the vibration dose value by integrating the fourth power of the acceleration in m/s/s over the ten second period, dividing by the number of samples, and taking the fourth root of the result.
- 3.21. Levelling**
- 3.21.1. Cause the car to stop automatically at floor level, without overshoot, regardless of load or direction of travel so that the car sill is level, within 6 mm (1/4"), with respect to the hoistway sill.
- 3.21.2. When the elevator cab is stopped at a floor, correct for over travel or under travel or movement of the cab away from the floor, by returning the car imperceptibly to floor level.
- 3.22. Brake**
- 3.22.1. Arrange the brake to stop the elevator with full load in the car from full speed in the down direction with an average deceleration of approximately 1.2 m/s^2 (4.0 ft/s^2) without shock or jar.
- 3.22.2. Adjust the brake to hold a minimum of 125 percent of the contract load.
- 3.22.3. Design and adjust the brake so that when it operates no noise can be detected either in the elevator cab, at the top floor landing or outside the closed machine room door.
- 3.23. Speed control**
- 3.23.1. Design and adjust the equipment so that the average acceleration over the period of constant acceleration is 0.8 m/s^2 (2.6 ft/s^2) plus or minus 10%.
- 3.23.2. Design and adjust the equipment so that the average change in acceleration (jerk) is 1.4 m/s^3 (4.6 ft/s^3) plus or minus 10%.
- 3.23.3. Design and adjust the equipment so that the rated speed is maintained with an accuracy of 1.5 percent.
- 3.24. Safety tests**
- 3.24.1. Arrange the safety so that the car stops at both no load and full load on a safety test without excessive acceleration and without damage to the equipment.
- 3.25. Test data form: traction**
- 3.25.1. After completion of the Work, and prior to the inspection by the Consultant, submit a test data form certifying that the unit is complete and ready for inspection.
- 3.25.2. Arrange that this form be signed by the person responsible for the performance of the Work.
- 3.25.3. Include a check list of the items in the specifications as well as other performance data such as door times, operating times, brake-to-brake times, starting, running, stopping currents and voltages, slowdown and limit switch settings, governor settings, and, in general, settings of any adjustable devices.
- 3.25.4. List on this form safety devices, together with their settings and indicate whether they have been checked and adjusted.

3.25.5. Submit a soft copy of the data form in PDF (Acrobat Reader) format.

3.26. Operating time

3.26.1. Adjust the equipment so that the elapsed time to travel one typical floor does not exceed the time shown in the data table.

3.26.2. Measure this time under the following conditions:

3.26.2.1. A typical floor height of less than 4000 mm (13');

3.26.2.2. Floor levelling accuracy of ± 6 mm (1/4");

3.26.2.3. Start time when the fully opened doors begin to close;

3.26.2.4. Stop time when the car is stopped level with the next floor and the car and hall doors are 800 mm (32") open;

3.26.2.5. Time measured with full load in the car and in both directions of travel;

3.26.2.6. Power door operation for the hall and car doors conforms to the elevator code requirements.

3.26.3. Adjust the equipment so that the operating time is compatible with dependable, consistent operation without undue wear or excessive maintenance and so that this operating time can be readily maintained over the life of the elevator installation.

3.26.4. Adjust the equipment so that, with the control functioning so as to give the required time, the elevator operates under smooth acceleration and retardation and provides a comfortable and agreeable ride.

3.27. Firefighters' Emergency Operation: automatic recall

3.27.1. Provide Firefighters' Emergency Operation including:

3.27.1.1. Phase I automatic Emergency Recall Operation;

3.27.1.2. Phase I Emergency Recall Operation to an alternate level;

3.27.1.3. Phase II Emergency In-Car Operation.

3.27.2. Provide switches and indicators in the hall and car stations as required by Code.

END OF SECTION

Section 14 21 23 MRL PASSENGER ELEVATOR

PART 1 - GENERAL

1.1. General requirements

1.1.1. Conform to Section 14 20 00.

1.2. Type

1.2.1. Installation of one partially-enclosed barrier-free platform lift.

1.3. Data

| Barrier-Free Lift | | |
|--------------------------------|---------------------------------------|-----|
| number of units | 1 | |
| designation | - | |
| application | Platform lift for barrier-free access | |
| rated speed (m/s, fpm) | 0.1 | 20 |
| capacity (kg, lb) | 340 | 750 |
| motor power (kW, HP) | 2.2 | 3 |
| operation | Constant pressure push button | |
| motor location | Within hoistway | |
| pump type | External | |
| pump machine unit location | Within hoistway | |
| jack type | Above ground | |
| corrosion protection | Not applicable | |
| overspeed valve | provide | |
| control system | Provide | |
| control location | Within hoistway | |
| front entrances | L3 lower | |
| rear entrances | L3 upper | |
| door type | Horizontal swing | |
| hoistway door fire resistance | Not applicable | |
| entrance width (mm, ") | 914 | 36 |
| entrance height (mm, "), lower | 2030 | 80 |
| entrance height (mm, "), upper | 1070 | 42 |
| entrance markings | None | |
| cab width (mm, ") | 914 | 36 |
| cab depth (mm, ") | 1525 | 60 |
| door operator | Provide | |
| interlocks | Provide | |
| main car station | Provide | |
| auxiliary car station | None | |

| | |
|------------------------------------|---------------------------------------|
| verbal annunciation | None |
| car position indicator | None |
| cab emergency lighting | Provide |
| cab communication | Hands-free phone |
| two-way video communication | None |
| in-cab video display system | None |
| car closed circuit camera | None |
| car call security | Keyswitch, provisions for card reader |
| hall call security | Keyswitch, provisions for card reader |
| hall stations (typical) | Provide |
| hall stations (main floor) | Provide |
| hall door finish (typical) | Powder coat |
| hall door finish (main floor) | Powder coat |
| hall lanterns | None |
| in-car lanterns | None |
| hall position indicator | None |
| lobby panel | None |
| CACF panel | None |
| central control monitor | None |
| car top inspection station | None |
| car guiding | Sliding shoes |
| load weighing device | None |
| guide rails | Provide |
| emergency recall (phase I) | None |
| firefighter's operation (phase II) | None |
| emergency power | Battery lowering device |
| car top railing | None |
| equipment guarding | None |

1.4. Dimensions

- 1.4.1. Provide equipment to suit the machine room, pit and provided overhead dimensions.

PART 2 - PRODUCTS

2.1. Speed

- 2.1.1. Arrange the lift to run at a speed (nominal) of 0.10 mps (20 fpm) full load up, and under any other condition of loading, except the case of overload, at not less than the contract speed.

2.2. Capacity

- 2.2.1. Provide a net lifting capacity of not less than 340 kg (750 lb) in addition to the weight of the car flooring, cab and associated equipment.

2.3. Enclosure

- 2.3.1. Provide a partially-enclosed shaft enclosure for the lift.

2.4. Hydraulic power unit

- 2.4.1. Provide a hydraulic power unit to move the lift up and down by regulating the flow of hydraulic fluid to and from the hydraulic jack.
- 2.4.2. Incorporate in the hydraulic unit directional and pressure relief valves as required to achieve the desired functions.
- 2.4.3. Provide an alternating current motor suitable for the lift power supply to drive the hydraulic pump so as to move the lift in the up direction.
- 2.4.4. Locate the power unit within the hoistway.

2.5. Hydraulic jack

- 2.5.1. Provide a hydraulic jack to raise and lower the lift either directly or in conjunction with a 2:1 roped sheave.
- 2.5.2. Provide a jack unit consisting of a plunger of heavy seamless steel tubing accurately turned and polished, a stop ring electrically welded to the plunger to positively prevent the plunger leaving its casing, packing of suitable design and quality, an outer casing made of steel tubing.
- 2.5.3. Use packing of the single sealing edge type of teflon, roulon or similar material to reduce wear and friction.

2.6. Hydraulic pit shut-off valve

- 2.6.1. Provide a pit shut-off valve for the hydraulic jack.

2.7. Overspeed valve

- 2.7.1. Provide an overspeed valve in the elevator pit.
- 2.7.2. Use Victaulic couplings to connect the valve in the oil line.
- 2.7.3. Provide a data tag on the valve showing the operating pressure, maximum pressure rating and overspeed setting.
- 2.7.4. Arrange the valve to operate in the event that the elevator speed in the down direction exceeds 125% (plus or minus 10%) of the elevator operating speed in the down direction
- 2.7.5. Arrange that the valve cuts off the flow of oil from the hydraulic jack in the event that the set tripping speed is exceeded.
- 2.7.6. Arrange that when the valve operates the elevator will be decelerated at a rate of not less than 0.25 g nor more than 1.00 g with any peak deceleration rate in excess of 2.50 g having a duration of not more than 0.04 seconds.
- 2.7.7. If the valve is field-adjustable, provide a numbered seal and record the date and number in the log book.

2.8. Controller

- 2.8.1. Provide a micro-processor based controller designed to give the required operation as herein specified.
- 2.8.2. Mount panels securely on substantial, self supporting steel frames designed for floor or wall mounting.
- 2.8.3. Provide completely enclosed controllers with covers.
- 2.8.4. Do not mount equipment on the covers unless:
 - 2.8.4.1. Its wiring is designed to support bending caused by opening and closing the cover;
 - 2.8.4.2. Its wiring is protected against damage;
 - 2.8.4.3. If damage happens to the equipment mounted on the cover or the wiring of this equipment, the unit will continue to operate normally.
- 2.8.5. Where relays are used, provide those having a design electrical life and mechanical life equivalent to thirty years operation in the given application, with their contacts designed for maximum conductivity and wiping action.
- 2.8.6. Install wiring on the controller, whether control or field wiring, in a neat workmanlike order and make connections to studs and terminals by means of solder or solderless lugs, or similar connecting devices.
- 2.8.7. Mark relays, contactors, fuses, printed circuit boards and other components clearly and permanently with designations as shown on the schematics.
- 2.8.8. Mount the designations for plug in components on the controller adjacent to the component; do not mount the designation on the plug in component.
- 2.8.9. Provide a written guarantee from the control manufacturer that software and firmware updates will be provided for not less than 20 years at no charge to the Owner.
- 2.8.10. Install the controller within the hoistway.

2.9. Entrance: power swing doors

- 2.9.1. Provide power operated hoistway doors of the swing type.
- 2.9.2. Provide a retiring cam so arranged that the hoistway door is unlocked when the elevator is levelling into the floor or stopped at the floor.
- 2.9.3. Provide means to eliminate any noise associated with the operation of the retiring cam.
- 2.9.4. Provide a door operator on each door to open and close the door.
- 2.9.5. Provide a hand-held remote control device.
- 2.9.6. Provide a push button control device.
- 2.9.7. Provide adjustable door open dwell time.
- 2.9.8. Provide adjustable speed control.
- 2.9.9. Provide a device to sense an object in the way of the closing door and to initiate door re-open.
- 2.9.10. Provide battery back-up to allow operation during power failures.
- 2.9.11. Arrange that the door can be opened manually in the event of power failure.

- 2.9.12. Provide an interlock so arranged that an electrical contact will be closed when the door is in the closed position so as to allow the retiring cam to lift, subsequent to which, with the retiring cam lifted, the door will be mechanically locked and a second contact closed to permit the elevator to run.
- 2.9.13. Provide substantial steel hinges, a minimum of three per panel pivot edge, of, as a minimum, dimensions 150 mm by 150 mm (4.5" by 4.5").
- 2.9.14. Manufacture the doors of minimum 1.3 mm thick (16 gauge) steel with appropriate reinforcing.
- 2.9.15. Manufacture the frames of 1.9 mm thick (14 gauge) steel.
- 2.9.16. Provide a sill the full width and depth of the entrance manufactured of non-slip metallic material.
- 2.9.17. Provide in each door a vision panel of minimum area 0.016 square metres (25 square inches) but not to exceed 0.052 square metres (80 square inches) for the total vision panel area for each entrance.
- 2.9.18. Provide clear wired glass of minimum 6 mm (1/4") thickness for each vision panel.
- 2.9.19. If car doors are provided, provide matching vision panels in the car doors so arranged as to provide direct convenient vision into the car when the elevator is at floor level.
- 2.9.20. Finish the doors and frames in powder coat in a choice of colour.

2.10. Cab design

- 2.10.1. Provide steel powder coat finishes in a choice of colour.
- 2.10.2. Provide a non-slip, corrosion resistant floor.
- 2.10.3. Supply a full description of the cab design together with photographs, renderings, and lists of options for fixtures, interior materials, finishes and colours.

2.11. Car station

- 2.11.1. Provide one car operating panel.
- 2.11.2. Provide in this panel all devices required for the normal operation of the lift including:
 - 2.11.2.1. push buttons for up and down movement;
 - 2.11.2.2. alarm button;
 - 2.11.2.3. emergency stop button;
 - 2.11.2.4. audiovisual warning signal to indicate carriage motion;
 - 2.11.2.5. two position key-switch to enable or disable car station push buttons.
- 2.11.3. Provide on the car station markings and signage such as car capacity, elevator number and other markings required by the prevailing codes and local regulations.
- 2.11.4. Provide clear space in the car station for the installation of a security card reader.

2.12. Emergency lighting

- 2.12.1. Provide a back-up battery power system for emergency signalling devices and emergency cab lighting.
- 2.12.2. Provide a lighting level of at least 11 lux of illumination at the car operating panels for a minimum period of four hours, using at least two lamps of equal rating.

- 2.12.3. Cause the lamps to be immediately energized in the event of a power failure or electrical fault de-energizing the normal elevator lighting circuit.
- 2.12.4. Provide for the automatic disconnection of the lamps and the automatic recharging of the lighting unit when normal power is restored to the elevator lighting circuit.
- 2.12.5. Provide a rechargeable battery of the hermetically sealed type, or of a type which provides a reserve of electrolyte, capable of operating unattended and requiring no addition of water or electrolyte for a period of not less than ten years, with provision for visual checking of the electrolyte level without opening the battery or removing caps or fittings.
- 2.12.6. Arrange the battery charging to operate automatically upon restoration of normal power to the unit, to remain in operation until the battery is fully recharged and to maintain the battery at full rated capacity at all times when the unit is not in operation.
- 2.12.7. Provide a pilot lamp to indicate that the normal power supply to the unit and battery charging is in operation.
- 2.12.8. Arrange that the unit can be conveniently tested and operated manually.
- 2.12.9. Install the unit as part of the car so that it is not readily removed.
- 2.12.10. Do not provide portable equipment.

2.13. Telephone: hands-free operation

- 2.13.1. Provide a hands-free telephone with automatic dialer capable of initiating and receiving calls.
- 2.13.2. Integrate the telephone into the car station.
- 2.13.3. Provide a push button to initiate the telephone connection.
- 2.13.4. Arrange that the telephone connection can be initiated by an external call.
- 2.13.5. Provide an indicator light to confirm that communication has been established.
- 2.13.6. Pierce the car station for the push button and indicator light with the indicator light mounted flush with the panel.
- 2.13.7. Provide a speaker/microphone for communication.
- 2.13.8. Pierce the car station in front of the speaker with multiple holes 3 mm (1/8") in diameter to allow passage of sound to and from the speaker.
- 2.13.9. Identify the telephone and the button with a raised symbol and Braille.
- 2.13.10. Provide wiring for the telephone from the cab to the machine room.
- 2.13.11. Provide a communication station in the machine room.
- 2.13.12. Connect the wiring on the car to a terminal block mounted in or adjacent to the telephone box.
- 2.13.13. Terminate the wiring in the machine room at a separate enclosed external terminal block mounted on the controller.
- 2.13.14. Provide the terminal block and its enclosure and locate it so that personnel other than elevator mechanics can easily run their conduit and wiring to these terminals without interfering with or touching the elevator wiring or controls.

- 2.13.15. Where more than one controller is in a common machine room bring wiring to one common terminal block.
- 2.13.16. Clearly mark the terminal block.
- 2.13.17. Provide wiring of the twin conductor shielded type with grounded shields.
- 2.13.18. Provide equipment and wiring compatible with and acceptable to the telephone company providing service to the project.
- 2.13.19. Provide material and labour as necessary so as to ensure that the communication system meets the requirements of the Code.

2.14. Hall stations: single riser

- 2.14.1. Provide a single riser of hall stations.
- 2.14.2. Provide one station for each floor.
- 2.14.3. Provide, for each station, all devices required for the normal operation of the lift including:
 - 2.14.3.1. single push button;
 - 2.14.3.2. two position key-switch to enable or disable hall push buttons;
 - 2.14.3.3. car arrival light;
 - 2.14.3.4. in use light.
- 2.14.4. Provide clear space in the hall station for the installation of a security card reader.

2.15. Security

- 2.15.1. Provide for the installation of a card reader security system in the car and hall.
- 2.15.2. Provide a security interface box in the machine room, complete with terminal blocks and wiring space for the interconnection of the security system to the control system.
- 2.15.3. Provide wiring from the card readers to the security interface box using standard connectors.
- 2.15.4. Interface with the security system using serial data transfer.
- 2.15.5. Provide a signal, unique for each call, to the security system when a call "request" is entered and enter the call when a return signal is received from the security system validating the request.
- 2.15.6. Provide any incidental elevator material and elevator work necessary to obtain a complete functioning elevator security system.
- 2.15.7. Submit for review, interface box drawings, location drawings and electrical schematics.

2.16. Sliding guides

- 2.16.1. Equip the car with spring-loaded sliding guides mounted at both the top and the bottom of the car frame.
- 2.16.2. Provide guide shoes of the self-aligning, self lubricating, swivel type with metal body and removable non-metallic liners to ensure smooth and quiet operation.

2.17. Emergency lowering

- 2.17.1. Provide battery operated emergency lowering.
- 2.17.2. Provide, as a minimum, sufficient battery power to perform the following cycle of operation five times within a 30 minute period:
 - 2.17.2.1. Close the elevator doors;
 - 2.17.2.2. Run the car to the bottom floor;
 - 2.17.2.3. Open the doors;
 - 2.17.2.4. Close the doors.
- 2.17.3. Cause the emergency lowering operation to be implemented in the event of a power failure or electrical fault de-energizing the normal elevator power supply.
- 2.17.4. Under emergency lowering conditions cause the elevator to close its doors and travel down (under constant pressure where applicable), without stopping, to the bottom floor, open its doors, and after the normal door open time has elapsed, close its doors and remain parked at the lowest floor.
- 2.17.5. On emergency lowering operation, maintain operational all of the normal safety devices including door open buttons, and door protective devices.
- 2.17.6. Provide for the automatic termination of the emergency lowering operation and the automatic recharging of the battery when normal power is restored.
- 2.17.7. Provide a rechargeable battery of the hermetically sealed type, or of a type which provides a reserve of electrolyte, capable of operating unattended and requiring no addition of water or electrolyte for a period of not less than ten years, with provision for visual checking of the electrolyte level without opening the battery or removing caps or fittings.
- 2.17.8. Arrange the battery charging means to operate automatically upon restoration of normal power, to remain in operation until the battery is fully recharged and to maintain the battery at full rated capacity at all times when emergency lowering is not in operation.
- 2.17.9. Provide a pilot lamp to indicate that the normal power supply and battery charging are in operation.
- 2.17.10. Provide means for convenient manual operation and testing.

2.18. Travelling cable

- 2.18.1. Provide travelling cables with flame-retarding and moisture-resisting outer covers and stranded conductors.
- 2.18.2. Supply cables approved for elevator use.
- 2.18.3. Provide in the travelling cables:
 - 2.18.3.1. 14 AWG (1.5 square mm) conductors for constant current-carrying circuits;
 - 2.18.3.2. 18 AWG (0.75 square mm) conductors for signal circuits;
 - 2.18.3.3. 20 AWG (0.5 square mm) shielded pair conductors with shielding for telecommunications circuits and data circuits;
- 2.18.4. Provide ten percent additional minimum spare signal and current-carrying wires in each cable.
- 2.18.5. Terminate cables using terminal blocks or suitable connectors having identifying numbers to facilitate replacement and service.

- 2.18.6. Suspend light weight cables using a wire mesh sleeve to relieve strain in the individual conductors and heavier cables using a steel supporting strand if the suspended weight exceeds 35 kg (seventy-five pounds).

2.19. Electric wiring

- 2.19.1. Provide wiring required to interconnect the equipment.
- 2.19.2. Provide copper wire.
- 2.19.3. Provide insulated wiring having a flame retarding and moisture resisting outer cover.
- 2.19.4. Where flexible conduit is used, supply it in aluminium.
- 2.19.5. Provide travelling cable to connect car operating panels and other car operating devices to the controller in the machine room.
- 2.19.6. Where shielded wire is specified, provide wire of not less than 0.52 mm² area (20 gauge) having individually shielded pairs with 100% shielding.
- 2.19.7. Provide colour or number coded wires in multiwire cables.
- 2.19.8. Provide waterproof terminal labels.
- 2.19.9. Provide stranded field wire except for the individual wires in multiwire cables which may be either stranded or solid.

PART 3 - EXECUTION

3.1. Operation: constant pressure

- 3.1.1. Provide constant pressure control for the lift.

3.2. Levelling

- 3.2.1. Cause the car to stop automatically at floor level, without overshoot, regardless of load or direction of travel so that the car sill is level, within 6 mm (1/4"), with respect to the hoistway sill.
- 3.2.2. When the elevator cab is stopped at a floor, correct for over travel or under travel or movement of the cab away from the floor, by returning the car imperceptibly to floor level.

END OF SECTION

Section 14900 ELEVATORS: MAINTENANCE

PART 1 - GENERAL

1.1. General instructions

- 1.1.1. Conform to Section 14 20 00.

1.2. Scope

- 1.2.1. Provide labour, materials, products, equipment and services necessary for the full maintenance of the equipment.

PART 2 - GENERAL REQUIREMENTS

2.1. Definition of terms

- 2.1.1. The term "Owner", as used herein, refers to University of Toronto.
- 2.1.2. The term "Consultant", "elevator consulting engineer", "consulting engineer" or "engineer", as used herein, refers to KJA Consultants Inc.
- 2.1.3. The term "elevator contractor" or "contractor", as used herein, refers to any person, partners, firm or corporation having a contract with the Owner to furnish labour and materials for the execution of the work herein described.
- 2.1.4. The term "sub-contractor", as used herein, refers to any person, partners, firm or corporation having a contract with the contractor to furnish labour and materials for the execution of the work herein described.
- 2.1.5. The term "inspecting authorities", as used herein, refers to authorized agents of governments which are charged with the responsibility of carrying out periodic inspections and tests on vertical transportation equipment.
- 2.1.6. The term "unit", as used herein, means any elevator, dumbwaiter, escalator, platform lift, lift for person with physical disabilities, moving walk or similar device mentioned in this Specification. These terms are to be interchangeable to meet the intent of the Specification.
- 2.1.7. The term "Code", as used herein, refers to the latest edition of the CAN/CSA-B44 Safety Code for Elevators and Escalators, as adopted by the Authority Having Jurisdiction.
- 2.1.8. All terms in the Specifications that are not otherwise defined shall have the definitions as given in the Code.

2.2. Owner's General Terms and Conditions

- 2.2.1. Abide by the Owner's General Terms and Conditions.
- 2.2.2. Where there is a conflict between the Owner's General Terms and Conditions and these specifications the Owner's Terms and Conditions take precedence.

2.3. Purpose

- 2.3.1. The purpose of the maintenance program is to maintain the equipment in substantially new condition, to secure the Owner's equity and to provide safe, trouble-free service.

2.4. Routine maintenance

- 2.4.1. Provide labour, materials, products, equipment and services necessary to complete maintenance testing and inspections required by the Authority Having Jurisdiction at the appropriate intervals.
- 2.4.2. Where required, perform the following:
 - 2.4.2.1. All Category 1 tasks at intervals not to exceed 12 months.
 - 2.4.2.2. All Category 3 tasks at intervals not to exceed 36 months.
 - 2.4.2.3. All Category 5 tasks at intervals not to exceed 60 months.
- 2.4.3. All other maintenance tasks required by Code with no prescribed frequency shall be completed at intervals not to exceed 12 months.
- 2.4.4. Perform periodic maintenance inspections once a month, at a minimum.
- 2.4.5. In the course of the examination, should faulty parts be discovered replace them at once, and should any unusual operations or noises be found take corrective action immediately.
- 2.4.6. Schedule parts showing excessive wear for replacement on the next regular examination.

2.5. Contract duration

- 2.5.1. Provide full maintenance on the equipment to the maintenance procedures set out in the Specifications for such periods as may be defined in the Contract Documents.
- 2.5.2. The services agreement will continue on a month-to-month basis at the expiration of the original term unless notice in writing is provided by either party, at least 60 days in advance of the expiration date, notifying the other party of their intent to not continue with the services agreement beyond the original term mandate or any subsequent monthly mandates.

2.6. Performance credits

- 2.6.1. The following credits shall be applied quarterly per elevating device, with the credit to be applied to the invoice for the subsequent quarter.
 - 2.6.1.1. If any periodic maintenance tasks due in the previous quarter have not been completed, as confirmed in the report data, issue a credit of 10% for the quarter.
 - 2.6.1.2. If any Category 1 or Category 5 maintenance tasks due in the previous quarter have not been completed, as confirmed in the report data, issue a credit of 15% for the quarter.
 - 2.6.1.3. If directives or deficiencies identified in reports from the Authority Having Jurisdiction have not been completed by the prescribed deadline issue a credit of 15% for the quarter.
 - 2.6.1.4. If deficiencies identified in the Consultant report are outstanding for more than three months, issue a credit of 5% for the quarter.
- 2.6.2. The following credits shall be applied quarterly per building, with the credit to be applied to the invoice for the subsequent quarter.
 - 2.6.2.1. Starting six months after the inception of the maintenance contract, at the end of any given quarter, should the number of callbacks for the previous six months exceed the reliability limits set out herein, issue a credit of 5% for the quarter.
- 2.6.3. Credits per elevating device are additive (i.e. two 5% credits means a 10% total credit), while per unit credits are applied before per building credits.
- 2.6.4. Credits will continue on a quarterly basis until deficient area has been rectified.

- 2.6.5. The Owner reserves the right to withhold regular invoice payments until the monthly data has been submitted in accordance with the data submission requirements.

2.7. Contract cancellation

- 2.7.1. The Owner may elect, at its option, to cancel the contract prior to its normal termination:
- 2.7.1.1. If the maintenance is not executed in accordance with the Specifications, as evidenced by the report of a recognized independent elevator consultant, and if, within four weeks of written notice, the necessary corrective action has not been completed;
- 2.7.1.2. If there is a continuing failure to perform as evidenced by more than two negative reports in any twelve month period with no positive or neutral reports in the same twelve month period. (A negative report is one which defines the level of contract performance as less than 95% of the specified requirements.)
- 2.7.2. In the event of such cancellation, the Owner may, at its option, elect to use another company to restore the equipment to the Specifications standards and to charge the cost of this to the elevator contractor.
- 2.7.3. The Owner has the option to cancel the contract upon one month's written notice if there is a significant change in the circumstances of the contract (e.g. a change in ownership of the equipment, a modernization or replacement at the Owner's cost of equipment components, a change in ownership of the maintenance company); this option to be available to the Owner for a period of three months from the date on which the changed circumstances become known to the Owner.

2.8. Unit removed from service

- 2.8.1. The Owner may elect, at its option, to remove a unit from service temporarily.
- 2.8.1.1. For a unit that is temporarily removed from service, each month start the unit, ensure that it operates correctly and perform regular maintenance.
- 2.8.1.2. For a unit that is temporarily removed from service, invoice the maintenance at 50% of the regular monthly price.
- 2.8.1.3. For a unit that is temporarily removed from service, continue to perform maintenance work mandated by the Regulatory Authorities.
- 2.8.2. The Owner may elect, at its option, to remove a unit from service permanently.
- 2.8.2.1. For a unit that is permanently removed from service, cease maintenance and invoicing activities.
- 2.8.3. The Owner will provide the Contractor with 30 days notice for units that are to be temporarily or permanently removed from service.

2.9. Work included: general

- 2.9.1. Maintain, repair or replace all of the elevating device equipment, except where specifically excluded, including the following, where provided:
- 2.9.1.1. Elevator and lift machine, motor, drive, controller, brake, emergency brake, governor, safety, hydraulic cylinder, hydraulic fluid, pump, valve, suspension means, door operating equipment, door equipment, fixtures, remote panels, elevator communication system, fixture lighting and elevator cab lighting, fans, and all other mechanical and electrical parts required for the operation of the equipment.
- 2.9.1.2. Escalator machine, motor, brake, controller, escalator steps, comb plates, chains, tracks, escalator hand rails, skirt panels, balustrade lights and all other mechanical and electrical parts required for the operation of the equipment.

2.9.1.3. Monitoring systems where such systems are independent from base building automation systems and dedicated to the monitoring of elevating equipment.

2.9.2. Upon commencement of the contract, immediately assume responsibility for maintenance of the equipment and correct any pre-existing deficiencies.

2.10. Work not included: general

2.10.1. Do not repair or replace the following, where provided:

2.10.1.1. Elevator and lift cab finishes, cab interior handrails (except for attachments on the exterior of the cab), flooring, hoistway enclosure, hall door and entrance (except to maintain clearances), sill and frame finish, unless damaged as a result of misalignment or incorrect maintenance;

2.10.1.2. Escalator decking finishes, unless damaged as a result of misalignment or incorrect maintenance;

2.10.1.3. Buried components of hydraulic cylinders, unless damaged as a result of inadequate or incorrect maintenance (the Contractor is still required to perform the requisite maintenance for buried cylinders with corrosion protection);

2.10.1.4. Electrical conduit/wiring outside the hoistway and machine/control room;

2.10.1.5. Electrical disconnects.

2.10.2. Repairs, replacements or call-backs directly resulting from abnormal environmental conditions (such as floods, fire, lightning, and other "acts of God") shall not be deemed included.

2.10.3. Repairs, replacements or call-backs directly resulting from vandalism or user negligence, apart from regular wear and tear, shall not be deemed included.

2.10.4. Repairs, replacements or call-backs directly resulting from failure or non-performance of non-elevator building elements (such as machine room air conditioning failure, building power failure, pit flooding) shall not be deemed included.

2.10.5. The cost premium for the repair or replacement of parts deemed obsolete by the Consultant where the cost premium is in excess of \$500, with the cost premium defined as follows:

2.10.5.1. The difference between the cost of repair or replacement where a part is deemed obsolete and the cost of repair or replacement if the obsolete part were readily available, as estimated by the Consultant.

2.10.5.2. The cost premium shall be based on the material cost plus labour at the contract rates.

2.10.5.3. The cost premium shall be exclusive of taxes, travel or handling fees.

2.10.5.4. Upon written direction from the Owner, the Contractor shall proceed with the work immediately and shall invoice for the work in accordance with the requirements herein. Work shall not require a Purchase Order or signed quote prior to proceeding.

Example: If a control board fails and needs to be replaced but the original equipment manufacturer is no longer in business, that part might be deemed obsolete (this decision to be made by the Consultant). If a replacement board is manufactured by a third party and the cost is substantially equivalent to the original replacement, this replacement would be covered by the contract. If, however, a new board needs to be custom-manufactured and the cost premium of the new board as compared to the original board cost exceeds the cost threshold, the cost premium would be deemed extra to contract.

2.10.6. Any of the foregoing work not included shall be deemed included in the contract where Contractor negligence, carelessness or improper maintenance is either the cause or a significant contributing

factor (ex: a pit drain blocked because of a pit not being kept clean, escalator skirts damaged as a result of incorrect alignment, buried cylinders with PVC failing due to exposure to water and missed annual testing, etc.).

- 2.10.7. All claims or invoices for work not included in the contract shall be substantiated by the Contractor to the satisfaction of the Consultant; absence of a root cause of a failure or call-back that is covered by the contract shall not be deemed sufficient justification for an extra to the contract.
- 2.10.8. In the case of power failures or power disruptions (ex: brown-outs or voltage spikes) requiring repairs or call-backs, the work will be deemed not included if the Owner, acting reasonably, can correlate the event to a building issue; in absence of any known power failure or building issue the work shall be deemed included in the Contract unless the Contractor can provide evidence in the form of power supply monitoring demonstrating a fluctuation of more than $\pm 10\%$.
- 2.10.9. Invoices or quotes for work not included in the contract shall be based on the material cost $+10\%$ plus labour at the contract rates.
- 2.10.10. The Contractor shall supply invoices from manufacturers to support the material cost and time tickets to support the labour cost, otherwise the work will be deemed included in the contract.

2.11. Extra to contract work

- 2.11.1. Give any claims for extra to contract work, due to instructions or otherwise, to the Owner in writing within a reasonable time after the work is completed.
- 2.11.2. No such claim shall be valid unless so made and authorized by the Owner.
- 2.11.3. Where extra to contract work is approved and done at the Owner's expense:
- 2.11.3.1. Bill the work at hourly rates in accordance with the Contract.
- 2.11.3.2. Do not charge for more than a total of forty (40) minutes of travel time per site visit.
- 2.11.3.3. Do not add miscellaneous charges (e.g. mileage, parking charges, truck charges, sundry charges, fuel charges, etc.).
- 2.11.4. For extra to contract work in buildings that are more than 75 kilometers driving distance away from the city center of a city with a population of more than 50,000:
- 2.11.4.1. Bill the work at hourly rates in accordance with the Contract.
- 2.11.4.2. Charge travel time based on the lesser of the actual time traveled or the shortest travel time to the nearest city with a population of more than 50,000.
- 2.11.4.3. Charge travel expenses based on the lesser of the actual distance traveled or the shortest travel distance to the nearest city with a population of more than 50,000.
- 2.11.4.4. Do not add miscellaneous charges (e.g. hotels, parking charges, truck charges, sundry charges, etc.).
- 2.11.4.5. Charge mileage at a rate that does not exceed the prevailing tax deduction rate established by federal tax authorities.

2.12. Special tools and access codes

- 2.12.1. For those elevators or components that have access codes or access tools used for commissioning, programming, or other purposes, keep all access tools on site with a hard copy listing of access codes.

- 2.12.2. If the contract is cancelled, provide to the Owner, for those elevators or components that have access codes or access tools for commissioning, programming or other purposes, the access tools and a hard copy listing of the access codes.
- 2.12.3. If the Owner provides access codes or access tools, preserve these codes and tools confidential for use only on the particular equipment for which the Owner has provided them and keep these access codes or access tools on site.
- 2.12.4. Change access codes only when authorized in writing by the Owner.

2.13. Minimum standard

- 2.13.1. As a minimum standard, perform to the Specifications and to the Code.
- 2.13.2. Maintain the equipment at all times in the same or better condition as at the commencement of the maintenance work.

2.14. Reliability

- 2.14.1. Ensure that the average number of callbacks does not exceed 4.9 per elevator per year.
- 2.14.2. Ensure that the average number of entrapments does not exceed 0.9 per elevator per year.
- 2.14.3. Ensure that the average number of callbacks does not exceed 3.0 per escalator per year.

2.15. Reliability: action plan and reporting

- 2.15.1. Provide a summary report detailing root cause analysis and a plan for corrective action where a building exceeds the reliability benchmark by more than 25% over an average of 6 months.
- 2.15.2. Provide a summary report detailing root cause analysis and a plan for corrective action where an individual elevator exceeds the reliability benchmark by more than 50% over an average of 12 months.
- 2.15.3. Continue to provide such summary reports every three months until such a time as the building or elevator reliability meets the reliability benchmark for a period of 6 months in a row.

2.16. Suspension means replacement

- 2.16.1. In groups of elevators, the elevator(s) adjacent to an elevator undergoing a suspension means replacement shall not be removed from service during regular hours if removing such elevators from service would reduce the number of elevators available in the group to less than 65%.
- 2.16.2. Where the suspension means replacement requires a reduction in the number of elevators available in a group to less than 65%, all such work shall be completed outside of regular hours (inclusive of preparatory work such as the installation of netting/hoarding, if applicable).
- 2.16.3. The foregoing requirements apply only to groups of elevators and not simplex elevators.
- 2.16.4. The foregoing requirements also apply to the replacement of governor ropes or compensating means.

2.17. Regular hours of work

- 2.17.1. Regular hours of work are from 08:00 to 17:00 Monday to Friday, excluding holidays.
- 2.17.2. For residential buildings and hotels complete noisy and disruptive work during regular hours.
- 2.17.3. For all other buildings, unless otherwise noted, complete noisy and disruptive work outside of regular hours.

2.18. Account representative

- 2.18.1. Assign and maintain a company representative for the contract to coordinate activities and to be responsible for communications with the Owner's representative.
- 2.18.2. Assign a person acceptable to the Owner for this position.

2.19. Maintenance meetings

- 2.19.1. Have qualified and capable representatives attend a meeting with the Owner and the Consultant at least every three months to review work procedures, extra charges, call backs, and any Owner concerns.
- 2.19.2. At the option of the Owner the meetings may be held by telephone conference.

2.20. Defective work and non-performance

- 2.20.1. The Owner reserves the right to correct defective work and to charge the cost to the Contractor.
- 2.20.2. Should the contractor fail to execute any of the Work set out in the contract the Owner reserves the right to do the Work and to charge the cost to the Contractor.
- 2.20.3. The Owner reserves the right to withhold payment in the event of non-performance or to pay only for that portion of the Work that has been executed.
- 2.20.4. The Owner will provide 30 days notice in writing prior to taking such action, except where the defective work or non-performance prejudice the safety of people or the installation, in which case the Owner need only provide 5 days notice in writing.
- 2.20.5. The Contractor may correct the defective work within the notice period but shall provide confirmation in writing to the Owner prior to the end of the notice period, or the Contractor shall still bear direct charges incurred by the Owner to correct the defective work.

2.21. Codes and ordinances

- 2.21.1. Supply equipment and do work in accordance with building codes, by-laws, regulations and requirements of the local, provincial and federal authorities in effect at the time of the execution of the work.
- 2.21.2. Supply equipment and do work in accordance with the Code, and any other code which may govern the requirements of the installation.
- 2.21.3. Provide labour and material, whether or not specifically mentioned in this specification, that may be necessary to provide an installation conforming to the applicable codes and regulations.
- 2.21.4. Prior to submission of the proposal and throughout the duration of work, give prompt notification in writing of any regulations or requirements known to be in process which might affect the acceptability of the work.
- 2.21.5. If changes in codes or regulations result in extra costs, those taking effect subsequent to the date of proposal submission shall be treated as an extra to the contract.
- 2.21.6. Requirements of the Authority Having Jurisdiction applicable at the time of proposal submission shall be deemed to be included in the contract, unless specifically excluded herein.
- 2.21.7. Should changes in codes, changes in legislative requirements or changes to the requirements of the Authority Having Jurisdiction be announced prior to the date of proposal submission but with a delayed adoption date, those changes shall be deemed to be included in the contract, unless specifically excluded herein.

2.22. Regulatory authority submissions

- 2.22.1. Complete any submissions to the regulating authorities that may be necessary for the continuing use and operation of the equipment.

2.23. Protection of the Work and property

- 2.23.1. Maintain protection of the Work and protect the Owner's property from injury or loss arising out of the execution of this contract.
- 2.23.2. Make good any injury or loss caused by the Contractor's agents or employees.
- 2.23.3. Take all necessary precautions to ensure that the Work is done in a manner that does not endanger any person.

2.24. Liability insurance

- 2.24.1. Provide, during the period this contract is in force, premises liability, including public liability insurance and property damage insurance in the amount of \$5,000,000 inclusive, to be covered against any claims for damage to property or for personal injury, including death, which may arise from operation under this contract, whether such operation is by yourself or by any sub-contractor or anyone directly or indirectly employed by you.
- 2.24.2. Upon completion of the contract, have in force a completed operations and products liability insurance, in the amount of \$5,000,000 inclusive, to be covered against any claims for damages to property or for personal injury, including death, which may arise after the premises liability is terminated.
- 2.24.3. Maintain the insurance in force for a minimum period of two years after completion of the contract.
- 2.24.4. List the Owner as an additional insured.
- 2.24.5. The certificates shall state that the insurance will not become ineffective without sufficient written notice to the Owner.
- 2.24.6. Submit certificates of such insurance with the Owner before work is begun.

2.25. Assignments

- 2.25.1. Do not assign nor sublet the contract without the written consent of the Owner.
- 2.25.2. Do not assign any payment due or to become due as a result of this contract without the written consent of the Owner.

2.26. Directives

- 2.26.1. Advise the Owner of directives received from the Inspecting Authorities and from the Regulatory Authorities.
- 2.26.2. Carry out directives from the Inspecting Authorities and from the Regulatory Authorities within the period of time set out on the directives, working in overtime if necessary to meet the required date, except for those items that are:
- 2.26.2.1. The responsibility of the Owner;
- 2.26.2.2. Directives resulting from changes to the existing regulations.

2.27. Deficiencies not corrected

- 2.27.1. If there is a failure to carry out instructions of the inspecting authorities (except for those items that are the responsibility of the Owner and directives resulting from changes to the existing codes) within the period of time allowed by the authorities issue a credit to the Owner for any costs, including the cost of the inspecting authority reinspection, incurred by the Owner as a result of this failure.

2.28. Submission of proposal

- 2.28.1. Submission of a proposal will be considered presumptive evidence that the proposer is conversant with local facilities and conditions, requirements of the Contract Documents and of pertinent provincial and local codes, state of labour and material markets, and in the proposal has made due allowance for all contingencies.

2.29. Request for payment

- 2.29.1. Submit monthly applications for payment for work done at the end of each month together with the necessary data, information, waivers and affidavits.

2.30. Delay in making repairs

- 2.30.1. Execute promptly the necessary repairs to return non-functioning units to service.
- 2.30.2. Return units to service when answering service calls unless return visits are necessary for additional troubleshooting or to source replacement parts.
- 2.30.3. Where return visits are necessary, promptly return to the site on the next business day upon availability of the necessary replacement parts.

2.31. Personnel

- 2.31.1. Supervise personnel so that they present a neat appearance and their movement in the building is within the requirements of their work.
- 2.31.2. Provide uniforms and photo identification for personnel.
- 2.31.3. The Owner reserves the right to reject or refuse access to personnel or contractors at its sole discretion.
- 2.31.4. Assign and maintain a dedicated service representative to the work, this representative to be responsible for liaison with the Owner and the Consultant.
- 2.31.5. Assign and maintain a dedicated service supervisor to the work, this supervisor to be responsible for technical communications with the Owner and the Consultant.

2.32. Designated substances

- 2.32.1. The Contractor is responsible to adhere to the designated substances and/or hazardous substances management programs in place at the site including, but not limited to, the presence of asbestos.
- 2.32.2. In the event that designated substances or hazardous substances are discovered by the Contractor's personnel and not previously identified by the Owner, report such substances to the Owner.
- 2.32.3. The Contractor shall not be responsible for abatement of designated substances or hazardous substances.
- 2.32.4. The Contractor acknowledges that small amounts of designated substances or hazardous substances may be present in elevator components (such as asbestos in brake pads and mechanical gaskets, lead in paints and soldering, silica in concrete and masonry, mercury in fluorescent light tubes, PCBs in transformers, etc.), and the Contractor shall ensure proper maintenance procedures are followed to safely complete maintenance, repair and replacement of such components.

2.32.5. The Contractor shall provide personal protective equipment as necessary to comply with the management program for work in such environments including, but not limited to, disposable protective clothing (gloves, boot covers, coveralls) and fit-tested respirators.

2.33. Labour disruptions

2.33.1. In the event of a labour disruption of the Contractor's technicians (e.g. strike, lockout, etc.) provide alternative qualified personnel to:

2.33.1.1. Respond to regular call-backs on non-critical units during regular working hours;

2.33.1.2. Respond to regular call-backs on critical units 24 hours per day, seven days per week;

2.33.1.3. Respond to emergency call-backs 24 hours per day, seven days per week;

2.33.1.4. Complete regular maintenance activities required by the Authority Having Jurisdiction.

2.33.2. For units that remain operational throughout the duration of the labour dispute, but where regular maintenance activities required by the Authority Having Jurisdiction are not performed, provide a credit of 50% towards the regular monthly maintenance fees for the duration of the labour dispute.

2.33.3. For units that were shut down and remained out of service during the labour dispute provide a credit of 100% towards the regular monthly maintenance fees for the duration of the time that the elevator was shut down.

2.34. Coordination with Owner

2.34.1. Before each routine maintenance visit contact a representative specified by the Owner.

2.34.2. Discuss the operation of the equipment with the Owner's representative and take immediate action on problems.

2.34.3. Should a problem be of a nature that cannot be satisfactorily resolved during the inspection or trouble call, report back to the Owner's representative to explain why it was not possible to correct the problem and when the problem will be resolved.

2.35. Rules of work: elevators

2.35.1. Check with and obtain approval from the site building management prior to taking an elevator out of service.

2.35.2. Keep the site building management informed of work activity including, but not limited to, the following:

2.35.2.1. When an elevator is taken out of service;

2.35.2.2. When an elevator is placed back in service;

2.35.2.3. When starting work each day;

2.35.2.4. When finishing work each day.

2.35.3. Perform work on an elevator at a floor selected by the site building management.

2.35.4. Where possible restrict activities to inside the hoistway with the hall doors closed.

2.35.5. Do not leave materials or tools in the elevator lobbies or other public areas.

2.35.6. Do not leave an elevator out of service with the hall and car doors open except as approved by site building management.

2.35.7. When taking an elevator out of service, station someone at the entrance or erect barricades so as to ensure that a passenger does not enter and is not trapped in the cab.

2.35.8. When finished working on the elevator, ensure that the elevator is in proper working order.

2.36. Software and firmware updates

2.36.1. Check each January for equipment software and firmware updates and advise the Owner of the status of these updates.

2.36.2. Obtain and install updates.

PART 3 - MAINTENANCE PROCEDURES

3.1. Maintenance Control Program

3.1.1. Provide to the Owner and the Consultant a copy of the Maintenance Control Program for each device type.

3.1.2. During the course of the maintenance contract update the Maintenance Control Program as necessary and forward to the Owner and the Consultant a copy of the updated Maintenance Control Program.

3.1.3. The Maintenance Control Program is the property of the Owner.

3.1.4. Store the Maintenance Control Program on site in accordance with the requirements of the Authority Having Jurisdiction.

3.1.5. Do not use electronic Maintenance Control Programs without explicit permission of the Owner.

3.1.6. Execute the maintenance in accordance with these specifications and the Maintenance Control Program.

3.1.7. As a minimum, perform tasks as required by the Authority Having Jurisdiction at the appropriate intervals.

3.1.8. Where maintenance and testing frequencies in the Maintenance Control Program are less frequent than the intervals defined in these specifications, these specifications shall take precedence and such frequencies shall be reflected in each device-specific Maintenance Control Program.

3.1.9. The Owner may approve changes to these specifications provided that the minimum requirements of the Authority Having Jurisdiction are respected.

3.1.10. In advance of performing Category 5 testing, submit to the Owner and Consultant a written plan outlining:

3.1.10.1. Step-by-step instructions of how the testing will be performed;

3.1.10.2. Names and qualifications of personnel selected to perform the testing;

3.1.10.3. Incremental testing procedures;

3.1.10.4. Alternative testing means, if applicable and accepted by the Authority Having Jurisdiction;

3.1.10.5. Schedule of the work.

3.1.11. As part of the Category 5 testing:

3.1.11.1. Perform pre-testing of the safeties prior to full load testing by testing application of the safeties at inspection speed with no load in the cab.

- 3.1.11.2. Perform alternative testing and provide the results to the Owner in an acceptable electronic format (e.g. PDF), and provide a hard copy printout in the Maintenance Control Program, for record keeping and to establish a baseline for future testing.
- 3.1.11.3. Take reasonable steps to protect the cab finishes from damage (i.e. laying down plywood or using rubberized weights).
- 3.1.11.4. If completion of the test on an elevator requires that adjacent elevators in the same group be removed from service, perform the testing outside of regular hours at a time approved by the Owner.
- 3.1.11.5. If testing is performed prior to submitting an adequate plan and receiving approval from the Owner, or testing deviates from the requirements herein, the Contractor is responsible for correcting any and all damage that may result from the testing (i.e. including building damage).
- 3.1.11.6. The contractor is responsible to repair or replace any elevator components that may be damaged or fail as a result of testing.

3.2. Repairs

- 3.2.1. For scheduled repair work, outside of the regular maintenance procedure, give the Owner at least two weeks prior notice.
- 3.2.2. For unscheduled repair work, outside of the regular maintenance procedure, give the Owner immediate notice.
- 3.2.3. Communicate, in writing, the status of repairs to the Owner at the beginning and close of the normal working day.
- 3.2.4. Where possible indicate the time required for completion of repairs.

3.3. Mis-adjustment

- 3.3.1. Do not change any of the adjustments in such a way as to lead to a deterioration of the equipment performance.
- 3.3.2. Do not, in the course of routine maintenance or trouble shooting, re-adjust any of those settings which affect either the performance or the safety of the equipment.
- 3.3.3. Should it appear that some setting has changed or some problem has arisen such as to alter the performance of the equipment, arrange that a qualified adjuster with the appropriate tools, manuals and training make the necessary re-adjustments in an organized, systematic way.
- 3.3.4. Do not allow ad hoc adjustments to the equipment.

3.4. Safety devices

- 3.4.1. At no time permit the equipment to operate while any of the safety devices, mechanical or electrical are in-operative.

3.5. Equipment defects

- 3.5.1. Should a defect in the equipment or the design of the equipment become apparent based on experience with this installation or similar installations elsewhere, advise the Owner immediately in writing setting out the steps to be taken to correct the problem.
- 3.5.2. Forward to the Owner copies of any memoranda, internal or external, published or unpublished, dealing with actual or potential flaws in the equipment and design.

3.6. Call-back service

- 3.6.1. Include, as part of the maintenance program, regular and emergency call-back service.
- 3.6.2. Provide regular and emergency call-back service 24 hours per day, seven days per week.
- 3.6.3. An emergency is a situation such as:
 - 3.6.3.1. An entrapment;
 - 3.6.3.2. An incident;
 - 3.6.3.3. An accident
 - 3.6.3.4. A shut down of more than one elevator in a group;
 - 3.6.3.5. The absence of elevator service to a floor;
 - 3.6.3.6. The absence of escalator service during the month of December for shopping and retail centres;
 - 3.6.3.7. The absence of escalator service during a key time period as defined by the Owner.
- 3.6.4. At the time the call is placed the Owner may choose to indicate that the call can be handled during regular hours; otherwise, answer the call immediately whether it be in overtime or regular time.
- 3.6.5. Respond only to calls placed by the Owner except in the case of emergency calls.
- 3.6.6. Provide an answering service staffed twenty-four hours per day.
- 3.6.7. Provide, where applicable, an answering service inclusive of two-way non-verbal communication and the means to monitor video.
- 3.6.8. Ensure that calls received by the answering service are transmitted immediately to a responsible person for action.
- 3.6.9. Provide regular call-back response within a maximum of two hours from the time a call is placed until the arrival of a maintenance person at the site.
- 3.6.10. Provide emergency call-back response within a maximum of 45 minutes from the time a call is placed until the arrival of a maintenance person at the site.

3.7. Maintenance: assistance for inspections & testing

- 3.7.1. Provide all necessary co-operation and assistance to allow inspections of the equipment by the Consultant and by the Inspecting Authorities.
- 3.7.2. Provide all necessary co-operation and assistance, either in regular time or overtime, to allow testing of those systems associated with the equipment such as smoke detectors, fire detectors, heat detectors, emergency power, firefighters emergency operation, communication systems, security systems and other systems ancillary to the equipment.
- 3.7.3. In the event that this requires the supply of one crew for more than an average of three hours per unit per year, submit a request to the Owner for an extra to contract payment.
- 3.7.4. Should the tests fail because of problems with the elevator or escalator equipment provide any necessary additional assistance at no extra charge.

3.8. Fire service testing

- 3.8.1. Perform testing of fire recall and Firefighters' Emergency Operation in accordance with B44 section 8.11.
- 3.8.2. For single elevators, residential building and hotels, execute the tests during regular hours.
- 3.8.3. For all other elevators (including elevators groups, or any elevators in commercial, retail or institutional buildings) execute the tests outside of regular hours or during regular hours with written approval of the Owner.
- 3.8.4. Carry out the testing as required by the regulatory authorities.
- 3.8.5. Record the results of the testing in the maintenance log book or in a dedicated fire service testing log book.

3.9. Safety inspections

- 3.9.1. Carry out instructions of the inspecting authorities within the period of time allowed by the authorities or, if no period is designated, 30 days of notice of deficiency except for those items that are the responsibility of the Owner and directives resulting from changes to the existing codes.

3.10. Manufacturers' parts

- 3.10.1. Supply replacement parts identical in make and model to the original parts where at all possible.
- 3.10.2. Where identical parts are not available or a better substitute is available submit the alternative part for the approval of the Owner.

3.11. Substitute parts

- 3.11.1. Where items visible to the general public, in particular exposed finishes and fixtures, are to be replaced, submit drawings, photographs or samples, as required, in ample time for consideration and review.
- 3.11.2. Submit samples of metals, plastic laminates and finishes properly identified as to project, location and material.
- 3.11.3. Supply materials in accordance with the reviewed samples.
- 3.11.4. The review does not include the checking of measurements nor the approval of variations from the Specifications or the Contract Documents.

3.12. Parts stocked locally

- 3.12.1. Arrange that the following spare parts are available on site, in a service vehicle or from the local maintenance office and allow the Owner, at their request, to inspect these parts:
 - 3.12.1.1. Buttons: four button heads;
 - 3.12.1.2. Car door equipment: two car door sheaves and one set of door gibs;
 - 3.12.1.3. Hall door equipment: one complete hoistway door closer assembly, two interlocks, four hall door sheaves, and two sets of door gibs;
 - 3.12.1.4. Fuses: three fuses of each size used in the controller and in the main line disconnect;
 - 3.12.1.5. Relays: three complete relays of each type with spare contacts and coils;
 - 3.12.1.6. An adequate supply of cleaning solvent, wipers, general purpose oil and door operator oil.

- 3.12.1.7. At least one spare for each part used in quantity on the equipment in the ratio of one spare for every 100 such parts.

3.13. Parts available as required

- 3.13.1. Arrange that spare parts not stocked locally, but for which like-for-like replacements are readily available from manufacturers, are provided within 72 hours to the site.
- 3.13.2. The Contractor shall arrange and pay for expedited shipping where necessary to meet this requirement.
- 3.13.3. For parts that are not stocked locally and not readily available from manufacturers, such as parts that require off-site repair or parts that are manufactured to suit the installation, the Contractor shall provide to the Owner an estimate for the time to manufacture or repair the part.

3.14. Building log

- 3.14.1. Complete required entries for building log systems.

3.15. Maintenance log book

- 3.15.1. Provide a maintenance log in a permanently bound journal having pre-numbered pages.
- 3.15.2. Indicate in the journal the following information: date, time, name of maintenance technician, regular maintenance, regular time callback, over time callback, action taken, work completed, and further repairs required.
- 3.15.3. The journal is the property of the Owner.
- 3.15.4. Maintain the journal current, on the premises, and available for inspection by the Owner at any time.
- 3.15.5. Make entries in ink, legibly, consecutively and without blanks.

3.16. Time tickets

- 3.16.1. Indicate the section of the normal maintenance schedule on each time ticket with details of the portion of the section completed.
- 3.16.2. Submit time tickets for each call-back detailing the cause of the call-back and the action taken.
- 3.16.3. If electronic time tickets are used, make these tickets accessible to the owner through internet at all times.

3.17. Data submission

- 3.17.1. Submit data to a Consultant website in an electronic format prescribed by the Owner.
- 3.17.2. In the absence of other requirements, submit data each month for call-backs and maintenance work in a Comma-Separated-Values (.csv) file with each line having the following information: Licence #; Call Time; Response Time; Resolution Time; Problem Description; Corrective Action; Entry Type; Scorecard Exemption; Exemption Reason with each item having the following meaning:
- 3.17.2.1. Licence #: The licence number assigned to the unit by the Authority Having Jurisdiction (where one has not been assigned, is not unique or is not known please coordinate a number with KJA).
- 3.17.2.2. Call Time: Date and time the call-back is reported by the client or date and time the elevating device is removed from service for maintenance or repair in format YYYY-MM-DD HH:MM.
- 3.17.2.3. Response Time: Date and time technician arrives on site to respond to the call-back or date and time the elevating device is removed from service for maintenance or repair in format

- YYYY-MM-DD HH:MM (in the event of a deferred call-back, the elapsed time will start based on 07:00 on the first business day following the original Call Time).
- 3.17.2.4. Resolution Time: Date and time the elevating device is returned to service in format YYYY-MM-DD HH:MM.
- 3.17.2.5. Problem Description: Description of problem as reported.
- 3.17.2.6. Corrective Action: Description of work done to correct problem as reported by the technician.
- 3.17.2.7. Entry Type: Type of call as "C" for call-back, "E" for call-back with entrapment, "D" for call-back with deferred response. "R" for maintenance or repair.
- 3.17.2.8. Scorecard Exemption: Marked "Y" or "Yes" if the Contractor is requesting an exemption from the scorecard for this call-back (null values or "N" are the only other acceptable values).
- 3.17.2.9. Exemption Reason: Description of why the Contractor is requesting the call-back or repair be exempted from the scorecard calculations (an entry in this field is required when the Scorecard Exemption field is "Y" or "Yes").
- 3.17.3. Submit the data for the month on or before the fifth day of the following month.
- 3.17.4. The Owner, acting reasonably, may at any point during the contract:
- 3.17.4.1. Change the format of the data submission.
- 3.17.4.2. Require a direct electronic exchange of data using standard protocols for data exchange to a Consultant website.

3.18. Accidents and claims

- 3.18.1. In the event of an accident causing death, personal injury or property damage, arising out of or in connection with the equipment or the performance of the Work whether on or adjacent to the site, advise the Owner immediately giving a verbal report and submit to the Owner within 24 hours of the accident signed written reports from each of the maintenance personnel involved.
- 3.18.2. In the event of an injury to anyone working on or using the equipment, take whatever immediate action is necessary to aid the injured person and to prevent further injury to others.

3.19. Electrical diagrams

- 3.19.1. Maintain any existing electrical diagrams in good condition and do not remove electrical diagrams from the site.
- 3.19.2. Where existing electrical diagrams are not bound or laminated to protect the diagrams from damage, either bind or laminate the drawings for longevity as part of the maintenance.
- 3.19.3. If, in the course of the maintenance contract, changes are made to the wiring or control, supply to the Owner marked-up prints of the altered schematics and field wiring diagrams showing the changes.

3.20. Consultant's inspections

- 3.20.1. From time to time the Consultant will carry out inspections to verify that the Work is being carried out in accordance with the specifications and with industry standards.
- 3.20.2. The Consultant will prepare a report listing deficiencies.
- 3.20.3. Carry out such maintenance, repair and replacement to correct the deficiencies listed on the Consultant's Report within 30 days or, if it is anticipated that the corrective measures will require more time, advise the Consultant of this and obtain their approval of the extension.

3.21. Maintenance tasks (rope replacements)

3.21.1. In addition to the tasks required in the Maintenance Task Intervals, perform maintenance in accordance with the following requirements.

3.21.2. When replacing the elevator suspension means:

3.21.2.1. Ensure that the number of wire rope rotations does not exceed:

3.21.2.1.1. 1.5 rotations per 30.5 m (100 ft.) for a 1:1 roping arrangement;

3.21.2.1.2. 3 rotations per 30.5 m (100 ft.) for a 2:1 roping arrangement.

3.21.2.2. Use wedge type cable clamps for suspension means;

3.21.2.3. Within six to eight weeks, inspect the suspension means and shorten as necessary.

PART 4 - PERFORMANCE

4.1. Performance data

4.1.1. Maintain the elevators so that at all times they comply with the following performance parameters.

| | geared machine with solid state drive | gearless machine with solid state drive |
|--------------------------|---|---|
| Operating time | < 8.0 s | < 7.8 s |
| Levelling accuracy | +/- 6 mm | +/- 6 mm |
| Speed accuracy | +/- 1.5 % | +/- 1.5 % |
| Door noise level | < 60 dB | < 60 dB |
| Cab noise level | < 55 dB | < 55 dB |
| M/R noise level | < 75 dB | < 75 dB |
| Average acceleration | < 0.95 m/s/s | < 0.95 m/s/s |
| Peak acceleration | < 1.2 m/s/s | < 1.2 m/s/s |
| Change in acceleration | < 1.9 m/s/s/s | < 1.9 m/s/s/s |
| Max horizontal vibration | 0.15 m/s/s | 0.15 m/s/s |

4.2. Performance data measurement method

4.2.1. The horizontal vibration, front to rear or side to side, is measured in the elevator cab with the elevator travelling with a load of less than 10 per cent of capacity from top to bottom and bottom to top (measured between two consecutive points of opposite value).

4.2.2. The door noise level is measured using an ANSI type 2 sound level meter on the "A" scale with an "F" response within the cab during a full door open, door close and door reversal cycle.

4.2.3. The cab noise level is measured using an ANSI type 2 sound level meter on the "A" scale with an "F" response within the elevator cab with the elevator travelling from one end of the hoistway to the other with the cab fan on.

4.2.4. The machine room noise level is measured with the elevator running by a meter positioned in the centre of the machine room.

4.2.5. The operating time is measured for a typical floor run (less than 4000 mm [13']) from the time when the fully opened doors begin to close until the car is stopped level with the next floor and the car and

hall doors are 800 mm (32") open. For door types other than centre-opening or slow rated speed, the specified operating time is adjusted as follows:

- 4.2.5.1. For elevators with side-opening doors and a door width under 1100 mm (43"), add 2.0 seconds to the specified operating time.
- 4.2.5.2. For elevators with wider entrances and centre-opening doors, add 0.25 seconds per additional 150 mm (6") of door width to the specified operating time.
- 4.2.5.3. For elevators with wider entrances and side-opening doors add 0.5 seconds per additional 150 mm (6") of door width to the specified operating time.
- 4.2.5.4. For electric elevators with a contract speed under 1.78 metres per second (350 fpm), add 1.5 seconds to the specified operating time.

4.3. Maintenance tasks: electric elevators

4.3.1. Check the following elements during each periodic maintenance visit:

- 4.3.1.1. Car ride and general operation;
- 4.3.1.2. Levelling;
- 4.3.1.3. Hall and car door operation;
- 4.3.1.4. Alarm bell;
- 4.3.1.5. Communication system;
- 4.3.1.6. Door open button;
- 4.3.1.7. Door force (maximum of 135 Newtons [30 lb]);
- 4.3.1.8. Door re-opening device;
- 4.3.1.9. Position indicators;
- 4.3.1.10. Car operating panel devices;
- 4.3.1.11. Commutator brushes.

4.3.2. Perform the following duties at least once every six months:

- 4.3.2.1. Clean pit;
- 4.3.2.2. Clean tops of car;
- 4.3.2.3. Clean the machine removing any oil from the gland packing drip tray;
- 4.3.2.4. Check and lubricate the governor tension sheave;
- 4.3.2.5. Check and lubricate the governor;
- 4.3.2.6. For oil buffers, check the buffers and the buffer oil;
- 4.3.2.7. For chain compensation, check the chain fastening and the chain release safety switch.
- 4.3.2.8. For group operation, check the door open pause times to ensure that they are consistent from one car to another in a group;
- 4.3.2.9. Check the door open pause time cancellation (i.e. monitor) circuit;

- 4.3.2.10. Check the load weighing devices;
- 4.3.2.11. Check the suspension means and governor rope.
- 4.3.3. Perform the following duties at least once every year:
 - 4.3.3.1. Check the machine and motor;
 - 4.3.3.2. Check and lubricate machine bearings, where necessary, in accordance with manufacturer's recommendations;
 - 4.3.3.3. Check the operation of the emergency brake;
 - 4.3.3.4. Check suspension means hitches;
 - 4.3.3.5. Inspect suspension means for wear in accordance with standards for elevator suspension means inspection;
 - 4.3.3.6. Lubricate the hoist ropes and compensation ropes in accordance with the rope manufacturer's recommendations;
 - 4.3.3.7. Check suspension means tension and adjust if necessary;
 - 4.3.3.8. Check for stretch in the suspension means and remove buffer blocks or shorten suspension means if required;
 - 4.3.3.9. Clean the machine with vacuum and blower;
 - 4.3.3.10. Check the tachometer;
 - 4.3.3.11. Check rotating electrical equipment connections;
 - 4.3.3.12. Remove the covers of the car operating panels and check the internal components and connections;
 - 4.3.3.13. Lubricate and clean car door tracks;
 - 4.3.3.14. Clean control room and control room floor;
 - 4.3.3.15. Check the car door contacts;
 - 4.3.3.16. Check the hoistway door interlocks.
 - 4.3.3.17. Check the car door rollers and eccentrics;
 - 4.3.3.18. Check the car door clutch assembly;
 - 4.3.3.19. Check door operator, clean and lubricate pivot points;
 - 4.3.3.20. Clean guide rails and guide rail fastenings;
 - 4.3.3.21. Vacuum hoistway from top to bottom;
 - 4.3.3.22. Replace the filters on the controller air inlets;
 - 4.3.3.23. Clean and check safety mechanism;
 - 4.3.3.24. Perform a test of the safeties;
 - 4.3.3.25. Check sheaves and shafts for soundness and wear;

- 4.3.3.26. Check the terminal slowdown device;
- 4.3.3.27. Strip, clean and lubricate the brake;
- 4.3.3.28. Check that the brake stops the elevator from full speed in the up direction with an average deceleration of approximately 0.1g without shock or jar;
- 4.3.3.29. Check to ensure that the brake spring setting is correct;
- 4.3.3.30. Ensure that the brake operates quietly so that no noise can be detected either in the elevator cab, at the top floor landing or outside the closed machine room door;
- 4.3.3.31. For oil buffers, check the buffer oil levels, check for water in the oil and test the buffers;
- 4.3.3.32. Check travelling cables for wear;
- 4.3.3.33. Check hangers and junction box connections;
- 4.3.3.34. Check guide rail fastenings;
- 4.3.3.35. Check the speed, acceleration and jerk profiles and if necessary adjust the drive parameters;
- 4.3.3.36. Measure performance parameters (noise levels, vibration, operating times) and re-adjust if required;
- 4.3.3.37. Check components and fastenings that under failure might create a dangerous situation (e.g. sheave bolts and welds, gear bolts, car slings et cetera);
- 4.3.3.38. As required, clean and paint machine room and pit floor (perform not less than once every five years);
- 4.3.3.39. Check the emergency power or battery lowering device operation.
- 4.3.3.40. Check the emergency fire recall operation.
- 4.3.3.41. Check the functioning of the in Firefighters' Emergency Operation.
- 4.3.3.42. Submit a report to the Owner confirming that the annual checks have been carried out, listing the items checked and the measured performance parameters.
- 4.3.4. When replacing the elevator suspension means:
 - 4.3.4.1. Ensure that the number of rope rotations does not exceed:
 - 4.3.4.1.1. 1.5 rotations per 30.5 m (100 ft.) for a 1:1 roping arrangement;
 - 4.3.4.1.2. 3 rotations per 30.5 m (100 ft.) for a 2:1 roping arrangement.
 - 4.3.4.2. Use wedge type cable clamps for suspension means;
 - 4.3.4.3. Within six to eight weeks, inspect the suspension means and shorten as necessary.

4.4. Maintenance tasks: lifts

- 4.4.1. Check the following elements every three months:
 - 4.4.1.1. Levelling operation;
 - 4.4.1.2. Door operation;

- 4.4.1.3. Protective devices;
 - 4.4.1.4. Emergency stop switch;
 - 4.4.1.5. Alarm bell;
 - 4.4.1.6. Communication devices;
 - 4.4.1.7. Door open button;
 - 4.4.1.8. Load weighing devices;
 - 4.4.1.9. Machine;
 - 4.4.1.10. Position indicators and signal lamps.
 - 4.4.1.11. The hydraulic fluid level;
 - 4.4.1.12. The piston gland packing;
 - 4.4.1.13. Clean pits;
 - 4.4.1.14. Clean tops of cars;
 - 4.4.1.15. Clean machine and machine room floor.
 - 4.4.2. Perform the following duties at least once every year:
 - 4.4.2.1. Check the plungers and rope sprockets as required;
 - 4.4.2.2. Inspect ropes for wear in accordance with standards for elevator wire rope inspection as required;
 - 4.4.2.3. Check the emergency signal device;
 - 4.4.2.4. Check components and fastenings that under failure might create a dangerous situation (e.g. sheave bolts and welds, gear bolts, car slings et cetera);
 - 4.4.2.5. Check and clean the sheaves as required;
 - 4.4.2.6. Clean the machine;
 - 4.4.2.7. Clean the brake as required;
 - 4.4.2.8. Check the emergency stopping device;
 - 4.4.2.9. Vacuum the hoistway from top to bottom;
 - 4.4.2.10. Check the limit switches and safety switches.
 - 4.4.2.11. Submit a report to the Owner confirming that the annual checks have been carried out.
- END OF SECTION
END OF SPECIFICATION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the Work.
- 1.1.2. The Specification is divided into Sections which are not intended to identify contractual limits between Subcontractors nor between the Contractor and their Subcontractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.
- 1.1.3. Provide mechanical components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.

1.2. INTENT

- 1.2.1. Mention in the Specifications or indication on the Drawings of equipment, materials, operation and methods, requires provision of the quality noted, the quantity required, and the systems complete in every respect.
- 1.2.2. The Specifications are an integral part of the accompanying Drawings. Consider any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, as properly and sufficiently specified.
- 1.2.3. Be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment and part of equipment and repair related damages.

1.3. SECTIONS AFFECTED

- 1.3.1. These instructions apply to and form a part of all Division 20, 21, 22, and 23 Sections referred herein as Mechanical.

1.4. DEFINITIONS

- 1.4.1. Where used on the Drawings or in the Specifications, the following words are given the meanings below.
 - 1.4.1.1. Provide: means supply, install, connect and test.
 - 1.4.1.2. Demolish: detach existing items and legally dispose of them off site.
 - 1.4.1.3. Remove and Reinstall: Detach existing items, prepare them for reuse, and reinstall them where indicated.
 - 1.4.1.4. Existing to Remain: existing items that are not removed and that are not otherwise indicated as being removed, removed and salvaged (turned over to Owner), or removed and reinstalled.
 - 1.4.1.5. Remove and Salvage: detach existing items and turn over to Owner.

1.5. REGULATIONS

- 1.5.1. Perform Work in accordance with codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.
- 1.5.2. Comply with all guidelines and standards issued by the authorities having jurisdiction.
- 1.5.3. Where names of codes and standards are referenced on the Contract Documents, comply with the latest in force edition in the jurisdiction of the Place of the Work.

- 1.5.4. Comply with regulations respecting plumbing made under the following legislation except as modified by rules, regulations and by-laws of authorities having jurisdiction:
 - 1.5.4.1. Ontario Water Resources Act.
 - 1.5.4.2. Ontario Building Code Part 7.
- 1.5.5. For natural gas systems, follow the requirements of:
 - 1.5.5.1. Regulations made under the Technical Standards and Safety Act
 - 1.5.5.2. CAN/CSA B149.1 - Natural Gas and Propane Installation Code.
- 1.5.6. Provide materials and assemblies with flame-spread ratings and smoke developed classifications in conformance with CAN/ULC-S102 "Test for Surface Burning Characteristics of Building Materials and Assemblies." Compliance with ASTM E84 "Surface Burning Characteristics of Building Materials" in lieu of CAN/ULC-S102 is not acceptable.
- 1.5.7. These Specifications are supplementary to the requirements above.
- 1.5.8. Drawings and Specifications should not conflict with the above regulations but where there are apparent discrepancies, notify the Engineer's Representative.
- 1.5.9. Where equipment utilizing refrigerants is provided, comply with regulatory refrigerant phase out requirements and dates applicable in the jurisdiction where the Project is taking place. Where equipment not meeting refrigerant phase out requirements or dates is supplied to site, provide revised unit(s) operating on a new refrigerant at no additional cost to the Owner; cover all costs of any electrical, structural, mechanical, architectural, etc. changes required to accommodate the new refrigerant.

1.6. PERMITS, FEES AND INSPECTIONS

- 1.6.1. Obtain all permits, make submissions, pay all fees and arrange for all inspections required for the Work of this Division.

1.7. EXAMINATION OF SITE

- 1.7.1. Before submitting Bids, examine the site to determine the conditions which may affect the proposed Work. No claims for extra payment will be considered because of failure to fulfil this condition.

1.8. DRAWINGS, CHANGES AND INSTALLATION

- 1.8.1. The Drawings show the general character and scope of the Work and not the exact details of the installation. Install all equipment and systems complete with all accessories required for a complete and operational installation.
- 1.8.2. The location, arrangement and connection of equipment and material as shown on the Drawings represents a close approximation to the intent and requirements of the Work. The right is reserved by the Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no additional cost.
- 1.8.3. In order to show more clearly the arrangement of the Work, plans and sections do not show every valve, thermometer, pressure gauge or other system accessory. Refer to the Mechanical Standard Details and to the Specifications to determine the requirements.
- 1.8.4. Install equipment in accordance with the manufacturer's written installation requirements. In the event of conflicts between the Drawings or Specifications and the manufacturer's written installation requirements, notify the Engineer's Representative for resolution.
- 1.8.5. Certain Details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details are applicable to every occurrence.

- 1.8.6. Conceal all piping and ductwork in finished areas in ceiling spaces and shafts or furred into walls. Do not install exposed piping or ductwork in such areas unless specifically reviewed and accepted by the Engineer's Representative. Do not install piping in outside walls.
- 1.8.7. Do not install vent pipes, exhaust hoods or other mechanical equipment mounted on the roof, or housing for such equipment, closer to the edge of the roof than a distance equal to the height of the pipe, hood or equipment, unless specifically reviewed and accepted by the Engineer's Representative.
- 1.8.8. The location and size of existing services shown on the Drawings are based on the best available information. Site verify the actual location of existing services before commencing Work. Pay particular attention to underground services.
- 1.8.9. Make changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other Trades, or to accommodate existing conditions, at no additional cost.
- 1.8.10. Leave areas clear of piping and ducts where space is indicated as reserved for future equipment and equipment for other Trades.
- 1.8.11. Allow adequate space and provisions for the removal of coils and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.8.12. Where equipment is shown to be 'roughed-in only,' obtain accurate information from the Engineer's Representative before proceeding with the Work.
- 1.8.13. Before fabricating ductwork or piping for installation, make certain that such items can be installed as shown on the Drawings without interfering with the structure or the Work of other Trades. Submit any problems that cannot be solved in agreement with the other Trades affected, for resolution. If ductwork or piping is prefabricated prior to the investigation and reaching of a solution to possible interference problems, make necessary changes in such prefabricated items at no additional cost.
- 1.8.14. Location of diffusers, grilles, registers, thermostats, sprinklers and all other equipment shown on plans is diagrammatic. Layout of each device in finished areas is critical in terms of symmetry and location. Refer to Architectural Drawings and to Supplemental Instructions in all regards. Revise any Work not installed in the correct location (at the sole discretion of the Engineer's Representative) at no additional cost. Mark-out fully co-ordinated Work with all other trades, in sufficient time for review by Engineer's Representative prior to rough-in. Precisely locate all mechanical and sprinkler services.
- 1.8.15. Prepare dimensioned layouts of each room prior to rough-in for review by the Architectural Consultant. Do not proceed with any Work until the Engineer's Representative has reviewed the layout.

1.9. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

- 1.9.1. Submit installation, interference and setting drawings dimensioned and to scale, for review by the Engineer's Representative, as may be required or requested by the Engineer's Representative to make clear the Work intended or to show its relation to adjacent Work or to the Work of other trades. When an alternative piece of equipment is substituted for equipment shown, prepare drawings of the area involved. Submit drawings in pdf format as well as in the format the Tender Drawings are prepared.
- 1.9.2. Prepare installation working drawings to 1:50 scale (1/4 in. equal to 1 ft.) for mechanical rooms showing plan and sections of the plant, services, bases, curbs, drains, motor terminals, etc.
- 1.9.3. Prepare interference drawings for shafts, ceiling spaces, typical floors and wherever there is possible conflict with the positioning of mechanical equipment, piping or ductwork and architectural or structural features or the Work of other trades.

- 1.9.4. The design of the structural framing of the mechanical rooms and pipe spaces and major pipe run supports has been based on assumed loadings supplied during the design phase. Well ahead of the construction of the affected areas, prepare and submit drawings for review by the Engineer's Representative showing the layout and weights of all finally selected mechanical equipment including details of concrete pads, concentrated pipe loads and point reactions of the equipment onto the structure.
- 1.9.5. Prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for piping, ductwork and equipment. Bear the cost of all extra work necessary due to failure to provide information in time (i.e. before the concrete is poured).
- 1.9.6. Do not proceed with Work in areas involved until after final review of such drawings has been obtained.

1.10. BID FORM AND SUBMISSIONS OF BIDS

- 1.10.1. Submit with the bid, all information called for on the Bid Form. Bids not completed in full may, at the discretion of the Owner, be rejected.
- 1.10.2. Show alternative and unit prices for optional equipment or systems called for as additions to or deductions from the Bid amount.
- 1.10.3. Where only one name appears in the Specification, include the specified equipment in the Bid.
- 1.10.4. Where two or more names are shown in the Specifications as alternatives or equal to, this Division can select which manufacturer is to be carried, provided the choice is shown on the Bid Form. Where the choice is not indicated, supply the equipment described in the Specification or first named on the Bid Form.
- 1.10.5. Substitute equipment may be offered as a price deduction to the Bid price. Acceptance of substitute equipment is at the discretion of the Owner whose decision is final.
- 1.10.6. Provide materials and Products specified by the name of the manufacturer, the brand or trade name, or catalogue reference, as the basis of the Bid price. Provide these Products under the Contract unless substitutions are proposed and accepted in accordance with the following procedures:
- 1.10.6.1. Substitution may be proposed only when the phrase, "or other approved manufacturer" is included in the Specification.
- 1.10.6.2. List the proposed substitution under Substitute Equipment on the Bid Form.
- 1.10.6.3. Indicate the Product name and provide a complete Product description.
- 1.10.6.4. Clearly indicate the change in the Bid price for this substitution.
- 1.10.7. Only propose alternative and/or substitute equipment that is equal in performance and quality to that specified. Include the cost of all changes required to accommodate alternative and/or substitute equipment, in the price shown on the Bid Form, including but not limited to space, power, structural or any other requirements that are different from the equipment specified.
- 1.10.8. The Owner reserves the right to accept or reject any substitution without question.
- 1.10.9. Include the cost of premium time in the Bid price for Work provided during nights, weekends or other times outside normal working hours, necessary to maintain all mechanical services in operation and to meet the Project schedule.

1.11. MATERIALS

- 1.11.1. Make and quality of materials used in the construction of this Work are subject to the approval of the Engineer's Representative.
- 1.11.2. Supply only new materials and equipment, free from defects and as specified by the manufacturer's name and catalogue reference.

- 1.11.3. Where a manufacturer's equipment has been specified by name and/or model number, ensure that the performance and quality of equipment provided by an acceptable manufacturer, meets the specified equipment performance, is inclusive of all standard and specified optional features, and can be installed in the planned location with access and maintenance clearances in accordance with the manufacturer's written installation recommendations. Provide all required piping, duct and electrical connections at no additional cost.

1.12. CO-OPERATION WITH ENGINEER'S REPRESENTATIVE

- 1.12.1. To assist in the successful execution of the Project, the Contractor will receive an initial job report that summarizes the expectations of the Engineer's Representative and the Contractor. This job report covers topics such as progress billings, shop drawing requirements, Change Order pricing, the commissioning process, installation drawings, the Specifications, as-built drawings and operations and maintenance manuals, along with a number of other items. This job report is intended to reiterate key items from the Contract Documents and is not intended to impose new requirements.
- 1.12.2. At the appropriate time during construction, submit the applicable documentation listed below. The Engineer's Representative will review the information and identify when the information is complete. The Engineer's Representative's general review letter (required for building occupancy) will only be issued when the information requested below is submitted by the Contractor and deemed to be complete by the Engineer's Representative.
- 1.12.3. For mechanical systems occupancy, provide a PDF copy of the following documents to the Engineer's office for review:
- 1.12.3.1. CAN/ULC-S1001 "Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems" reports for mechanical systems
- 1.12.3.2. Fire alarm verification certificate
- 1.12.3.3. Fire protection system test reports, certificates, and verifications, including: material and test certificates for underground and/or above ground standpipe systems to NPFA 14, test certificate for fire booster pump to NFPA 20, verification letter of fire hose in place and complete with inspection tags to NFPA 14, verification letter of portable fire extinguishers in place and complete with inspection tags in compliance with Specifications for all floors to be occupied, and fire department inspection verification certificate.
- 1.12.3.4. Sprinkler System Engineer's letters of assurance and occupancy, signed and sealed by P.Eng.
- 1.12.3.5. Seismic Engineer's letters of assurance signed and sealed by P.Eng.
- 1.12.3.6. Contractor's letter verifying that all fire fighting access routes have been provided and are accessible
- 1.12.3.7. Contractor's letter confirming ventilation supply air and return air available for each room
- 1.12.3.8. Report confirming sanitary and lab exhaust systems operational
- 1.12.3.9. Stair pressurization start-up report
- 1.12.3.10. Fuel oil system completion certificates, including authority having jurisdiction inspection certificates
- 1.12.3.11. Contractor's letter verifying fire stops and smoke seals installed in accordance with Mechanical Specification
- 1.12.3.12. Contractor's letter verifying fire damper, smoke damper, and / or combination smoke / fire damper installations are in accordance with their listings and the Mechanical Specification, and fire damper test confirmation letter
- 1.12.3.13. Contractor's letter verifying smoke control system is installed, operational and commissioned per Mechanical Contract Documents and Building Code requirements

- 1.12.3.14. Contractor's letter verifying smoke control venting to aid firefighting is installed, operational and commissioned per Mechanical Contract Documents and Building Code requirements
- 1.12.3.15. Contractor's letter verifying carbon monoxide detection and exhaust system is installed, operational and commissioned per Mechanical Contract Documents and Building Code requirements
- 1.12.3.16. Start up report(s) for heating systems, air handling unit(s), heating boiler(s), fan coil unit(s), heat pump(s), fan(s), etc.
- 1.12.3.17. Contractor's letter confirming that emergency power generation ventilation system is installed, operational and commissioned
- 1.12.3.18. Start up report(s) for ventilation systems, air handling unit(s), fan coil unit(s), heat pump(s), fan(s), exhaust fan(s), etc.
- 1.12.3.19. Start up report(s) for cooling systems including chillers, cooling towers, air handling unit(s), fan coil unit(s), heat pump(s), split a/c unit(s), etc.
- 1.12.3.20. Plumbing system pressure testing, flushing, water quality test, and chlorination report(s)
- 1.12.3.21. Final plumbing inspection certificate
- 1.12.3.22. Pressure test report on all piping systems
- 1.12.3.23. Contractor's letter verifying that all plumbing fixtures are installed and operational
- 1.12.3.24. Test reports and certificates from local building inspection authority confirming that the following items are installed, pressure tested and operational: building drains, sanitary and storm building sewers, drainage system and venting system, pipes, fittings, fixtures, etc.
- 1.12.3.25. Backflow preventer test reports
- 1.12.3.26. Contractor's letter verifying grease interceptor(s) installed and tested in accordance with Mechanical Contract Documents and Building Code
- 1.12.3.27. Contractor's letter verifying oil interceptor(s) installed and tested in accordance with Mechanical Contract Documents and Building Code
- 1.12.3.28. Contractor's letter verifying acid neutralization system installed and commissioned in accordance with Mechanical Contract Documents and Building Code
- 1.12.3.29. Contractor verification of accessibility of the fire dampers, fixtures, cleanouts, valves, plumbing appliances, devices and equipment
- 1.12.3.30. Cyber Security Report Letter
- 1.12.3.31. Air balancing report
- 1.12.3.32. Hydronic (Piping) balancing report
- 1.12.3.33. Pressure testing of refrigerant systems report
- 1.12.3.34. Where the Owner has hired a third party commissioning agent, all documentation and completion of the commissioning process submitted up to the initial BAS commissioning stage where the system is ready for season performance testing, where relevant.
- 1.12.4. For mechanical systems financial close, provide the following additional documents to the Engineer's office for review:
 - 1.12.4.1. Copies of as-built drawings
 - 1.12.4.2. Operating and maintenance manual
 - 1.12.4.3. Warranty letter

1.13. SUBSTANTIAL PERFORMANCE

- 1.13.1. The Owner will not deem the Project “ready for use” as defined in the provincial or territorial lien legislation until the following minimum items are complete:
 - 1.13.1.1. Everything required in the clauses above for occupancy.
 - 1.13.1.2. All mechanical items commissioned and accepted by Engineer's Representative as noted in Specification Section 20 08 00 – COMMISSIONING.
 - 1.13.1.3. Submission of final, reviewed Operating and Maintenance Manuals including final reviewed Shop Drawings turned over to the Engineer's Representative and Owner as outlined in Section 20 08 03 – OPERATING AND MAINTENANCE INSTRUCTIONS.
 - 1.13.1.4. Submission of final, reviewed as-built documentation to the Engineer's Representative and Owner, as outlined in Specification Section 20 05 02 – AS-BUILT DRAWINGS. Note that this includes all final balancing reports.

1.14. CO-OPERATION WITH OTHER DIVISIONS

- 1.14.1. Pay particular attention to the proximity of electrical conduit and cable to mechanical piping and equipment.
- 1.14.2. Maintain at least 150 mm (6 in.) separation between pipes transporting hot fluids and pipes carrying cold fluids, unless approval from the Engineer's Representative is obtained.
- 1.14.3. Do not allow Electrical conduits to touch or be supported from piping or ductwork.
- 1.14.4. Install all materials in the spaces shown without encroaching upon space for materials installed under other Sections or Divisions. Where the space allocated to another Section or Division is encroached upon, relocate the materials to their proper space allocation in such a manner to complete the Work using space allocated to the various Sections and Divisions. Relocate materials and Work involved at no additional cost.
- 1.14.5. Supply all items to be built in ample time for rapid progress of the Work. Schedule and proceed with Work as required to satisfy the construction schedule.
- 1.14.6. Confirm the available voltage for all single phase and three phase motors or other similar electrically driven equipment with the Electrical Division prior to ordering the equipment. Report any discrepancy between the requirements identified within the Contract Documents and those of the Electrical Division to the Engineer's Representative and supply equipment to suit the appropriate power requirements. Bear all costs associated with failure to perform this coordination prior to ordering of the motors or equipment.

1.15. TEMPORARY USE OF EQUIPMENT

- 1.15.1. Where systems, or a part thereof, are operated during construction, maintain the system and equipment in proper operating condition.
- 1.15.2. Prior to application for Substantial Performance of the Work as certified by the Engineer's Representative, return the systems and/or equipment to new condition by replacing all consumables such as air or water filters, belts in belt driven equipment, etc. with new components. Clean the air side of all coils in the air handling systems, lubricate all bearings according to manufacturer's written factory standards and adjust the thermostatic control system according to Specifications. Clean all duct systems to NADCA Standards.

1.16. EXISTING SERVICES AND EQUIPMENT

- 1.16.1. Provide temporary filters, 1 in. thick disposable media type, over all return air openings in the base building HVAC systems that remain in operation during construction. Maintain and replace the temporary filter media as required to prevent construction dust from fouling the base building equipment. Remove same at the completion of construction. Replace filters in all base building air handling equipment i.e., Air Handling Units, Induction Units, Fan Coil Units, etc., after construction is completed.
- 1.16.2. Reuse existing materials and equipment wherever possible. Provide new materials and equipment as required to ensure a complete installation. Package and turn-over to Landlord all existing equipment, materials and associated controls not used in this contract. Include in the bid for all shipping and placement in a designated on-site storage location. Remove any equipment or material not wanted by the Landlord from the site.
- 1.16.3. Schedule all changes and connections to existing services at a time approved by the Engineer's Representative so as to avoid any interruption of such services during normal working hours. If necessary, make changes and connections to existing services outside of normal working hours, without additional cost.
- 1.16.4. All changes and connections to existing services shall be made only in a manner and at a time approved by the Engineer's Representative so as to avoid any interruption of such services during normal working hours. If necessary, make changes and connections to existing services outside of normal working hours, without additional cost.
- 1.16.5. Prior to operating any existing or new equipment during any stage of construction, receive written approval from the Landlord and Engineer's Representative.
- 1.16.6. Whenever existing services or equipment are to be removed, remove all associated piping and ducts back to the main, nearest pipe or duct and securely cap or plug open ends in an approved manner. If necessary to facilitate installation of new Work, remove existing services and equipment and then replace without additional cost.
- 1.16.7. Whenever it becomes necessary to relocate existing piping, ducts or equipment to make possible installation of the Work under this Contract, make such relocation without additional cost.
- 1.16.8. Where connections are made to existing services, replace and make good existing insulation.

1.17. INTERRUPTION OF SERVICES

- 1.17.1. Perform all shutdown, draining, filling and chemical treatment for any portion of the existing base building systems to the satisfaction of the Landlord's building operations staff and co-ordinate with the Landlord for time and duration of interruptions. Comply with all of the Landlord's instructions and include for all costs of this Work, including Work performed by the Landlord's Chemical Treatment Supplier, in the bid price.
- 1.17.2. Schedule interruptions of the mechanical services to any part of the building at a time agreeable to the Landlord. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.
- 1.17.3. Schedule interruptions of the mechanical services to any part of the building at a time agreeable to the Owner's Representative. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.
- 1.17.4. Obtain approval from the Engineer's Representative for testing and operation of major equipment to avoid excessive utility charges. Such testing is to be generally carried out after normal working hours or on weekends.
- 1.17.5. Perform all such overtime Work at no additional cost.

1.18. STATEMENT OF PRICES

- 1.18.1. For the purpose of progress applications, submit a summary statement of estimated prices for the various portions of the Work, including labour, materials and equipment shown separately. The total price of all portions of the Work must equal the total price of the Work covered under Divisions 20, 21, 22 and 23.
- 1.18.2. Submit the summary of Work for this Contract to the Engineer's Representative for review and approval. Provide sufficient detail in the summary to enable the Engineer's Representative to evaluate the progress of Work and identify all major equipment, components and sub trades.

1.19. METRIC CONVERSIONS

- 1.19.1. Take particular care with imperial versus SI metric conversions. This applies to all services including, but not limited to, equipment, pipes, ductwork and site services in both new and existing installations.
- 1.19.2. Conform to CAN/CSA-Z234.1 "Metric Practice Guide."

1.20. ALTERNATIVE AND IDENTIFIED PRICES

- 1.20.1. If alternative and unit prices have been requested, include on the Bid Form. Prices not on the Bid Form at time of submission will not be accepted. Refer to the Specifications and the Drawings for details.

1.21. DEMOLITION

- 1.21.1. The Drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services, follow the service through to ensure other areas of the building are not affected. Open shafts, walls and ceilings as required to examine the services.
- 1.21.2. If there are no isolating valves readily available to isolate sections of pipe that requires removal, add valves as required. The cost of these valves will be paid for from the Cash Allowance Section. Co-ordinate with the Engineer's Representative to shut-down the system. Install caps on all services. Add caps to all valves at the termination point of existing services.
- 1.21.3. Where valves are removed, remove valve tags, revise existing charts and hand tags over to Owner.

1.22. SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

- 1.22.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.
- 1.22.2. There may be access restrictions to the site (location, time of day, days of week). Refer to Front End Specifications for more information and conform to all requirements stated within.
- 1.22.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. In particular:
- 1.22.3.1. No open flames without prior written approval of the Owner.
- 1.22.3.2. No smoking.
- 1.22.3.3. Keep the site clean at all times.

1.23. HOUSEKEEPING PADS, CURBS AND SUPPORT PIERS

- 1.23.1. Provide dimensioned drawings for final sizes and locations for housekeeping pads, support piers, and curbs around all floor penetrations for pipes and ducts. Submit for review by Division 3 and the Engineer's Representative. Extend edge of equipment housekeeping pad 100 mm (4 in.) beyond equipment frame and hold down bolts. Refer to the Drawings and Details for additional information.
- 1.23.1.1. Mechanical Division shall furnish and install curbs and housekeeping pads.
- 1.23.1.2. Mechanical Division shall furnish and install equipment support piers.
- 1.23.1.3. Division 3 shall furnish and install curbs and housekeeping pads.
- 1.23.1.4. Division 3 shall furnish and install equipment support piers.
- 1.23.2. Provide housekeeping pad and curb heights as follows:
- 1.23.2.1. Air handling equipment with cooling coils: 150 mm (6 in.).
- 1.23.2.2. Air handling equipment with heat wheels: 200 mm (8 in.).
- 1.23.2.3. All other equipment: 100 mm (4 in.).
- 1.23.2.4. Curbs around floor penetrations: 50 mm (2 in.).

1.24. ASHRAE 90.1

- 1.24.1. Provide mechanical equipment that complies with the minimum efficiency standards set out in ASHRAE 90.1 "Energy Standard for Buildings Except Low-rise Residential Buildings" and the National Energy Code of Canada for Buildings. Submit all necessary information to substantiate conformance.

1.25. HOISTING FACILITIES

- 1.25.1. Provide hoisting facilities for the Work of this Division.
- 1.25.2. Hoisting facilities provided by the General Contractor may be available for Subcontractor's use. If the General Contractor's hoisting facilities are inadequate, provide hoisting facilities for the Work of this Division. Coordinate requirements with the General Contractor prior to submission of Bid.

1.26. HEALTHCARE FACILITY REQUIREMENTS

- 1.26.1. This Project or facility, in part or in whole, includes areas that shall conform to the following requirements for design, materials and installation for healthcare facilities. Be responsible for adhering to these Standards and Municipal or Provincial requirements:
- 1.26.1.1. CSA Z317.2 "Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities."
- 1.26.1.2. CSA Z317.1 "Special Requirements for Plumbing Installations in Health Care Facilities."
- 1.26.1.3.

1.27. INTELLECTUAL PROPERTY

- 1.27.1. The Contractor acknowledges, represents, warrants and agrees that the Owner, its Consultants, and the Engineer's Representative are not responsible, and are hereby indemnified against any action as a result of patent infringement made through the review, acceptance, or receipt of materials, equipment, Work, etc. provided by the Contractor or any of their Suppliers or manufacturers in the execution of this Contract.

1.28. MATERIALS AND EQUIPMENT

- 1.28.1. Use new materials and equipment as specified or shown that are free from defects that impair strength, durability, or aesthetics.
- 1.28.2. Manufacture in Canada wherever possible.
- 1.28.3. Labelled and/or Listed as required by the Authority Having Jurisdiction or Code.
- 1.28.4. Mechanical systems are designed and coordinated based on the manufacturer and model number and/or parameters indicated on the Equipment Schedules. Accept all costs for differences in physical properties or performance between scheduled equipment and acceptable alternative equipment manufacturers or models identified in these Specifications. Differences may include, but are not limited to, size, layout, arrangement of components, connection sizes, maintenance access, locations and/or quantity of service connections, and performance differences such as noise, power consumption, flow rates, etc.
 - 1.28.4.1. Electrical coordination: accept all extra costs to revise the electrical provisions, including but not limited to feeder/wiring sizes, breaker sizes, fuse sizes, starters and equipment, to supply power to the non-basis of design piece of equipment.
- 1.28.5. Be responsible for all design costs associated with differences between scheduled equipment and alternate manufacturers or models identified in these Specifications.

1.29. CYBER SECURITY

- 1.29.1. Coordinate with Owner's Information Technology representatives, obtain a copy of Owner's cyber security policy and provide all applicable cyber security configurations.
- 1.29.2. Definitions
 - 1.29.2.1. Cyber Assets: Systems (including hardware, software, and data) and communication networks (including hardware, software, and data).
 - 1.29.2.2. Critical Cyber Assets: Cyber assets that perform critical system functions. The loss or compromise of these cyber assets would adversely affect the operational reliability of the system.
 - 1.29.2.3. Cyber Attack: The use of electronic means to interrupt, manipulate, destroy, or gain unauthorized access to a computer system, network, or device.
 - 1.29.2.4. Cybercrime: Any crime where cyber – the internet and information technologies, such as software, firmware, computers, tablets, personal digital assistants or mobile devices – has a substantial role in the commission of a criminal offence.
 - 1.29.2.5. Cyber Hygiene: Practices and steps that users of computers and other devices take to maintain system health and improve online security. These practices are often part of a routine to ensure the safety of identity and other details that could be stolen or corrupted.
 - 1.29.2.6. Cyber Incident: Any unauthorized attempt, whether successful or not, to gain access to, modify, destroy, delete, or render unavailable any computer network or system resource.
 - 1.29.2.7. Cyber Security: Technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access.
 - 1.29.2.8. Cyber Threat or Cyber Security Threat: Malicious act that seeks to damage data, steal data, or disrupt digital life in general. Cyber threats include computer viruses, data breaches, Denial of Service (DDoS / DoS) attacks and other attack vectors.
 - 1.29.2.9. Cyber Threat Actors: Broad term for any states, groups, or individuals who, with malicious intent, aim to take advantage of vulnerabilities, low cyber Security awareness, and technological developments to gain unauthorized access to information systems in order to access or otherwise affect victims' data, devices, systems and networks.

- 1.29.2.10. IP Multicast: Technique for one-to-many and many-to-many real-time communication over an IP Infrastructure network.
- 1.29.2.11. Endpoint: Remote computing device that communicates back and forth with a network to which it is connected. Such as a server, desktop, or laptop.
- 1.29.2.12. Network Certificates: Also known as a Digital Certificates, which are an electronic “password” that allows a person or organization to exchange data securely over the internet using the public key infrastructure (PKI). Digital Certificates are also known as a public key certificate or identity certificate. There are 3 Main types of certificates:
 - 1.29.2.12.1. Secure Socket Layer Certificate (SSL) Digi-SSL
 - 1.29.2.12.2. Software Signing (Code Signing Certificate) Digi-Code
 - 1.29.2.12.3. Client Certificate (Digital ID) Digi-ID
- 1.29.2.13. Social Engineering: Exploitation methods that target human vulnerabilities, such as carelessness and trust.
- 1.29.2.14. Technical Vulnerabilities: Weaknesses or flaws in the design, implementation, operation, or management of an information technology system, device, or service.
- 1.29.3. Cyber Security Measures
 - 1.29.3.1. Implement at minimum the following multi-layered Cyber Security measures to limit and / or reduce the Owner’s potential risk from a cyber threat event; such as a Cyber Security data breach or Cyber Security attack.
 - 1.29.3.2. Password Management
 - 1.29.3.2.1. Employ password management best practices such as:
 - 1.29.3.2.1.1. Do not use default passwords.
 - 1.29.3.2.1.2. Use strong and unique passwords for all applications. Use a minimum of 8 characters where there is no password policy inherent in the software; use a mixture of uppercase and lowercase letters, numbers, and include at least one special character (! @ # ?]).
 - 1.29.3.2.1.3. Reset passwords at regular intervals.
 - 1.29.3.2.1.4. Configure two-factor authentication for all accounts where possible in the system software.
 - 1.29.3.2.1.5. Do not use System Admin logins for simple tasks; create separate User accounts with rights levels appropriate for the job function. Create and define user accounts as appropriate such as Role based, Individual logins or assigned roles.
 - 1.29.3.2.1.6. Use different passwords for every account.
 - 1.29.3.2.1.7. Enforce secure password policies within the business environment.
 - 1.29.3.2.1.8. Have interface lock after a predefined # of failed login attempts for a pre determined time interval.
 - 1.29.3.3. Port and Interface Management
 - 1.29.3.3.1. Employ Port Management techniques such as:
 - 1.29.3.3.1.1. Restrict access on network switch ports to assigned devices addresses.
 - 1.29.3.3.1.2. Lock down all open, unused and unsecure ports on the networking devices such as switches, routers, and firewalls.
 - 1.29.3.3.1.3. Shut off all unused communication services and hardware interfaces.
 - 1.29.3.3.1.4. Advise Owner on use of 3rd party port security monitoring.
 - 1.29.3.4. Physical and Virtual Networks

- 1.29.3.4.1. Provide a dedicated VLAN for network connected systems where a dedicated LAN has not been provided.
- 1.29.3.5. Encryption
 - 1.29.3.5.1. Use minimum TLS 1.2 for all network attached equipment and use TLS 1.3 where available.
- 1.29.3.6. Network Certificates
 - 1.29.3.6.1. Ensure Network Certificates are up to date and not expired for all equipment and systems.
- 1.29.3.7. Firmware & Software Update Management
 - 1.29.3.7.1. Use the latest stable Firmware / Software version on all devices / equipment as well as implement a Firmware / Software Update management process and procedure.
- 1.29.3.8. Manufacturer's System Hardening Guides
 - 1.29.3.8.1. Provide the Manufacturer's System hardening guides for the equipment being installed and implement as many recommendations / features as possible.
- 1.29.3.9. External Memory
 - 1.29.3.9.1. Restrict the use of external memory. Restrict or eliminate the use of devices such as external USB Thumb drives unless expressly allowed by the Owner's Information Technology representatives.
- 1.29.3.10. Log Off
 - 1.29.3.10.1. Enable auto-log off timer for all software, websites and logins. Set auto-log off timer on local Workstation(s) being used to access the equipment with a reasonable timer in the case that an employee leaves the workstation unattended.
- 1.29.3.11. Anti-Virus Software
 - 1.29.3.11.1. Enable and configure anti-virus software on PC endpoints in accordance with the Owner's Information Technology requirements, unless it is to be installed and configured by the Owner.
- 1.29.3.12. Filtering Techniques
 - 1.29.3.12.1. Apply filtering techniques including the types listed below where possible:
 - 1.29.3.12.1.1. Web Filtering: A Web filter adds another layer to anti-phishing defences by blocking the web based component of phishing and malware attacks.
 - 1.29.3.12.1.2. Multicast Message Filtering: Filters the packets sent to multicast groups users are not subscribed to.
 - 1.29.3.12.1.3. Content Filtering: Is the use of a program to screen and / or exclude access to web pages or email deemed objectionable. A content filter will then block access to this content.
- 1.29.3.13. Back up Regularly
 - 1.29.3.13.1. Provide backup schedule in the closeout submittals and configure system for automatic backups wherever possible.
 - 1.29.3.13.2. Identify files that require manual backup and the backup procedure. This helps to protect against many types of data loss, especially if a Cyber Threat Actor gains access.
- 1.29.4. IT Devices and Systems
 - 1.29.4.1. Apply the Cyber security measures listed in the clauses above in part or in full, as possible, to a wide range of Information Technology (IT) Devices including:
 - 1.29.4.1.1. Firewalls
 - 1.29.4.1.2. Routers

- 1.29.4.1.3. Network switches (Core and Edge Devices)
- 1.29.4.1.4. Servers and databases
- 1.29.4.1.5. Workstation computers
- 1.29.4.1.6. Network connected system devices and controllers
- 1.29.4.1.7. Wireless Access Points and wireless controllers
- 1.29.4.1.8. Mobile phones and tablets
- 1.29.4.1.9. Any IT System or endpoint connected to the network
- 1.29.5. Operational Technology (OT) Devices and Systems
- 1.29.5.1. Apply the Cyber security measures listed in the clauses above, in part or in full, as possible, to a wide range of OT Network devices including:
 - 1.29.5.1.1. Industrial Control Systems such as:
 - 1.29.5.1.1.1. (PLC's) Programmable Logic Controllers are an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices.
 - 1.29.5.1.1.2. (SCADA) Supervisory Control and Data Acquisition is a control system architecture comprising of computers, networked data communications and graphical user interfaces (GUI) for high level process supervisory management.
 - 1.29.5.1.1.3. (DCS) Distributed Control System is a computerized control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system.
 - 1.29.5.1.1.4. (CNC) Computer numerical Control is the automated control of machining tools (Drills, boring tools, lathes) and 3D printers by means of a computer.
 - 1.29.5.1.2. Building Management Systems (BMS) and Building Automation Systems (BAS)
 - 1.29.5.1.3. HVAC equipment
 - 1.29.5.1.4. Lighting controls for both internal and external applications
 - 1.29.5.1.5. Energy monitoring and metering equipment
 - 1.29.5.1.6. Transportation and parking systems
 - 1.29.5.1.7. Scientific equipment
 - 1.29.5.1.8. Any other OT System or endpoint that can be connected to the network
- 1.29.6. Report Cybercrime
- 1.29.6.1. Advise the Owner and / or their representatives of any indication of a Cyber Incident of a criminal nature when performing any work on a network connected system.
- 1.29.7. Cyber Security Report Letter
- 1.29.7.1. Provide a Cyber Security Report Letter in the closeout documents to the client stating which Cyber Security measures have been implemented, when implementing any and / or all of the Cyber Security Measures mentioned in this Specification.
- 1.30. LIFE SAFETY INTEGRATION TESTING**
- 1.30.1. Provide testing of the integration of all life safety and fire protection systems.
- 1.30.2. The Integrated Testing Coordinator (ITC) will complete an Integration Testing Plan (ITP). Carry out the testing as described by the ITC in the ITP, and in accordance with CAN/ULC-S1001 "Integrated Systems Testing of Fire Protection and Life Safety Systems" as it relates to any mechanical systems.

- 1.30.3. The ITC and development of the ITP are not the responsibility of this Contractor.
- 1.30.4. The testing of the integrated systems shall include, but not be limited to the following systems and all associated components:
 - 1.30.4.1. Fire Alarm (e.g. mechanical systems integrated with or controlled by fire alarm system – dampers, fan start up, fan shut down, make up air, pressurization, etc.)
 - 1.30.4.2. Elevators
 - 1.30.4.3. Emergency Generators and/or Inverters (e.g. combustion air, cooling air, cooling, dampers, fuel, alarms, etc.)
 - 1.30.4.4. Sprinkler Systems
 - 1.30.4.5. Standpipe Systems
 - 1.30.4.6. Fire Pumps
 - 1.30.4.7. Water Supplies
 - 1.30.4.8. Water Supply Control Valves
 - 1.30.4.9. Heat Tracing for Life Safety Systems
 - 1.30.4.10. Fixed Fire Suppression Systems
 - 1.30.4.11. Cooking Equipment Fire Suppression Systems
 - 1.30.4.12. Automatic Door Operators for Stair Relief
 - 1.30.4.13. Hold-Open Devices (e.g. smoke control system integration)
 - 1.30.4.14. Smoke Control Systems (Passive and / or Active)
 - 1.30.4.15. Venting to Aid Firefighting
 - 1.30.4.16. Hazardous Protection Monitoring
 - 1.30.4.17. Gas / CO Detection Systems
 - 1.30.4.18. Prevention of Smoke Recirculation (AHUs)
- 1.30.5. Coordinate with all other trades to carry out the appropriate testing.
- 1.30.6. Be responsible for carrying out and coordinating the testing Work associated with the ITP. Coordinate all Work with the ITC and include but not be limited to the following:
 - 1.30.6.1. Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.
 - 1.30.6.2. Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.
 - 1.30.6.3. Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001.
 - 1.30.6.4. Provide all other documentation requested by the ITC as it relates to the mechanical systems in conformance with CAN/ULC-S1001.
- 1.31. VALUATION OF CHANGES**
 - 1.31.1. Further to Contract requirements, use the following method in determining the value of a change to the Work, by either Change Order or Change Directive:
 - 1.31.1.1. Estimate and acceptance in a lump sum, unless the Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.

- 1.31.2. Provide the Engineer's Representative with a detailed cost analysis of the proposed change including:
 - 1.31.2.1. Quantity of each material.
 - 1.31.2.2. Unit cost of each material.
 - 1.31.2.3. Labour units based on Mechanical Contractors Association of America (MCAA) Labour Estimating Manual.
 - 1.31.2.4. Labour (hours) involved.
 - 1.31.2.5. Suppliers' quotation or credit memo for equipment noted in proposed change, with detailed breakdown.
 - 1.31.2.6. Sub-trade quotations including a complete cost breakdown of the proposed change meeting the requirements of this section.
 - 1.31.2.7. Sub-trade's suppliers' quotation or credit memo for equipment noted in proposed change, with detailed breakdown.
 - 1.31.2.8. Mark-ups, if applicable.
 - 1.31.2.9. Value of GST or HST, as applicable.
 - 1.31.2.10. Proposed change in contract time, if any.
 - 1.31.2.11. S+A proposed change number in every quotation to facilitate record keeping.
- 1.31.3. Comply with requirements of Contract Documents for all materials included in quotations for proposed changes.
- 1.31.4. List material and labour separately for each item/clause of the proposed change, on the detailed cost breakdown.
- 1.31.5. Not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-2020 GC 6.2.
- 1.31.6. Inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the Work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.
- 1.31.7. Charge special equipment rental rates at cost. Provide an official quotation of the equipment rental with the proposed change quotation as backup, otherwise special equipment rentals will not be accepted by the Owner/Consultant.
- 1.31.8. The maximum percentage fee for mark-ups is as stated in the Division 0/1 specifications or Contract Supplementary Conditions.
- 1.31.9. All changes, change notices, proposed changes, revisions to contract, Supplemental Instructions, Change Directives or any additional costs or deletes to the stipulated lump sum Contract Price are subject to review and scrutiny by a qualified third party or individual.
- 1.31.10. Use material costs based on a discount to nationally available pricing guides (i.e. Trade Service, Allpricer, etc.) to reflect a value with a fair and reasonable markup to the actual cost of the materials purchased from distributors. The Owner and/or Engineer's Representative reserve the right to negotiate material pricing to a value that is fair and reasonable to the Owner. Indicate on the Bid Form or Supplementary Bid Form: which pricing guide is proposed to be used and discount rate compared to list price.

- 1.31.11. Base the hourly labour rate for all changes on a Journeyperson rate as listed on the Bid Form and/or Supplementary Bid Form. The Owner and/or Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be inclusive of overhead, markup and profit.
- 1.31.12. At the request of the Owner or the Engineer's Representative, submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.
- 1.31.13. When pricing additional work for proposed changes, only price new materials that are required for the proposed change. Where existing materials and/or infrastructure can be re-used for the proposed change, utilize these items in the valuation of the change at no extra cost.
- 1.31.14. Where a proposed change includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.
- 1.31.15. When pricing proposed changes containing both additions and credits, and where no work and/or materials have been installed on site, only price the net new materials and net new labour that are required for the proposed change. Utilize equal per unit labour and material costs for credits and additions.
- 1.31.16. Utilize equal per unit labour and material costs for credits and additions.

1.32. STATEMENT OF PRICES

- 1.32.1. To form a basis for progress payments, submit a sample progress draw for the various portions of the work. Provide sample progress draw format matching that shown in the example progress draw below. As part of the sample progress draw, include a breakdown which illustrates all categories shown on the example progress draw which are relevant to the project. Break down the categories to clearly illustrate the value of the material being supplied as the first subcategory and the value of the labour being supplied as the second subcategory, as shown on the example progress draw. Provide further material and labour breakdowns by floor, area, or phase if the project sequencing or schedule focuses on distinct areas, one at a time. The Engineer's Representative reserves the right to request that additional categories be added to the progress draw if the Engineer's Representative feels that doing so will aid in assessing the Contractor's progress on site, thereby expediting Contractor payment. Progress draws not including the categories shown on the example progress draw where relevant to the project and / or not providing separate labour value and separate material value subcategories will be rejected.
- 1.32.2. Ensure that the total price of all portions of the work equals the total price of the work covered under the Mechanical Division. Present cost for as-built drawings and O&M manuals as separate line items as shown below. Present line items from Section 20 08 00 – COMMISSIONING as shown below.
- 1.32.3. List and track each of the approved changes on separate lines on the progress draw.
- 1.32.4. Amortize costs of temporary facilities and utilities over the duration of the Work. Claims for 'mobilization,' 'bidding costs,' or similar lump sums at or before start of Work are not acceptable.

EXAMPLE PROGRESS DRAW
Mechanical Contractor Name
Billing Application Mechanical Division
Project Name

| Application Number – xx | | | | Date – xxxx to xxxx | | | | <u>Balance to Complete</u> |
|--|-----------------------|----------|-----------------------|---------------------|---------------------|----------|---------------------|----------------------------|
| <u>Description</u> | <u>Contract Value</u> | <u>%</u> | <u>Billed To Date</u> | <u>%</u> | <u>Prev. Billed</u> | <u>%</u> | <u>This Billing</u> | |
| Permits | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Demolition & removals | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Plumbing piping – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Plumbing piping – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Plumbing fixtures – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Plumbing fixtures – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Plumbing equipment – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Plumbing equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Drainage piping – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Drainage piping – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Drainage pumps – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Drainage pumps – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire protection piping – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire protection piping – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire protection valves / equipment – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire protection valves / equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| HVAC piping – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| HVAC piping – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| HVAC ductwork – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| HVAC ductwork – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| HVAC equipment – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| HVAC equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Building Automation System raceways and wiring – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Building Automation System raceways and wiring – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Building Automation System equipment – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Building Automation System equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Heat tracing – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Heat tracing – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Gas service – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Gas service – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Gas piping – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |

| | | | | | | | | |
|---|------------|-----|------------|-----|------------|-----|------------|------------|
| Gas piping – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Water service – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Water service – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fuel oil system – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fuel oil system – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Excavation and backfill – Materials | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Excavation and backfill – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Shop Drawings (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Installation review and equipment verification (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Plumbing and drainage system testing (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Testing of piping systems (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Assistance with Independent Contractor balancing of piping systems (0.25 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Testing of air systems (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Assistance with Independent Contractor balancing of air systems (0.25 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| System start-up (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Commissioning / Testing (3% of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Operating & Maintenance Manuals (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Training (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| As-Built Drawings (0.5 % of contract value) | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Demobilization / Clean-up | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Subtotal | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Additions to Contract | | | | | | | | |
| CO # / PC # / CCN # | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| Cash Allowance # | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| ----- | | | | | | | | |
| Subtotal | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| ----- | | | | | | | | |
| ----- | | | | | | | | |
| Total Contract | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Less Holdback | | | xxx,xxx.xx | | xxx,xxx.xx | | xxx,xxx.xx | |
| | | | ----- | | ----- | | ----- | |
| Total | | | xxx,xxx.xx | | xxx,xxx.xx | | xxx,xxx.xx | |

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. ABBREVIATIONS

1.1.1. The following list of common abbreviations and acronyms may be utilized in the Contract Documents or in the execution of the Work. The list is considered general in nature and all abbreviations or acronyms identified may not apply to the specific Work required to be completed. The list is not exhaustive and some abbreviations or acronyms may be the same however represent different denotation (e.g. BHP - Boiler Horsepower and BHP - Brake Horsepower) and must be read in the context of the Section the abbreviation or acronym is written in. A Section may define alternative abbreviations or acronyms that take precedence in the execution of the Work of that Section.

| | |
|--------|---|
| AABC | - Associated Air Balance Council |
| AAP | - Alarm Annunciator Panel |
| ABMA | - American Boiler Manufacturers Association |
| ABSA | Alberta Boilers Safety Association |
| AC | - Alternating Current |
| ACO | - Acid Resistant Cleanout |
| AD | - Acid Resistant Drains |
| AFD | - Acid Resistant Floor Drain |
| AFF | - Above Finished Floor |
| AGA | - American Gas Association |
| AMCA | - Air Movement and Control Association |
| ANSI | - American National Standards Institute |
| AHRI | - Air-Conditioning, Heating and Refrigeration Institute |
| ASCE | - American Society of Civil Engineers |
| ASHRAE | - American Society of Heating, Refrigerating and Air Conditioning Engineers |
| ASME | - American Society of Mechanical Engineers |
| ASTM | - American Society for Testing and Materials |
| AV | - Acid Resistant Vent |
| AWG | - American Wire Gauge |
| AWS | - American Welding Society |
| AWWA | - American Water Works Association |
| BHP | - Boiler Horsepower or Brake Horsepower |
| Btu/hr | - British Thermal Units per Hour |
| BWG | - British Wire Gauge |
| CAD | - Computer Aided Drafting |
| CAFV | - Controllable Air Flow Venturis |
| CAP | - College of American Pathologists |
| CBC | - California Building Code |
| CCA | - Chromated Copper Arsenate |
| CEMA | - Canadian Electrical Manufacturer's Association |
| CEMS | - Central Energy Management System |
| CCF | - Central Computer Facility |
| CCMC | - Canadian Construction Materials Centre |
| cfm | - Cubic Feet per Minute |

| | |
|--------|--|
| CGA | - Canadian Gas Association |
| CGSB | - Canadian General Standards Board |
| CI | - Cast Iron |
| CIMJ | - Cast Iron Mechanical Joint |
| CPU | - Central Processing Unit |
| CRN | - Canadian Registration Number |
| CSA | - Canadian Standards Association |
| cu.ft. | - Cubic Feet |
| cu.m. | - Cubic Meter |
| c/w | - Complete with |
| db | - Dry Bulb |
| dB | - Decibel |
| dBA | - A-weighted Decibel |
| DC | - Direct Current |
| DDC | - Direct Digital Control |
| DegC | - Degrees Celsius |
| DegF | - Degree Fahrenheit |
| dia. | - Diameter |
| DPDT | - Double Pull Double Throw |
| DPTX | - Differential Pressure Transmitters |
| EAP | - Excess Exhaust Alarm Panel |
| EDR | - Equivalent Direct Radiation |
| EF | - Exhaust Fan |
| EEMAC | - Electrical Equipment Manufacturers Association of Canada |
| EEPROM | - Electrically Erasable Programmable Read-Only Memory |
| EMT | - Electrical Metallic Tubing |
| EP | - Electric Pneumatic |
| EPDM | - Ethylene Propylene Diene-Rubber |
| EPROM | - Electrically Programmable Read Only Memory |
| ERW | - Electric Resistance Welded |
| FACP | - Fire Alarm Control Panel |
| FDA | - Food and Drug Administration |
| FHC | - Fume Hood Controller or Firehose Cabinet |
| FLA | - Full Load Amps |
| fpm | - Feet per Minute |
| fps | - Feet per Second |
| FM | - Factory Mutual |
| ft. | - Foot or Feet |
| ga | - Gauge |
| gal | - Gallons |
| GFD | - Gallons per Square Feet per Day |
| GPD | - Gallons per Day |
| GPH | - Gallons per Hour |
| GPM | - Gallons per Minute |
| GS | - Galvanized Steel |

| | | |
|------------|---|----------------------------|
| GSG | - Galvanized Sheet Gauge | |
| GSS | - Galvanized Sheet Steel | |
| h-cu.ft. | - Hour-cubic foot HCFCs | - Hydrochlorofluorocarbons |
| HEPA | - High Efficiency Particulate Air | |
| HOA | - Hand/Off/Auto | |
| HOT | - Hand Held Operator Terminal | |
| HSS | - Hollow Steel Sections or Hollow Structural Sections | |
| HTK | - Hood Termination Kit | |
| hp | - High Pressure or Motor Horsepower | |
| Hz | - Hertz | |
| IAO | - Insurers' Advisory Organization | |
| IAOC | - Insurers' Advisory Organization of Canada | |
| IBC | - International Building Code | |
| ICU | - Intensive Care Unit | |
| (I)GPH | - (Imperial) Gallons per Hour | |
| (I)GPM | - (Imperial) Gallons per Minute | |
| in. | - Inch or Inches | |
| in. WG | - Inches of Water Gauge | |
| IRMA | - Inverted Roof Membrane Assembly | |
| kg | - Kilogram | |
| kg/cu.m. | - Kilogram per cubic meter | |
| kPa | - Kilopascals | |
| kVa | - Kilovolt-amps | |
| kW | - Kilowatts | |
| lbs/cu.ft. | - Pounds per cubic foot | |
| lbs/hr. | - Pounds per Hour | |
| L | - Litre | |
| L/s | - Litres per Second | |
| LFC | - Laminar Flow Cabinets | |
| LEDs | - Light Emitting Diodes | |
| LCP | - Laboratory Control Panel | |
| LTF | - Linear foot | |
| LM | - Linear meter | |
| mA | - Milliamps | |
| MAC | - Make-up Air Controller | |
| mADC | - Milliamps Direct Circuit | |
| MBH | - 1000 British Thermal Units per Hour | |
| MCC | - Motor Control Centre | |
| mm | - Millimetre | |
| m | - Metre | |
| m/s | - Metres per Second | |
| mL | - Millilitre | |
| MCP | - Motor Control Panel | |
| MJ | - Mechanical Joint | |
| MOV | - Motor Overvoltage | |

| | |
|--------|---|
| mPa | - Millipascals |
| MSC | - Master Summing Controller |
| MSG | - Manufacturers' Standard Gauge |
| NADCA | - National Air Duct Cleaners Association |
| NBS | - National Bureau of Standards |
| NC | - Noise Criterion as Defined by Graph in ASHRAE |
| NCCLS | - National Committee for Clinical Laboratory Standard |
| NEMA | - National Electrical Manufacturers Association |
| NFPA | - National Fire Protection Association |
| NIM | - Network Interface Module |
| NIST | - National Institute of Standards and Technology |
| NIOSH | - National Institute of Occupancy Safety and Health |
| NPS | - American National Standard Straight Pipe Thread |
| NPSH | - Net Positive Suction Head |
| NPT | - American National Standard Taper Pipe Thread |
| No. | - Number |
| NST | - National Standard Thread |
| NVLAP | - National Voluntary Laboratory Accreditation Program |
| OAT | - Outside Air Temperature |
| OC | - On Centre |
| OCP | - Operator Control Panel |
| OPSS | - Ontario Provincial Standard Specification |
| OS&Y | - Outside Screw and Yoke |
| OWRA | - Ontario Water Resources Act |
| oz. | - Ounce or Ounces |
| PCU | - Personal Computer Unit |
| PE | - Pneumatic Electric |
| PIT | - Portable Interface Terminal |
| ph | - Hydrogen Ion Concentration |
| ppm | - Part per Million |
| psf | - Pounds per Square Foot |
| psi | - Pounds per Square Inch |
| psia | - Pounds per Square Inch Absolute |
| psig | - Pounds per Square Inch Gauge |
| PWM | - Pulse Width Modulation |
| PVC | - Polyvinyl Chloride |
| qt. | - Quart |
| RAH | - Return Air Humidity |
| RH | - Relative Humidity |
| RO | - Reverse Osmosis |
| rpm | - Revolutions per Minute |
| RPU | - Remote Processing Unit |
| RPU-TU | - Remote Processing Unit for Terminal Units |
| SCFH | - Standard Cubic Feet per Hour |
| SCMH | - Standard Cubic Meters per Hour |

| | |
|-------------|--|
| SCR | - Silicone Controlled Rectifier |
| SI | - International System of Units |
| SMACNA | - Sheet Metal and Air Conditioning Contractors' National Association |
| sp. in. wg. | - Static Pressure, Inches Water Gauge |
| SPDT | - Single Pull Double Throw |
| SPS | - Sash Position Sensor |
| SS | - Stainless Steel |
| SF | - Supply Fan |
| SPWM | - Sine-Coded Pulse Width Modulated |
| SSPC | - Steel Structures Painting Council (The Society of Protective Coatings) |
| sq.m. | - Square Meter |
| STC | - Supply/Exhaust Tracking Controller or Sound Transmission Class |
| SWS | - Sidewall Velocity Sensors |
| TDS | - Totally Dissolved Solids |
| TEFC | - Totally Enclosed Fan Cooled |
| TIG | - Tungsten Inert Gas |
| TKV-TWA | - Threshold Limit Value - Time Weighted Average |
| UACU | - Unitary Air Conditioning Units |
| UL | - Underwriter's Laboratories |
| ULC | - Underwriter's Laboratories of Canada |
| Ohm | - Ohm |
| USP | - United States Pharmacopeia |
| USG | - United States Gallons |
| USGPH | - United States Gallons per Hour |
| USGPM | - United States Gallons per Minute |
| UV | - Ultraviolet |
| VAC | - Volts Alternating Current |
| VDC | - Volts Direct Current |
| VFD | - Variable Frequency Drive |
| VSC | - Variable Speed Controllers |
| VSCFH | - Closed Loop Variable Frequency Drives For Dedicated Exhaust Hoods |
| VSD | - Variable Speed Drives |
| W | - Watt |
| W/cu.m. | - Watts per Cubic Meter |
| W/ft. | - Watts per Foot |
| W/m | - Watts per Meter |
| W/sq.in. | - Watts per Square Inch |
| W/sq.m. | - Watts per Square Meter |
| WC | - Water Closet |
| wb | - Wet Bulb |
| wg | - Water Gauge |
| WHMIS | - Workplace Hazardous Material Information System |
| WSP | - Working Steam Pressure |
| WOG | - Water, Oil, Gas |

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Refer to as-built drawings in Section 01 70 00 (01 72 29) - CLOSEOUT SUBMITTALS.

1.3. RECORD OF REVISIONS ON SITE

1.3.1. Print and maintain two complete sets of white prints to mark the Project progress, changes and deviations.

1.3.2. Maintain an updated copy of plans and schematics in the digital format for which the Project is provided (i.e. AutoCAD or Autodesk Revit MEP) and be capable to produce documents in Adobe PDF upon request.

1.4. SUBMITTALS

1.4.1. Submit as-built drawings in Revit/CAD format and PDF format for underground services for review prior to slab pour.

1.4.2. Submit as-built drawings in Revit/CAD format and PDF format for all other areas of the building prior to request for occupancy.

1.4.3. Comply with Section 20 05 03 - SHOP DRAWINGS for all submittals.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. DOCUMENTATION REQUIREMENTS

3.1.1. As the Project progresses record all changes and deviations.

3.1.2. Maintain an accurate dimensional record of revisions. Specifically record:

3.1.2.1. Underground piping invert elevations and pipe locations dimensioned to column lines after review and acceptance by the Authority Having Jurisdiction.

3.1.2.2. Inverts of underground piping at building exit and entry, below floor slab at each branch connection, riser base, and change in direction as well as a least 3 points on long straight runs.

3.1.2.3. Above ground piping revisions.

3.1.2.4. Duct revisions.

3.1.2.5. Equipment revisions.

3.1.2.6. Locations of access doors and panels. Identify the equipment and components they serve.

3.1.2.7. Locations of valves.

3.1.3. Keep revisions up-to-date during construction including Change Orders, Change Directives, and Supplemental Instructions. Documentation shall be available for review at all times.

3.1.4. Final as-built documents shall not contain markings or corrections electronically or by hand (i.e. marker, pen, pencil, etc.). Drawings submitted that contain mark-ups will not be accepted.

3.2. SUBMISSION REQUIREMENTS

- 3.2.1. On completion of the Work, submit the draft documentation indicating all such changes and deviations for review by the Engineer's Representative. Submit all documents in PDF format.
- 3.2.2. Upon return of the "Reviewed" draft submittal, transfer "as-built" information and any additional submittal comments to the final software submission requirement (i.e. Autodesk AutoCAD or Autodesk Revit MEP).
 - 3.2.2.1. Request the acceptable version(s) of the software that may be used. Owner shall confirm the acceptable software version upon receipt of request. If the Owner has no preference, the latest published version shall apply.
 - 3.2.2.2. Conform to the Owner/Engineer's Representative's standards.
 - 3.2.2.3. The Mechanical Contractor may request from the Engineer's Representative the most current electronic documentation in Autodesk Revit MEP. Documents to be forwarded via a secure file transfer (at a nominal charge of \$1,000.00).).
 - 3.2.2.4. Clearly label electronic files with Engineer's Representative and Owner, Contract number, file names and the Drawing number.
- 3.2.3. Submit the documents in PDF along with the submission of the completed electronic source software documentation on an approved electronic storage device for review by the Engineer's Representative.
- 3.2.4. If required, the Engineer's Representative will provide a quotation to this Contractor to transfer "as-built" information from the mark-up documentation to the acceptable software.
 - 3.2.4.1. Include a cost of \$400.00 per sheet for the transfer of marked up "as-built" information to Autodesk Revit MEP and forwarding of the mechanical information by the Engineer's Representative to the Owner.
- 3.2.5. The Project will remain incomplete and monies retained until a satisfactory as-built submission is provided.

3.3. AUTODESK REVIT MEP SPECIFIC SUBMISSION REQUIREMENTS

- 3.3.1. Submit a complete list of layer names and brief description of each layer's use with all files.
- 3.3.2. Submit a complete list of symbol (block) names with a description of each symbol.
- 3.3.3. Make special effort to ensure that drafting is accurate, i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and that entities are placed on correct layers.
- 3.3.4. Use the standard fonts available in the software. Do not use custom fonts, shape files, etc.
- 3.3.5. Provide all drawings in the same scale of measurement and units as issued on Bid Documents.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Comply with Section 01 33 00 (01 33 23) for Submittals except as amended below.

PART 2 PRODUCTS

2.1. SHOP DRAWINGS

- 2.1.1. Submit Shop Drawings organized by Specification Section. Ensure shop drawing package for a given Specification Section is complete, including all equipment, products, materials, and systems to be used as part of that Specification Section, and submit as a single shop drawing package. Do not submit numerous separate Shop Drawings for the same Specification Section. Do not combine more than one Specification Section into one submission. Incorrect submissions will be returned without review.
- 2.1.2. Submit Shop Drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:
- 2.1.2.1. S+A Project number and Contractor Shop Drawing Identifier in Subject Line
- 2.1.2.2. Attachments shall be limited to 20MB
- 2.1.2.3. Provide FTP hyperlink for all attachments in excess of 20MB with appropriate information for downloading the file (as required)
- 2.1.2.4. Shop Drawing Submission to the following email address:
- 2.1.2.4.1. ContractAdmin.Toronto@smithandandersen.com
- 2.1.3. Shop drawings submitted directly to Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.
- 2.1.4. Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number as noted in the documents of the specific pump, fan, etc. for which it was prepared.
- 2.1.5. Each Shop Drawing for non-catalogue items shall be prepared specifically for this Project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
- 2.1.6. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation. The Engineer's Representative may also request that this information be added to the maintenance and operating manual.
- 2.1.7. Provide a cover sheet with the Project name, issue date, issue number, Specification section number, title of section and with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

PART 3 EXECUTION

3.1. SUBMISSIONS

- 3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that they have checked the submission for conformance with all requirements of the Drawings and Specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the Work of other trades. Ensure that electrical co-ordination is complete before submitting Shop Drawings for review.
- 3.1.2. Scanned PDF versions are not acceptable.
- 3.1.3. Manufacturing of equipment, installation of equipment or connecting services shall not start until after final review of Shop Drawings by the Engineer's Representative has been completed.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. These Specifications are an integral part of the Contract Documents and apply to all Division 20, 21, 22 and 23 Sections.
- 1.1.3. Provide labour, materials, products, equipment and services required to complete the decommissioning and/or demolition Work specified herein.
- 1.1.4. Refer to Drawings for extent of decommissioning and/or demolition Work. The Drawings indicate the approximate locations of services as far as these are known. The Drawings do not necessarily represent the full extent of the installed service(s) to be removed and are inferred to include decommissioning of all pipes, valves, fittings, appurtenances, etc. except where a service or component is explicitly identified to remain as an abandoned service.
 - 1.1.4.1. For decommissioning and demolition of all services within a floor or identified area, refer to as-built drawings for reference for additional detail as required.
 - 1.1.4.2. Where full removal of services or equipment is required and existing as-built drawings are not available, review the service locations on site, plan the removal to avoid disruption or accidental discharge from services, and mark all services for demolition with colour coding as required for phased removal.
- 1.1.5. Dispose of all debris offsite in accordance with the jurisdictional authorities.
- 1.1.6. Remove and pay for the disposal of refrigerants, oils, glycol, or similar materials in accordance with all municipal by-law or code requirements.
- 1.1.7. Remove and store salvageable items as directed herein or indicated on Drawings.
- 1.1.8. Mechanical decommissioning and/or demolition Work associated with this building is indicated on the Mechanical Drawings and generally consists of the following:
 - 1.1.8.1. HVAC systems including all ducts, pipes, controls, and appurtenances.
 - 1.1.8.2. Plumbing and drainage including all sanitary, storm, venting, water distribution, natural gas distribution, specialty piping such as compressed air, fuel oil, etc.
 - 1.1.8.3. All fire protection systems including sprinkler systems, standpipe systems, fire hose cabinets and all appurtenances.
 - 1.1.8.4. Remove services in a staged or phased approach to allow for immediate repair or service replacement where required to temporarily maintain the integrity of the building envelope against weather, etc.

1.2. REFERENCE STANDARDS

- 1.2.1. Meet the requirements of all Municipal, Provincial and Federal By-laws and Ordinances for the Province and Municipality for the Place of the Work.
- 1.2.2. Execute this Work in accordance with the latest or in force edition of the following codes and standards:
 - 1.2.2.1. Ontario Building Code.
 - 1.2.2.2. Occupational Health and Safety Act.
 - 1.2.2.3. Regulations for Construction Projects.
 - 1.2.2.4. Ontario Fire Code.

- 1.2.2.5. National Fire Code of Canada.
- 1.2.2.6. Regulations under Fire Protection and Prevention Act.
- 1.2.2.7. Technical Standards and Safety Authority (TSSA).

1.3. SUBMITTALS

- 1.3.1. Submit Shop Drawings as requested by the Engineer's Representative, indicating demolition sequence, cutting and patching, bracing and protection of existing services designated to remain.
- 1.3.2. Comply with Section 01 33 00 (01 33 23) for Submittals except as amended below.
- 1.3.3. Comply with Section 20 05 03 – SHOP DRAWINGS.

1.4. QUALITY ASSURANCE

- 1.4.1. Provide adequate equipment and skilled labour with appropriate certifications suitable to the demolition task.
- 1.4.2. Remove from site and dispose of debris, refrigerants, oils, etc. in accordance with the requirements of the Authority Having Jurisdiction.
- 1.4.3. Arrange and pay for all permits, notices and inspections necessary for the proper execution and completion of the demolition Work.
- 1.4.4. Decommissioning of special equipment, where noted on the Mechanical Drawings, must be provided by the equipment manufacturer.
- 1.4.5. Review and sign off on all demolition Work prior to demobilization of demolition trades. Any associated costs due to failure to review and sign off on demolition Work will be the responsibility of the Mechanical Contractor.

PART 2 PRODUCTS

2.1. DISPOSAL OF MATERIALS

- 2.1.1. Except as required by Law for disposal, the Contractor may claim ownership of all materials which have not been designated for salvage from the demolition. Remove all material and debris from the site as quickly as possible and dispose of in a legal manner. Properly remove and dispose of all refrigerant and other toxic or hazardous materials. Burning of debris or selling of materials on site is not permitted. The Contractor is responsible for all future use (or misuse) of items once they have been removed from the installed location.
- 2.1.2. Conform to the requirements of the Municipality regarding disposal of waste materials.
- 2.1.3. Materials prohibited from municipality waste management facilities shall be removed from site and disposed to recycling companies specializing in recyclable materials.

2.2. SALVAGEABLE ITEMS TO BE REMOVED AND STORED

- 2.2.1. The following is a list of salvageable items to be carefully disconnected, removed and turned over for storage for future use:
 - 2.2.1.1. NONE.

PART 3 EXECUTION

3.1. GENERAL INSTRUCTIONS

- 3.1.1. At the end of each Work shift, leave Work in a safe condition.
- 3.1.2. Demolish Work into sections of practical size for removal without alteration or damage to existing building structure or finishes that are indicated to remain.

- 3.1.3. Demolish Work in sections, replacing with new materials as required, for services to remain in operation during the demolition and construction process. This may include, but is not limited to systems such as storm drainage, sanitary drainage, etc.

3.2. STORAGE OF MATERIALS

- 3.2.1. Store materials only in areas designated and as permitted by the local jurisdictional authorities.
- 3.2.2. Do not stack materials and debris in the building to the extent that overloading of any part of the structure will occur.

3.3. PROTECTION OF PREMISES

- 3.3.1. Adhere strictly to the Owner's requirements.
- 3.3.2. Adhere strictly to the requirements for heritage preservation.
- 3.3.3. Adhere to an agreed upon schedule for dust and noise control prior to commencing Work in or adjacent to existing facilities where such Work might affect other facilities or their occupants.
- 3.3.4. Execute Work with least possible interference or disturbance to the building occupants, public, and normal use of adjacent premises.
- 3.3.5. Provide temporary means to maintain security when security has been reduced by this Contractor.
- 3.3.6. Utilize only elevators, dumbwaiters, conveyors or escalators assigned for Contractor's use for moving workers and material within the building. Protect walls of passenger elevators prior to use. Accept liability for damage, safety of equipment and overloading of existing equipment.
- 3.3.7. Provide temporary dust screens, barriers, warning signs in locations where renovations and alteration Work is adjacent to public areas which will be operative during Work.
- 3.3.8. Protect all heritage or other mechanical systems indicated to remain against damage.
- 3.3.9. Provide and maintain ready access to firefighting equipment at all times.
- 3.3.10. Provide and maintain proper and suitable fire extinguishers throughout the duration of the Work.
- 3.3.11. The Drawings indicate the approximate locations of services, as far as these are known. Should any mechanical or electrical service that is anticipated to remain in place (i.e. storm drainage) be broken or disrupted by operations specified under this contract, repair the service and make good all damage. Temporarily remove and replace all services or parts of services to permit the full removal of services identified.
- 3.3.12. The existing Drawings and/or as-built drawings indicate the approximate locations of services as far as these are known. Where specific services are identified for removal within an area of Work, immediately advise the Engineer's Representative in writing when unknown or unexpected services are encountered. Investigate and clearly document these services back to their source, as required, to facilitate further direction regarding removal.
- 3.3.13. Accept liability for costs incurred by the Owner in repairing and cleaning equipment, etc., resulting from failure to comply with the above requirements.

3.4. RESTRICTIONS REGARDING USE OF PREMISES

- 3.4.1. Use only those existing entrances and stairs designated for access to and egress from the existing buildings and various floors where Work of this contract is to be carried out. No traffic through other areas of the building will be permitted without the prior consent of the Owner.
- 3.4.2. Keep stairs and corridors clear and open as required for exit purposes in case of fire, and as required for use by the Contractor's personnel.

3.5. PREPARATION

- 3.5.1. Prior to commencing this Work, arrange to have the appropriate trades present to disconnect all utility services where required.
- 3.5.2. Drain completely all gravity or pressurized water services to avoid damage or hazard due to accidental discharge. Where sections of the installed services cannot be drained fully utilizing existing valves, drain connections, etc., open the service and control the discharge of water appropriately to avoid discharge during service removal.
- 3.5.3. Identify and protect all existing services designated to remain.

3.6. INTERRUPTION OF EXISTING SERVICES TO REMAIN

- 3.6.1. Arrange, schedule and perform Work to mitigate disturbance to existing facilities and services.
- 3.6.2. Submit a complete master schedule of anticipated service interruptions and changeovers with approximate dates required, durations and times of day, for approval by the Owner before proceeding with any Work. Update and submit the schedule on a weekly basis during construction.
- 3.6.3. Notify the Owner in writing at least 36 hours in advance (unless specified elsewhere) of the planned interruption of existing services that are to remain.
- 3.6.4. Interruption of services must occur at the times and for the duration stipulated by the Owner.
- 3.6.5. Keep service interruption duration to an absolute minimum. Carry out all preparatory Work, measurements, etc., without interruption of existing services where possible.
- 3.6.6. The following service interruptions are required to be performed after business hours or on weekends, etc. Include all required costs to complete the Work during this time:
 - 3.6.6.1. Sprinkler Work

3.7. PARTIAL REMOVAL OF A SERVICE

- 3.7.1. Remove services back to the main (service pipe or duct) or nearest branch (pipe or duct) serving other areas to remain. Cap services tight to the main or branch.
- 3.7.2. Do not abandon unused services in the ceiling space, furred walls, shafts, etc. unless expressly permitted by the Engineer's Representative or Owner.
- 3.7.3. Where an unused service is indicated or permitted to remain, mark the abandoned services clearly including the service type (i.e. Do Not Connect - Abandoned Chilled Water).

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workpersonlike installation.
- 1.1.3. Hangers, supports, anchors, guides, and restraints shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings in accordance with Section 20 05 03 – SHOP DRAWINGS.
- 1.2.2. The Mechanical Division shall prepare detailed Shop Drawings showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall bear the signed seal of a Professional Engineer licensed to practice in the appropriate discipline and Place of the Work. The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the Project Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division. No anchor points shall be permitted without reviewed Shop Drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Engineer's Representative.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Provide hangers and supports manufactured by Anvil ASC Engineered Solutions, Taylor Pipe Supports, or E. Myatt & Co.
- 2.1.2. All pipe hangers and supports shall be manufactured to the latest requirements of ANSI MSS-SP-58 "Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation." Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME B31 "Code for Pressure Piping."
- 2.1.3. Pipe rolls shall have cast iron rollers, shaped to accept the outside diameter of the insulated pipe. Roll shall either rotate on a steel shaft mounted on a cast iron stand or shall roll on a cast iron bed plate.
- 2.1.4. Pipe slide assembly shall be manufactured to the latest requirements of ANSI MSS-SP-58. Assembly shall be complete with Carbon steel structural or fabricated tee, 100% virgin PTFE bonded slide plates and carbon steel base.
 - 2.1.4.1. For cold services such as cooling systems (chilled water, chilled glycol, brine, refrigerant, etc.), domestic cold water, and dual temperature systems (cooling systems and heating systems (heating glycol, heating, etc.)) to maintain the integrity of the insulation and vapour barrier and where slides cannot be directly welded to the pipe, provide a plain carbon steel pipe clamp to be welded to the tee support. Clamp shall be full length of tee support and shall be minimum 150 mm (6 in.) or as recommended by manufacturer for the specific pipe size.
 - 2.1.4.2. For hot services such as heating systems (steam, steam condensate, heating glycol, heating, etc.), domestic hot water, etc. where the piping is 50 mm (2 in.) and larger, use a standard catalogue protection saddle tack welded to the pipe, which provides a space between the pipe and tee equal to the thickness of the insulation. Weld the tee to the protection saddle.
 - 2.1.4.3. For longitudinal movement only provide hold down lugs.
 - 2.1.4.4. For free movement in all directions width of slide plate base shall be sufficient for full travel.

- 2.1.4.5. As an alternative to the above, for compact installations, tees may be welded to the pipe directly provided that the temperature is suitable, extended structural or fabricated tees are used, and the tee is vapour sealed at the insulation and completely insulated to prevent condensation for cold services. Provide details and obtain approval from the Engineer's Representative prior to proceeding with this arrangement.
- 2.1.6. For pipe and duct runs on the roof of the building, provide roof supports by Trikon Systems, MIRO Industries (Unistrut), Advanced Support Products Inc., or Portable Pipe Hangers Inc.
- 2.1.7. For pipe and duct runs on the roof of the building, anchor pipes and ducts to the building structure using supports by Thaler Roof Specialties or equal.
- 2.1.8. As an alternative to pipe and duct runs on the roof of the building being anchored to the building structure, provide support system design taking into account wind load review, stamped and signed by a Professional Engineer registered in the location of the Project. Provide roof supports by Trikon Systems, MIRO Industries (Unistrut), Advanced Support Products Inc., or Portable Pipe Hangers Inc.
- 2.1.9. All hangers, supports, brackets and other devices installed exterior to the building or in corrosive environments (pool mechanical rooms, pools, pool change rooms, etc.) shall be galvanized to prevent failure from environmental corrosion. If galvanized components cannot be used submit samples of proposed substitute for review prior to installation.
- 2.1.10. Provide supplemental support to minimize the risk of joint separation under high thrust conditions for large diameter no-hub cast iron fittings over 102 mm (4 in.) in accordance with the Standard Details and manufacturer's recommended installation instructions.
- 2.1.10.1. As an alternative to the above field devised methods and materials, provide engineered pipe and fitting restraints designed and manufactured for the specific purpose of restraining no hub cast iron pipe and fittings against separation under thrust forces equivalent to 145 kPa (50 ft) head pressure. Equal to Holdrite #117.

2.2. CONSTANT SUPPORT HANGERS

- 2.2.1. For piping at hanger locations where the vertical movement of the piping is 12 mm (1/2 in.) or more or where necessary to avoid the transfer of load to adjacent hangers or connected equipment, pipe hangers shall be constant support design.
- 2.2.2. The total travel for constant support hangers shall be equal to travel plus 20%. In no case shall the difference between the actual and total travel be less than 25 mm (1 in.). The constant support hanger shall have travel scales on both sides of the support frame for inspection purposes.
- 2.2.3. Each constant support hanger shall be individually calibrated prior to shipment to support the exact loads specified.
- 2.2.4. Alloy springs shall meet the requirements of ASTM A125 "Standard Specification for Steel Springs, Helical, Heat-Treated" and shall be shot peened and examined by magnetic particle. The spring rate tolerance shall be +/- 5%.
- 2.2.5. Constant supports shall have a wide range of load adjustability. No less than 10% of this adjustability shall be provided either side of the calibrated load for plus or minus field adjustment. Load adjustment scale shall be provided to aid the field in accurate adjustment of loads and load adjustment shall be possible without the use of special tools and shall not impact the travel capabilities of the supports.
- 2.2.6. Constant supports shall be furnished with travel stops to prevent upward and downward movement of the hanger. The travel stops shall be factory installed so that the hanger level is at the cold position. The travel stops shall be designed to permit future re-engagement.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent undue stress to building structural components.
- 3.1.2. Piping shall be supported from walls, beams, columns, and slabs using approved structural attachments. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies shall receive approval prior to installation. Prior approval shall be given for any cutting or drilling of building structural steel. Damage or modification to the structure through welding, cutting, or drilling shall not be permitted if it reduces the integrity of the building structure as deemed by the Structural Engineer's Representative. It shall be the responsibility of the Mechanical Division to supply anchor bolts and base diagrams for equipment and pipe supports showing exact location of attachments.
- 3.1.3. All drilling for hangers, rod inserts and Work of similar nature shall be done by this Division.
- 3.1.4. Auxiliary structural members shall be provided under the Mechanical Section concerned where piping, ducts or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Auxiliary structural members shall be the same material and finish as the primary structure (i.e. prime painted, galvanized, etc.). Submit details for review as requested.
- 3.1.5. Depending on the type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts. Submit proposed hanger details for review and acceptance by the Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.
- 3.1.6. For precast concrete construction, hanger rods shall pass between slabs and be supported on the slab within the topping by a 100 mm x 100 mm x 3 mm (4 in. x 4 in. x 1/8 in.) steel plate welded to the hanger rod. A lock nut threaded to the hanger rod together with a 50 mm (2 in.) minimum dia. washer shall be applied tight against the under surface of the deck to prevent rising of the hanger.
- 3.1.7. Approved type expansion shields and bolts may be used for pipe up to 100 mm (4 in.) diameter where the presetting of concrete inserts is not practical. Submit proposed hanger details for review and acceptance by the Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.
- 3.1.8. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer's Representative. Drawings of the proposed method of suspension must be submitted for review.
- 3.1.9. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CSA S413 "Parking Structures" and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval.
- 3.1.10. Hanger rods shall be subject to tensile loading only. Suspended piping shall be supported by adjustable hanger rods sized as follows:

| Pipe Size | Hanger Rod Diameter |
|-------------------------------------|---------------------|
| 50 mm (2 in.) and under | 9 mm (3/8 in.) |
| 65 mm (2-1/2 in.) and 75 mm (3 in.) | 12 mm (1/2 in.) |
| 100 mm (4 in.) and 125 mm (5 in.) | 16 mm (5/8 in.) |
| 150 mm (6 in.) to 200 mm (8 in.) | 19 mm (3/4 in.) |
| 250 mm (8 in.) to 300 mm (12 in.) | 22 mm (7/8 in.) |

- 3.1.11. Unless otherwise specified or shown, hanger spacing for all services shall be as follows:

| Nominal Pipe Diameter | Maximum Span |
|---------------------------------------|----------------|
| Up to and including 32 mm (1-1/4 in.) | 1.8 m (6 ft.) |
| 38 mm (1-1/2 in.) to 75 mm (3 in.) | 3 m (10 ft.) |
| 100 mm (4 in.) and larger | 4.6 m (15 ft.) |

- 3.1.12. In addition, provide a hanger within 600 mm (2 ft.) on each side of valves, fitting or tees on pipes 38 mm (1½ in.) diameter and larger.
- 3.1.13. Hanger spacing for plumbing and drainage services shall be in accordance with the plumbing code or municipal by-laws as applicable.
- 3.1.14. Hanger spacing for fire protection services shall be in accordance with the NFPA codes.
- 3.1.15. All horizontal piping 50 mm (2 in.) diameter and larger shall be supported by adjustable wrought iron clevis type hangers. Smaller piping shall be supported by adjustable split ring hangers or clevis type hangers.
- 3.1.16. Suspending one hanger from another shall not be permitted.
- 3.1.17. For all heating systems piping (steam, steam condensate, heating glycol, heating, etc.) and domestic hot water piping, 50 mm (2 in.) and larger, use a standard catalogue protection saddle tack welded to the pipe, which provides a space between the pipe and hanger equal to the thickness of the insulation.
- 3.1.18. For all heating systems piping (steam, steam condensate, heating glycol, heating, etc.) and domestic hot water piping, 38 mm (1-1/2 in.) and smaller, use line size hangers.
- 3.1.19. For all cooling systems (chilled water, chilled glycol, brine, refrigerant, etc.) piping, domestic cold water piping, or dual cooling systems and heating systems (heating glycol, heating, etc.) piping, 25 mm (1 in.) and smaller, install a section of high density insulation complete with continuous vapour barrier between the pipe and the hanger. Refer to Section 20 07 00 - INSULATION.
- 3.1.20. For all cooling systems (chilled water, chilled glycol, brine, refrigerant, etc.) piping, domestic cold water piping, or dual cooling systems and heating systems (heating glycol, heating, etc.) piping, larger than 25 mm (1 in.), use a galvanized steel shield between the insulation and the hanger. Between the shield and the pipe, install a section of high density insulation complete with continuous vapour barrier. Refer to Section 20 07 00 - INSULATION.
- 3.1.21. For insulated ducts, ensure supports are on the outside of the insulation so as to not be directly connected to the duct creating a vapour barrier issue. Provide high density insulation in the area of the supports and spread the load.
- 3.1.22. The shield width shall be minimum 1/4 of the pipe circumference. The length and gauge shall be as follows:
 - 3.1.22.1. 150 mm (6 in.) long and 14 US gauge for pipe larger than 25 mm (1in.) up to 50 mm (2 in.) diameter
 - 3.1.22.2. 250 mm (10 in.) long and 12 US gauge for pipes 65 mm (2-1/2 in.) to 300 mm (12 in.) diameter
 - 3.1.22.3. 300 mm (12 in.) long and 10 US gauge for pipes 350 mm (14 in.) to 400 mm (16 in.) diameter
- 3.1.23. Hangers and riser clamps in contact with copper pipe shall be copper coated construction or plastic coated. Taped hangers and riser clamps shall not be accepted.
- 3.1.24. Unless otherwise specified or shown, all pipes supported from below shall be mounted on pipe rolls or pipe slides.
- 3.1.25. Provide constant support hangers where shown for horizontal or vertical pipes which require vertical movement for expansion. Vertical movement shown for these hangers shall be movement either up or down. Provide hangers to allow for movement in both directions.

- 3.1.26. Unless otherwise specified or shown, vertical pipes shall be supported at least every fourth floor or every 12 m (40 ft.) maximum.
- 3.1.27. Pipe slides shall be pre-engineered type. Structural or fabricated tees shall be welded to the pipe or to the protection saddle.
- 3.1.28. Install resilient hangers in accordance with Section 20 05 48 - VIBRATION AND NOISE CONTROL.
- 3.1.29. Install additional seismic supports in accordance with Section 23 05 49 - SEISMIC FORCE RESISTING SYSTEMS.
- 3.1.30. Other means of support shall be as shown or as specified hereunder.
- 3.1.31. For special equipment supports refer to equipment sections. Where no support method is identified, secure wall mounted equipment to metal framing or masonry, with steel toggle or expansion fasteners, machine screws or sheet metal screws as applicable. Plastic, fibre or soft metal inserts shall not be acceptable. Wall mounted equipment shall not exceed 45.5 kg (100 lbs) in weight or 250 mm (10 in.) in depth unless reviewed or detailed by the Engineer's Representative. Where framing does not permit direct attachment, provide metal strut sub-framing or minimum 19 mm (3/4 in.) fire retardant treated plywood backboards, unpainted, attached to the framing. Provide attachments for backboards at 600 mm (24 in.) on centres with no less than 4 attachments.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Concrete Work on grade or cast integrally with a floor is provided under Division 3.

1.2.2. Sound isolated concrete floors – under Division 13.

1.3. SUBMITTALS

1.3.1. Shop Drawings: Supply Shop Drawings of the vibration and noise control equipment being supplied in accordance with Section 20 05 03 - SHOP DRAWINGS. Provide Shop Drawings showing completely the various acoustic assemblies. Include on the Shop Drawings the equipment weight at each isolator and the isolator proposed to be used complete with its weight rating. Submit Shop Drawings after all major equipment (e.g. chillers, cooling towers, etc.) has been reviewed and isolators have been coordinated.

1.3.2. Report: Submit a report, complete with resultant sound curves to the Engineer's Representative substantiating that all equipment has been adequately isolated and that acceptable noise levels exist in the occupied zones.

1.4. PERFORMANCE REQUIREMENTS

1.4.1. Adequately isolate all equipment to maintain acceptable noise levels in the occupied area of the building as specified below. Take noise measurements over the complete audible frequency range in each of the occupied zones under, above and beside Mechanical Equipment Rooms, and where indicated by the Engineer's Representative. Noise levels due to mechanical equipment, ductwork, grilles, registers, terminal devices, diffusers, etc., shall not exceed sound pressure levels in all 8 octave bands corresponding to the NC levels per ASHRAE handbook as indicated.

| | | |
|--------|----------------------|-----------|
| 1.4.2. | AREAS | NC LEVELS |
| | Residential Suites | 30 NC |
| | General offices | 35 NC |
| | Meeting Rooms | 35 NC |
| | Corridor and Lobbies | 35 NC |
| | Storage Rooms | 40 NC |
| | Entrance Halls | 40 NC |
| | Amenity Space | 35 NC |
| | Fitness | 40 NC |
| | Pool | 40 NC |
| | Outdoors | 45 dBA |

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. All equipment provided for vibration isolation or noise control shall be new and manufactured specifically for the purpose intended.

2.1.2. All vibration isolation devices shall be Vibro-Acoustics, Kinetics Noise Control, VMC Amber Booth, Isotech, or Mason Industries and shall be one manufacturer throughout the Project.

- 2.1.3. All factory built silencers and acoustic plenums shall be Vibro-Acoustics, Kinetics Noise Control/Vibron, VAW Systems or EH Price and shall be one manufacturer throughout the Project.
- 2.1.4. Provide vibration isolation devices for all motorized or electrical equipment. Static deflection of isolators shall be as given in the Vibration Isolation Schedule and/or as specified below. The Vibration Isolation Schedule shall take precedence.
- 2.1.5. Provide silencers in accordance with the Silencer Schedule and/or as shown on Drawings to maintain acceptable noise levels.
- 2.1.6. Provide vibration isolation with integral seismic resisting for equipment intended to provide resisting from seismic and wind forces. Housings shall be capable of withstanding the applicable design forces for the specific installation. Installation shall be in accordance with Section 23 05 49 – SEISMIC FORCE RESISTING SYSTEMS.

2.2. VIBRATION ISOLATION

- 2.2.1. Type SPNH (Spring and Neoprene Hangers) - Vibro-Acoustics Model SHR, Kinetics Model SRH, Mason Industries Model 30N, or ISOTECH Model IHSE, IHAЕ or IHBE.
 - 2.2.1.1. Type SPNH shall consist of a steel spring and welded steel housing. Spring diameter and hanger box hole shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19 mm (3/4 in.) larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions.
 - 2.2.1.2. Type SPNH shall include the addition of a neoprene element in series with the spring. The neoprene element shall have a deflection of not less than 9 mm with a strain not exceeding 15 %. Unless otherwise specified, the static deflection of SPNH hangers under actual load conditions shall be 50 mm (2 in.).
- 2.2.2. All spring mounts shall be complete with levelling devices 6 mm (1/4 in.) thick ribbed neoprene sound pads and completely colour coded stable springs.
- 2.2.3. Where steel spring isolation systems are described in the Specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 80 % of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after spring installation.
- 2.2.4. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50 % above the design deflection.
- 2.2.5. All vibration isolators shall have either known undeflected heights of calibration markings to that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to design.
- 2.2.6. All mounts installed outdoors or exposed to high humidity conditions shall have two coats of rust resisting paint and springs shall be cadmium plated and neoprene coated. Nuts and bolts shall be cadmium plated. All metal parts of mountings (except springs and hardware) shall be hot dip galvanized.
- 2.2.7. Flexible spherical expansion joints shall be constructed of EPDM in the covers, liners and with Kevlar tire cord frictioning.
 - 2.2.7.1. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not permitted.
 - 2.2.7.2. 19 mm (3/4 in.) to 38 mm (1-1/2 in.) shall have threaded two piece bolted flange assemblies, one sphere and cable retention.

- 2.2.7.3. 50 mm (2 in.) and larger shall have two spheres reinforced with a ductile iron external ring between spheres.
- 2.2.7.4. 400 mm (16 in.) to 600 mm (24 in.) shall be single sphere.
- 2.2.7.5. Flanges shall be split ductile iron or steel with hooked or similar interlocks.
- 2.2.7.6. Connectors shall be rated at 1.72 MPa (250 psi) up to 77 Deg. C. (170 Deg. F.) with a uniform drop in allowable pressure to 1.48 MPa (215 psi) at 121 Deg. C. (250 Deg. F.) in sizes through 350 mm (14 in.). 400 mm (16 in.) through 600 mm (24 in.) single sphere minimum ratings shall be 1.24 MPa (180 psi) at 77 Deg. C. (170 Deg. F.) and 1.03 MPa (150 psi) at 121 Deg. C. (250 Deg. F.).
- 2.2.7.7. Higher rated connectors shall be used to accommodate service conditions where required.
- 2.2.7.8. Factory test all expansion joints to 150 % of the rated pressure. Safety factors to burst and flange pullout shall be a minimum of 3/1.
- 2.2.8. Neoprene mounting sleeves for hold down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.
- 2.2.9. Grout: Non-shrink, self-levelling grout having ability to withstand thermal, vibratory and impact stresses.
- 2.2.10. Acoustic Sealant: Non-hardening, non-skinning permanently flexible, to CAN/CGSB-19.21 "Sealing and Bedding Compound, Acoustical." Tremco, CGC Acoustic Sealant or approved equivalent.

2.3. INTERNAL ACOUSTIC DUCT LINING

- 2.3.1. Fiberglass duct lining manufacturer: Certainteed, Owens-Corning, Knauf Insulation, or Johns Manville.
- 2.3.2. Natural fibre duct lining manufacturer: Bonded Logic.
- 2.3.3. Provide acoustic duct lining with a minimum density of 24 kg/m³ (1.5 lbs/ft³).
- 2.3.4. Provide acoustic duct lining that complies with the requirements of NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilation Systems" and the "Duct Liner Materials Standard" of the Thermal Insulation Manufacturer's Association.
- 2.3.5. Provide internal acoustic duct lining that incorporates means to prevent fiber entrainment in the air stream, such as airstream surface and long edges complete with acrylic polymer surface coating.
- 2.3.5.1. For clinical areas of Healthcare facilities, incorporate additional mylar or tedlar lining and perforated metal protection as required by CSA Z317.2 "Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities."

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Obtain one copy of all Shop Drawings of equipment to be isolated showing weights, shaft centres and all dimensions.
- 3.1.2. On system start-up, inspect the complete installation and provide a report in writing.
- 3.1.3. All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 6 mm maximum, under all operating conditions. Lateral restraining isolators shall have the same static deflection as equipment being isolated.

- 3.1.4. Seismic snubbers shall be installed on all equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 3.2 mm (1/8 in.). Install seismic restraint devices using methods approved by required submittals for component.
- 3.1.5. Unless otherwise indicated, all equipment mounted on vibration isolators shall have a minimum operating clearance of 50 mm (2 in.) between the bottom of the equipment or inertia base (and height-saving bracket) and the concrete housekeeping pad (or bolt heads) beneath the equipment. The clearance shall be checked by the Contractor to ensure that no material has been left to short-circuit the vibration isolators. There shall be a minimum 100 mm (4 in.) clearance between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.
- 3.1.6. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.
- 3.1.7. Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping, and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.
- 3.1.8. All wiring connections to mechanical equipment on isolators shall be made with a flexible conduit installed in a slack "U" shape.
- 3.1.9. Elastomeric isolators that will be exposed to temperatures below 0 deg. C. (32 deg. F.) shall be fabricated from natural rubber instead of neoprene.
- 3.1.10. Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.
- 3.1.11. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.
- 3.1.12. Fans and air handling units shall be levelled with fans operating before the flexible connectors are attached.

3.2. EQUIPMENT ISOLATION

- 3.2.1. Ceiling Suspended Centrifugal Fans, and axial flow fans shall be mounted on Type SPNH spring isolators. Static deflection of the isolators shall be 50 mm (2 in.) unless shown otherwise on the Vibration and Isolation Schedule. Fans shall be suspended from above only if expressly noted as such on the Drawings and Schedules. Thrust restraint shall be by pre-compressed springs.
 - 3.2.1.1. If the fan to be suspended is not furnished with integral structural frame and external mounting lugs of suitable strength and rigidity, install approved structural base with lugs in the field.
- 3.2.2. Suspend all piping in Mechanical Rooms on Type SPH or SPNH isolators as required. Where piping is supported from the floor, weld brackets to the piping and support on Type SPNM isolators. Isolators do not replace constant support hangers or mounts.
- 3.2.3. The first isolator both upstream and downstream of equipment on springs shall have a static deflection of 1.5 times the deflection of the vibration isolated equipment to a maximum of 50 mm (2 in.). All other piping supports shall have a static deflection of 25 mm (1 in.) minimum.
- 3.2.4. Where a pipe connects to multiple pieces of equipment in the Mechanical Room the pipe isolators for the entire run shall be chosen to suit the connected equipment of the greatest static deflection.
- 3.2.5. No rigid connections between equipment and the building structure shall be made that degrades the specified noise and vibration control system.

- 3.2.6. Any conflicts with other trades which result in rigid contact with the equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Engineer's Representative's attention prior to installation. If not brought to the attention of the Engineer's Representative prior to installation corrective Work necessitated by conflicts shall be at the Contractor's expense.
- 3.2.7. Locate isolation hangers with the housing a minimum of 50 mm (2 in.) below but as close as possible to the structure. Where isolator hangers would be concealed by a non-accessible acoustical sub-ceiling, install the hangers immediately below the sub-ceiling for access.
- 3.2.8. Ducts shall be connected to fans, fan casings and fan plenums by means of flexible connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection.
- 3.2.8.1. Flexible connections are not permitted on NFPA 96 "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations" kitchen exhaust systems.
- 3.2.8.2. Flexible connectors shall be in accordance with Section 23 31 13 - DUCTWORK AND SPECIALTIES.
- 3.2.9. After installation, manufacturer shall verify that the vibration isolation systems are installed and operating properly, and shall submit a certificate so stating. Verify that the isolators are adjusted, with springs perpendicular to bases or housings, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked. In addition, the manufacturer shall certify that Type RTIC isolation curbs are assembled and installed properly.

3.3. ACOUSTICAL LINING OF DUCTS

- 3.3.1. Except where noted otherwise, acoustically line ducts internally, from the fan connection to the terminal. Line both supply and return systems unless otherwise specified. Internally line exhaust ducts where shown on the Drawings to reduce sound transmission.
- 3.3.2. Acoustically line ductwork where shown on the Drawings and as Specified.
- 3.3.3. Provide 50 mm (2 in.) thick acoustical duct lining in ducts within Mechanical Rooms, in plenums, and where expressly shown on the Drawings.
- 3.3.4. Provide a minimum of 25 mm (1 in.) thick acoustical duct lining in all internally lined sheet metal ducts, unless otherwise specified or shown on the Drawings.
- 3.3.5. In addition, internally line all low or medium pressure supply air ductwork in mechanical rooms, fan rooms, or equipment rooms.
- 3.3.6. Install acoustic lining using both pins and a minimum of 50 % coverage of a fire-resistant adhesive. Install pins on maximum 450 mm (18 in.) centres on all sides and tack weld to the duct or plenum. Mechanical fasteners that pierce the duct are unacceptable. Seal all edges of acoustic lining to prevent air erosion with sheet metal nosing that overlaps the insulation by 19 mm (3/4 in.) minimum. Coat all ends of the liner with a fire resistant cementing material to prevent delamination, leakage or erosion. Firmly butt all joints and coat ends with an adhesive to ensure that the lining is smooth across all joints.
- 3.3.7. For acoustic lining downstream of VAV boxes refer to Section 23 36 16 - VARIABLE VOLUME BOXES.
- 3.3.8. Where acoustical duct lining is installed, increase the dimensions of the sheet metal to include the thickness of the lining material. Dimensions shown on the Mechanical Drawings are the clear internal dimensions after the liner has been installed.
- 3.3.9. Do not install acoustic duct lining for any health care Projects conforming to CSA Standard Z317.2 "Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities."
- 3.3.10. Internally insulate the following ductwork:
 - 3.3.10.1. All return air transfer ductwork.

- 3.3.10.2. All ductwork specifically identified in Specifications and/or on the Drawings.
- 3.3.10.3. All supply and return air ductwork in the amenity spaces, lobbies, and common areas that serve that space.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Field painting of non-colour coded piping and ductwork - under Division 9, Section 09 90 00 - PAINTING AND COATING.

1.3. SUBMITTALS

- 1.3.1. Submit designations and abbreviations for review in accordance with Section 20 05 03 – SHOP DRAWINGS. Submit digital samples of identification for review.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Paint shall be compatible with the surface material to be painted.
- 2.1.2. Colour code shall conform to CAN/CGSB 24.3-92 "Identification of Piping Systems" and ANSI/ASME A13.1 "Scheme For The Identification Of Piping Systems."
- 2.1.3. Pipe covering shall be SMS, Brady, Primark Manufacturing Inc. and Seton equal to SMS Coil-Mark system pipe markers.
- 2.1.4. All identification shall incorporate direction of flow arrows, and the specified system designations and abbreviations. Designations and abbreviations shall be submitted for review prior to installation.
- 2.1.5. All reclaimed rainwater distribution systems shall be purple in colour and conform to requirements of NSF-RW and NSF/ANSI Standard 14 "Plastics Piping System Components and Related Materials." All other non-potable water piping shall conform to the requirements of CAN/CSA B128.1 "Design and Installation of Non-potable Water Systems," CAN/CSA B128.2 "Maintenance and Field Testing of Non-potable Water Systems," and CAN/CSA B128.3 "Performance of Non-Potable Water Treatment Systems."
- 2.1.6. Colour code shall conform to the requirements under the by-laws of the Authority Having Jurisdiction.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. After completion of insulation and/or painting, all piping and ductwork shall be marked to show the service and direction of flow.
- 3.1.2. Marking shall be placed at each side of any wall, partition or floor, at 9.1 m (30 ft.) intervals (maximum) on all exposed piping and ductwork and at each access panel or door. Marking shall be located so as to be in full view and visible from the floor.
- 3.1.3. All pipe identification shall be installed in accordance with the manufacturer's recommendations.
- 3.1.4. Pipe identification markers for insulated or non-insulated pipe sizes less than 150 mm (6 in.) circumference shall be pre-coiled and shall cover the pipe in its entirety and be joined using adhesive along the longitudinal joint. In addition to the adhesive the marking system shall be banded with clear plastic tie-wraps on each end.
- 3.1.5. Pipe identification markers for insulated or non-insulated pipe sizes equal to and greater than 150 mm (6 in.) circumference shall be strapped on with recommended tie-wraps.

- 3.1.6. Adhesive labels are not acceptable.
- 3.1.7. Gas piping shall be painted yellow for the entire length and identified with pipe identification markers. Banding is not permitted.
- 3.1.8. All electric traced piping shall have additional identification to show it is traced.
- 3.1.9. Identify ductwork with 50 mm (2 in.) stencils using black or white ink to contrast the surface being identified.
- 3.1.10. Identification location for ductwork shall conform to the guidelines for pipe and shall indicate flow medium, function, and direction.
- 3.1.11. Contractor shall ensure stenciling is performed in a neat, quality manner.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Nameplates for systems include the designated equipment name, model number and main design parameters.
- 1.1.3. Every piece of equipment shall have a nameplate.

1.2. SUBMITTALS

- 1.2.1. Submit samples of nameplates before installation in accordance with Section 20 05 03 – SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. The nameplates must be a minimum 2 mm (3/32 in.) thick microsurface impact acrylic suitable for a service temperature up to -29 Deg. C. through 80 Deg. C. (-20 Deg. F. through 175 Deg. F.). Minimum size shall be 100 mm (4 in.) long x 50 mm (2 in.) wide with maximum size to suit nomenclature required. Nameplate shall be with black face and white centre and with 5 mm (7/32 in.) high lettering engraved through to the white lamination.
- 2.1.2. The nameplates shall have the equipment type and name as indicated in the Equipment Schedules.
- 2.1.3. The nameplates shall have the service and area of the building served (e.g. Chilled Water - South Zone).

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Nameplates shall be securely fastened with screws or brass chains in a conspicuous place on the equipment.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit samples of charts and numbering system before installation in accordance with Section 20 05 03 – SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Tags must be a minimum 2 mm (3/32 in.) thick Micro Surface Impact Acrylic suitable for a service temperature up of -29°C through 80°C (-20°F through 175°F), with engraved numbers and/or letters as required. Tags shall be a minimum of 25 mm (1 in.) square and maximum to suit numbering system. Numbers shall be nominally 9 mm (3/8 in.) high. Letters shall be nominally 6 mm (1/4 in.) high.
- 2.1.2. Number and nameplates for standpipe and sprinkler system supervisory and main operating valves shall be minimum 2 mm (3/32 in.) thick laminated phenolic plastic and a minimum 125 mm (5 in.) long x 100 mm (4 in.) wide with red face and white centre. Lettering shall be a minimum 9 mm (3/8 in.) high with maximum to suit local authorities and shall be engraved through to the white lamination. Each nameplate shall contain the system name, service and valve number.
- 2.1.3. For all other valves on standpipe and sprinkler system not required to have laminated number and nameplates, provide plastic tags as specified above.
- 2.1.4. Abbreviations and colour code shall be as shown on Standard Details.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Tags and nameplates shall be attached to the valve body or handle with brass hooks or chains.
- 3.1.2. All valves shall be provided with tags, other than valves on convectors, induction units or other space heating, cooling units and valves on plumbing fixtures. Provide a chart or charts, indicating location, service and zone of each valve. This Work shall be co-ordinated between the various Mechanical Sections to prevent overlapping of numbering systems.
- 3.1.3. Provide separate charts for all fire system nameplates and tags.
- 3.1.4. For extension and/or alterations to existing systems, provide new charts conforming in appearance to the existing charts.
- 3.1.5. Co-ordinate valve identification with pipe and ductwork identification.
- 3.1.6. Roof drains used for restricting or controlling the flow of water from the roof or acting as an overflow shall be affixed with an identification label "Control Flow Roof Drain - Do Not Remove Restriction Device".
- 3.1.7. Electronically submit charts as PDF files along with as-built drawings. Provide charts set in metal picture frames with a clear acrylic front and fastened securely where directed by Engineer's Representative.
- 3.1.8. All valve tag numbers for all systems shall be shown on the as-built drawings.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings showing size, type and location of all access doors, for review, before installation in accordance with Section 20 05 03 – SHOP DRAWINGS.
- 1.2.2. Have Balancing Contractor review proposed access door sizes and locations to ensure that sufficient access is available. Confirm in writing that this review has occurred.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Provide access doors that comply with Section 08 31 00 - ACCESS DOORS AND PANELS from the Architectural Specification. Where the Architectural Specification section is silent on a required access door type, comply with the Part 2 clauses in this section.
- 2.1.2. Provide access doors by Acudor, Bauco or Mifab Manufacturing Inc. Steel thickness (US Gauge) indicated as minimum acceptable.
- 2.1.3. For doors in solid walls, provide a 16 US gauge, prime painted steel door panel, rust resistant concealed hinges, flanged frame, and screwdriver operated lock. Acudor Model UF-5000 or Mifab Model UA.
- 2.1.4. For doors in drywall partitions or ceilings, provide a minimum 22 US gauge, prime painted steel recessed door panel for the acceptance of a drywall insert, concealed hinges, drywall bead frame, and screwdriver operated lock. Bauco Plus II, Acudor model DW-5015 or Mifab Model CAD-DW.
- 2.1.5. For doors in drywall partitions or ceilings, provide 16 US gauge, prime painted steel flush door panel, concealed hinges, drywall bead frame, and screwdriver operated lock. Acudor model DW-5040 or Mifab Model MDW.
- 2.1.6. For access doors in fire rated walls or ceilings, provide ULC labeled with insulated door panel, concealed hinge, self-closing, self-latching, flanged frame, and prime painted. Provide master key operated catch in areas accessible to the public. Acudor Model FW-5050 or Mifab MPFR.
- 2.1.7. For doors in tiled walls or ceilings, provide 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock. Acudor Model UF-5000 or Mifab Model UA-SS.
- 2.1.8. For doors in tiled walls or ceilings, provide 16 US gauge, prime painted steel recessed door panel for the acceptance of tile finish, concealed hinges, flush frame and screw driver operated lock. Acudor Model AT-5020 or Mifab Model CAD.
- 2.1.9. For doors for medium and high security applications in solid walls, provide 10 US gauge door with minimum 4 mm (3/16 in.) welded angle frame with heavy duty butt hinges welded to the door and frame with master keyed cylinder lock provided by the Owner. Acudor Model SD-6000 or Mifab Model MI-SADH.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Provide access doors of minimum 600 mm x 600 mm (24 in. x 24 in.) size. Custom size access doors may be required to allow combining access doors in close proximity and to ensure maintenance and accessibility of all parts requiring periodic maintenance.

- 3.1.2. Ensure all parts of the installation requiring periodic maintenance are accessible. Wherever valves, dampers and other appurtenances are concealed by building construction, provide access doors and install under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.). Be responsible for the proper location of the access doors.
- 3.1.3. For all mechanical equipment located above drywall and other inaccessible ceilings, provide access doors that will allow for full removal and replacement.
- 3.1.4. For wall mounted plumbing fixtures with back water connection, provide an adjacent access door.
- 3.1.5. Wherever possible, locate items requiring access in easily accessible areas (i.e. exposed or T-bar ceilings).
- 3.1.6. Group items in order to minimize the number of access doors required.
- 3.1.7. Install each access door to provide complete access to equipment for maintenance and servicing.
- 3.1.8. Make any changes to locations of access doors as directed by the Engineer's Representative.
- 3.1.9. Show the final installed locations of all access doors on the as-built drawings.

END OF SECTION

PART 1 GENERAL**1.1. WORK INCLUDED**

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. This Section governs requirements for all Work required for the installation of underground storm drains, sanitary sewers, gas lines, pressurized water lines, and appurtenances associated with such services.
 - 1.1.2.1. Excavation and backfill Work includes all Work within the building footprint (plan), and extends to a point 1500 mm (5 ft. 0 in.) beyond face of building foundation line. Services underground within interior courtyards are included in this Section.
- 1.1.3. Assume that material to be excavated is earth. When rock is encountered during construction, payment will be made on unit price basis to the extent of net difference in cost between dry earth excavation and solid rock excavation, all as indicated in Contract Documents.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Removing subgrade materials for service trenches inside and outside building perimeter, for general grade adjustments, and backfilling of trenches from top of bedding up to bottom of slab-on-grade - under separate Contract.
- 1.2.2. Dewatering of Site - under Division 31.
- 1.2.3. Rock excavating and spreading - under Division 31.
- 1.2.4. Finish grading and spreading of topsoil - under Division 31.
- 1.2.5. Weeping tile drainage lines and filter media - under Division 31.

1.3. SUBMITTALS

- 1.3.1. Provide Shop Drawings indicating proposed method of bedding and backfilling in accordance with Section 20 05 03 – SHOP DRAWINGS.

PART 2 PRODUCTS**2.1. SOILS**

- 2.1.1. Provide Granulars "A", "B" (Type 1), "M" and "Select Subgrade Material";
 - 2.1.1.1. CAN/CSA A23.1 "Concrete materials and methods of concrete construction" and CAN/CSA A23.2 "Test methods and standard practices for concrete."
 - 2.1.1.2. Ontario Provincial Standard Specifications (OPSS), Form No. 1010
- 2.1.2. Requirements for Pea Gravel: Granular, well-graded clean rounded pea gravel or stone with not more the 2% material that will pass 75 um (No. 200) sieve, maximum 6 mm (¼ in.), containing not other deleterious material, and subject to testing that specified density can be achieved without compaction.
- 2.1.3. Requirements for Sand Fill: Uniform quality and unwashed river sand or any clean sand containing less than 5% organic materials, clay or silt (passing 125 um sieve) is acceptable. It can contain a limited amount of small stones or rocks as it comes from the pit. Sharp, clean, coarse sand, water washed, free from clay, salts and organic matter, and in accordance with CAN/CSA A179 "Mortar and Grout for Unit Masonry" for masonry sand is also acceptable.

PART 3 EXECUTION**3.1. INSTALLATION**

- 3.1.1. All excavation and backfilling for all services shall be in accordance with Division 31.
- 3.1.2. Refer to Division 31 for rough excavation, removal of excavated material and backfill.
- 3.1.3. Protection:
 - 3.1.3.1. Provide protection to existing structures and services. Be responsible for rectifying any damage to existing structures and services resulting from this operation.
- 3.1.4. Excavation in Soil:
 - 3.1.4.1. Where rough excavation is carried out by Division 31, perform all layout Work for trenches required under this Division, including verification of trench depths and slopes. Work in close cooperation with excavating trades that remove subgrade to within 6 in. (150 mm) of the correct and final trench depth.
 - 3.1.4.2. Perform the final excavation to the correct trench invert to permit proper bedding as detailed in the Standard Drawings. Excavation carried below the correct inverts shall be backfilled with 2000 psi (13.5 MPa) concrete to the underside of the pipe lines, unless otherwise directed in writing.
- 3.1.5. Excavation in Rock:
 - 3.1.5.1. All excavation in rock is included under a separate Section, and is taken to a minimum of 150 mm (6 in.) below the correct pipe invert. This Division shall use a bedding material as detailed in the Standard Details to the correct trench invert.
- 3.1.6. Backfilling
 - 3.1.6.1. Backfill with sand from the bottom of the trench or excavation up to a point 300 mm (12 in.) above the top of service line or appurtenance. Backfill pipe trenches with sand to a depth 300 mm (12 in.) above the pipe. The sand shall be thoroughly tamped around and over the pipes in 150 mm (6 in.) layers.
 - 3.1.6.3. Backfill up to top of subgrade.
 - 3.1.6.4. Backfill the remainder of trench or excavation up to top of subgrade or bottom of floor slabs on grade.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Firestopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers, etc.) with the exception of sleeves shown for future use installed in fire or smoke rated partitions shall be the responsibility of Mechanical Division. All other firestopping and smoke seals of mechanical services are part of Mechanical Division.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Sleeves passing through stud partitions shall be 0.75 mm (0.0299 in. - 22 GSG) steel.
- 2.1.2. Sleeves passing through concrete or masonry partitions and floors shall be Schedule 40 steel pipe.
- 2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal where additional protection is provided to prevent water from passing freely (i.e. housekeeping pad).
- 2.1.4. Sleeves for pipes passing through exterior foundation walls shall be pre-manufactured molded non-metallic HDPE equal to GPT Industries/Garlock Century-Line. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve and installed at each end to prevent deformation during the concrete pour.
- 2.1.4.1. The annular space between the service pipe and the sleeve shall be a modular EPDM seal element, reinforced nylon polymer pressure plates, joined with ASTM B633 "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel" carbon steel bolts with zinc dichromate and corrosion inhibiting coating equal to GPT Industries/Garlock Link-Seal Model C wall seal.
- 2.1.4.2. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.
- 2.1.5. Firestopping and smoke seal systems shall be in accordance with CAN/ULC-S115 "Standard Method of Fire Tests of Firestop Systems," CAN/ULC-S101 "Standard Methods of Fire Endurance Tests of Building Construction and Materials," ASTM E119 "Standard Test Methods for Fire Tests of Building and Construction Materials" and ASTM E814 "Standard Test Method for Fire Tests of Penetration Firestop Systems."
- 2.1.5.1. Unless noted otherwise "F" and "T" ratings are required.
- 2.1.5.2. Systems shall be asbestos free and maintain an effective barrier against flame, smoke, and gases in accordance with CAN/ULC-S115 and shall not exceed opening sizes for which they are intended.
- 2.1.5.3. Firestopping and smoke seals at openings around mechanical services shall be an elastomeric seal for sound and vibration control.
- 2.1.5.4. Fire resistance rating of firestopping assembly shall not be less than the fire resistance rating of surrounding floor or wall assembly.
- 2.1.5.5. Service penetration assemblies shall be ULC certified in accordance with CAN/ULC-S115 and listed in ULC Guide No. 40 U19.

- 2.1.5.6. Service penetration firestop components shall be ULC certified in accordance with CAN/ULC-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15.
- 2.1.5.7. Firestopping and smoke seals shall be by Hilti, Tremco/Royal Quickstop, STI Firestop or 3M.
- 2.1.5.8. Firestop Products shall be mold and mildew resistant.
- 2.1.6. Escutcheons shall be satin finish stainless steel or satin finish chrome or nickel plated brass, with non-ferrous set screws. Do not use stamped steel split plates. Split cast plates with screw locks may be used. For escutcheons for plumbing fixtures refer to Section 22 42 00 - FIXTURES AND TRIM.
- 2.1.7. Provide adequate bracing for support of sleeves during concrete and masonry Work. For floors and walls with a fire resistance rating, build fire damper assemblies into structure to attain fire rated construction, in a manner acceptable to the governing authorities.
- 2.1.8. Cover exposed duct sleeves in finished areas with 1.42 mm (0.0561 in. - 18 GSG) galvanized sheet steel in the form of duct collars. Fix in position with non-ferrous metal screws.
- 2.1.9. Counter flashing for roof penetrations shall be commercial quality galvanized sheet steel to ASTM A653/A653M "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," 0.70 mm (0.0276 in. - 24 GSG) minimum thickness, Z275 275 zinc coated by hot dip process.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Mechanical Division for the mechanical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.
- 3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer's Representative.
- 3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers.
- 3.1.4. Sleeves shall be sized to maintain insulation and vapour barrier around all pipes and ducts for all service penetrations. Coordinate thickness requirements with Section 20 07 00 - INSULATION.
- 3.1.5. For sleeves through barriers without a fire resistance rating, for non-insulated pipe, fill the annular space between the service and the sleeve with insulation as specified in Section 20 07 00 - INSULATION and caulk around the edges with sealant.
- 3.1.6. Firestopping and smoke seal material and components shall be installed in accordance with the ULC Listing and manufacturer's written instructions. Examine the sizes and conditions of the cavities to be filled to determine the correct thicknesses and installation of materials. All substrates and surfaces in contact with firestopping materials shall be dry and prepared in accordance with the Manufacturer's written instructions at appropriate ambient conditions.
- 3.1.7. Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.
- 3.1.8. Provide escutcheons at all penetrations of piping into finished areas, and at insulated pipes, make the escutcheons large enough to fit around the insulation.
- 3.1.9. Counter flash vertical duct penetrations through roof at intersection of roof curb and duct.

- 3.1.10. Extend sleeves a minimum of 50 mm (2 in) above floor and seal water tight to prevent seeping to the floor below. Sleeves passing through housekeeping pads are permitted to be flush with the top of the housekeeping pad.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Openings required for mechanical services for new construction shall be in accordance with Section 20 05 83 - SLEEVES AND ESCUTCHEONS. This Section shall apply for openings required in existing construction or where sleeves for mechanical services have been omitted in new construction in error.
- 1.1.3. Include for all cutting and patching for all mechanical services for holes and openings with dimensions up to 200 mm (8 in.) in size and related patching. Perform cutting and patching Work in accordance with requirements of Section 01 60 00 - PROJECT FORMS.
- 1.1.4. Cutting and Patching shall be in accordance with Section 01 60 00 - PROJECT FORMS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Section 01 60 00 - PROJECT FORMS, and shall be carried out by professional workers experienced in the cutting and patching Work to be done.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Locate all openings in non-structural elements requiring cutting and patching in cooperation with the applicable Trades in a timely manner to avoid unnecessary cutting. All openings shall be shown on drawings and submitted to the Engineer's Representative for review. No holes through structure shall be permitted prior to review by the Structural Engineer's Representative.
- 3.1.2. Core drilling for individual services shall be by this Division. Cut all openings no larger than is required for the services.
- 3.1.3. Locate all openings in structural elements requiring cutting and patching (concrete walls or floors) and x-ray the structure to obtain Structural Engineer's Representative's approval prior to cutting or core drilling of structure. Make adjustments to location of openings as required to minimize cutting of rebar and completely avoid electrical conduit.
 - 3.1.3.1. Cut holes through slabs or walls only.
 - 3.1.3.2. Do not cut holes through beams.
 - 3.1.3.3. Holes to be cut are 200 mm (8 in.) diameter or smaller only.
 - 3.1.3.4. Maintain at least 100 mm (4 in.) clear from all beam faces. Space at least 3 hole diameters on Centre.
 - 3.1.3.5. For holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.
 - 3.1.3.6. For holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.
 - 3.1.3.7. X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity.
- 3.1.4. Obtain written approval from the Landlord and the Structural Engineer's Representative before cutting or core drilling openings or holes.

- 3.1.5. Obtain written approval from the Structural Engineer's Representative before cutting or core drilling openings or holes.
- 3.1.6. Patch all openings after services have been installed to match the surrounding finishes.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Provide Shop Drawings with technical data on all types of insulation to be installed, in accordance with Section 20 05 03 – SHOP DRAWINGS.

1.2.2. Provide two samples of each type of insulation indicating where each is to be used, and a sample of a typical vapour barrier dam, where vapour barrier dams are called for: in Part 3 or on the Drawings. Samples shall be mounted on boards. One shall be kept at the Contractor's site office and the other shall be turned over to the Engineer's Representative.

PART 2 PRODUCTS

2.1. GENERAL

2.1.1. Provide insulation and jacket systems that are fire retardant, with a flame-spread rating not to exceed 25 and a smoke developed classification not to exceed 50, when tested in accordance with CAN/ULC S102 "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies."

2.1.2. For indoor applications, provide insulation systems (insulation, jackets, adhesives, coatings, etc.) that are Certified under the UL GREENGUARD Certification Program for low chemical and particle (volatile organic compounds (VOC)) emissions.

2.2. PIPE INSULATION

2.2.1. Type P1 - Inorganic mineral fibre: glass wool, rock wool, slag wool.

2.2.1.1. To ASTM C547 "Standard Specification for Mineral Fiber Pipe Insulation."

2.2.1.2. Rigid, pre-formed, with pressure sensitive longitudinal adhesion strip.

2.2.1.3. Reinforced all service jacket (ASJ) vapour retarder.

2.2.1.4. Suitable for temperature range of pipe application in question.

2.2.1.5. Acceptable manufacturers:

2.2.1.5.1. Johns Manville

2.2.1.5.2. Knauf

2.2.1.5.3. Manson

2.2.1.5.4. Owens-Corning

2.2.2. Type P3 - Closed cell flexible elastomeric:

2.2.2.1. To ASTM C534 "Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form."

2.2.2.2. Preformed, with self closing adhesion strips.

2.2.2.3. Suitable for temperature range of pipe application in question.

2.2.2.4. UV resistant with protective jacket/cladding where used outdoors.

2.2.2.5. Adhesive for both surfaces to be joined.

2.2.2.6. Acceptable manufacturers:

- 2.2.2.6.1. Armacell
- 2.2.3. Type P4 - Inorganic rock wool mineral fibre pipe wrap:
 - 2.2.3.1. To ASTM C553 "Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications."
 - 2.2.3.2. Flexible blanket, with foil scrim kraft (FSK) facing or reinforced all service jacket (ASJ) vapour barrier.
 - 2.2.3.3. Suitable for temperature range of pipe application in question.
 - 2.2.3.4. Acceptable manufacturers:
 - 2.2.3.4.1. Johns Manville
 - 2.2.3.4.2. Rockwool

2.3. DUCT INSULATION

- 2.3.1. Type D1 - Inorganic mineral fibre blanket:
 - 2.3.1.1. To ASTM C553 "Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications."
 - 2.3.1.2. Flexible blanket, with foil scrim kraft (FSK) facing jacket vapour barrier.
 - 2.3.1.3. Density: 24 kg/cu.m. (1.5 lbs/cu.ft.).
 - 2.3.1.4. Suitable for temperature range of duct application in question.
 - 2.3.1.5. Acceptable manufacturers:
 - 2.3.1.5.1. Johns Manville
 - 2.3.1.5.2. Knauf
 - 2.3.1.5.3. Rockwool
- 2.3.2. Type D2 - Inorganic mineral fibre board:
 - 2.3.2.1. To ASTM C612 "Standard Specification for Mineral Fiber Block and Board Thermal Insulation."
 - 2.3.2.2. Semi-rigid board, with factory applied foil scrim kraft (FSK) facing jacket vapour barrier.
 - 2.3.2.3. Suitable for temperature range of duct application in question.
 - 2.3.2.4. Density: 48 kg/cu.m. (3 lbs/cu.ft.).
 - 2.3.2.5. Acceptable manufacturers:
 - 2.3.2.5.1. Johns Manville
 - 2.3.2.5.2. Knauf
 - 2.3.2.5.3. Owens-Corning
 - 2.3.2.5.4. Rockwool

2.4. EQUIPMENT INSULATION

- 2.4.1. Type E1 - Inorganic mineral fibre blanket:
 - 2.4.1.1. To ASTM C553 "Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications."
 - 2.4.1.2. Blanket, foil faced.
 - 2.4.1.3. Suitable for temperature range of equipment application in question.
 - 2.4.1.4. Density: Minimum 12 kg/cu.m. (0.75 lbs/cu.ft.).

- 2.4.1.5. Acceptable manufacturers:
 - 2.4.1.5.1. Johns Manville
 - 2.4.1.5.2. Knauf
 - 2.4.1.5.3. Manson
 - 2.4.1.5.4. Owens-Corning
- 2.4.2. Type E2 - Inorganic mineral fibre blanket:
 - 2.4.2.1. To ASTM C553 "Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications."
 - 2.4.2.2. Blanket, with foil scrim kraft (FSK) facing jacket or all service jacket (ASJ), vapour barrier.
 - 2.4.2.3. Suitable for temperature range of equipment application in question.
 - 2.4.2.4. Density: Minimum 24 kg/cu.m. (1.5 lbs/cu.ft.).
 - 2.4.2.5. Acceptable manufacturers:
 - 2.4.2.5.1. Johns Manville
 - 2.4.2.5.2. Knauf
 - 2.4.2.5.3. Manson
 - 2.4.2.5.4. Owens-Corning
- 2.4.3. Type E6 - Closed cell flexible elastomeric:
 - 2.4.3.1. To ASTM C534 "Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form."
 - 2.4.3.2. Self adhering roll sheets.
 - 2.4.3.3. Suitable for temperature range of equipment application in question.
 - 2.4.3.4. UV resistant with protective jacket/cladding where used outdoors.
 - 2.4.3.5. Acceptable manufacturers:
 - 2.4.3.5.1. Armacell
- 2.5. JACKETS**
 - 2.5.1. All service jacket (ASJ)
 - 2.5.1.1. As indicated in insulation types above.
 - 2.5.2. Foil skim kraft (FSK)
 - 2.5.2.1. As indicated in insulation types above.
 - 2.5.3. Insulation Jacketing System:
 - 2.5.3.1. Multi-layered, reinforced laminate jacketing tape with acrylic pressure sensitive adhesive.
 - 2.5.3.2. Zero permeability; self-adhesive; UV and weather resistant.
 - 2.5.3.3. Colour: Natural aluminum or white, as chosen at Shop Drawing stage.
 - 2.5.3.4. Finish: flat or embossed, as chosen at Shop Drawing stage.
 - 2.5.3.5. Acceptable manufacturers:
 - 2.5.3.5.1. 3M – VentureClad Insulation Jacketing System 1577 Series
 - 2.5.3.5.2. 3M – VentureClad Heavy Duty Jacketing System 1579 Series
 - 2.5.4. Canvas jacket:

- 2.5.4.1. ULC listed plain weave cotton fabric insulation jacket.
- 2.5.4.2. Weight of canvas: 220 g/sq.m (6 oz/sq.yd.).
- 2.5.4.3. Complete with two coats of fire retardant lagging finish.
- 2.5.5. Polyvinyl Chloride (PVC) jacket:
 - 2.5.5.1. Pre-moulded PVC covers.
 - 2.5.5.2. Pre-moulded PVC elbows and fittings.
 - 2.5.5.3. Minimum thickness: 20 mil.
 - 2.5.5.4. Colour: white or coloured as chosen at Shop Drawing stage.
 - 2.5.5.5. Tape: vinyl, pressure sensitive, colour matched.
 - 2.5.5.6. Sealed with adhesive.
- 2.5.6. Aluminum jacket:
 - 2.5.6.1. Finish: smooth.
 - 2.5.6.2. Minimum thickness: 0.41 mm (0.016 in.).
 - 2.5.6.3. Factory applied polysurlyn moisture barrier laminated to inside surface of jacket.
 - 2.5.6.4. Longitudinal and circumferential slip joints.
- 2.5.7. Stainless Steel (SS) jacket:
 - 2.5.7.1. Grade: 316.
 - 2.5.7.2. Finish: smooth.
 - 2.5.7.3. Minimum thickness: 0.25 mm (0.01 in.).
 - 2.5.7.4. Factory applied polysurlyn moisture barrier laminated to inside surface of jacket.
 - 2.5.7.5. Longitudinal and circumferential slip joints.

2.6. SECUREMENT

- 2.6.1. Banding
 - 2.6.1.1. Aluminum or Stainless steel.
- 2.6.2. Tie Wire
 - 2.6.2.1. Stainless steel.
 - 2.6.2.2. Minimum 1.3 mm (16 gauge).
 - 2.6.2.3. Twisted ends.
- 2.6.3. Corner beads and channels at floor line:
 - 2.6.3.1. Minimum 0.4 mm (28 gauge) galvanized sheet metal.
- 2.6.4. As per insulation / jacket manufacturer's written installation instructions.

2.7. CEMENTS AND ADHESIVES

- 2.7.1. Where cements or adhesives are required, provide those that are compatible with insulation and jacket, per insulation and jacket manufacturer's written recommendations / instructions.
- 2.7.2. Fire retardant lagging coating:
 - 2.7.2.1. Chil Seal CP-50A by Childers Products Company or Henry equivalent.
- 2.7.3. Vapour barrier dam:

- 2.7.3.1. CHIL-PERM CP-30 with fibreglass cloth reinforcing.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install insulation in accordance with the manufacturer's written installation instructions unless noted otherwise.
- 3.1.2. Insulation thicknesses and conductivities shall meet or exceed the minimum standards set out in ASHRAE 90.1 "Energy Standard for Buildings except Low-rise Residential Buildings" and in National Energy Code of Canada for Buildings (NECB), (refer to Table 2 below), and as specified herein for the services covered.
- 3.1.3. Apply insulation to clean, dry surfaces only while ambient temperature is at least 10 Deg. C. (50 Deg. F.).
- 3.1.4. Commence application of insulation following required testing of piping, ductwork, and apparatus where such items are to be covered. Do not commence insulation installation until testing report is submitted to Engineer's Representative and is reviewed by Engineer's Representative without requesting a resubmit.
- 3.1.5. Where pipes and ducts are specified to be insulated, insulate complete piping system and duct system with no gaps in insulation.
- 3.1.6. Protect insulation and pipe from moisture ingress where insulation is installed exterior to the building.
- 3.1.7. Utilize oversized hangers and pipe supports where pipes are installed exterior to the building and are to be insulated. Hangers and supports to support assembly on the outside of the insulation, so as to protect insulation and pipe from water damage due to ambient conditions.
- 3.1.8. Where vapour barrier dams are called for, terminate the insulation and seal the vapour barrier to the pipe or ductwork using a mesh embedded in a vapour barrier mastic. Provide dams at valves, fittings used for servicing, groups of other types of fittings, irregular shaped objects at floor and wall penetrations, and at 15 m (50 ft.) intervals of straight pipe or straight ductwork for the following services: water piping that is less than 26.7 deg. C. (80 deg. F.), including but not limited to the following:
- 3.1.8.1. Domestic cold water piping
- 3.1.8.2. Exterior ductwork
- 3.1.9. Terminate insulation on pipes passing through fire rated walls or floors, and fit tight to the fire stop material.
- 3.1.10. Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, shall be insulated with removable caps or sections. All edges shall be sealed between pipe and vapour barrier and held in place with stainless steel straps. Finish all insulation smooth, making the outline of pipe insulation a true circular and concentric shape. Shape the outline of fitted insulation to blend with adjacent covering.
- 3.1.11. On piping systems specified to be insulated, include insulation on valves, flanges, couplings and unions.
- 3.1.12. Do not use staples to secure joints of insulation jackets.
- 3.1.13. Where tie wires are used, install on maximum 305 mm (12 in.) centres.
- 3.1.14. Install insulation jackets with minimum 50 mm (2 in.) laps.
- 3.1.15. Provide insulation and jacket systems in accordance with Table 1 below:

TABLE 1: INSULATION AND JACKET SYSTEMS

| Pipe Application | Insulation | Thickness | Jacket |
|---|--------------------------|---|--|
| Piping services that will be painted | See table contents below | See table contents below | Do not use PVC. |
| Pipe insulation exposed to view / not concealed, where being painted | See table contents below | See table contents below | Canvas pasted on |
| Pipe insulation exposed to view / not concealed, where NOT being painted | See table contents below | See table contents below | Canvas pasted on or PVC |
| Pipes that are electrically heat traced | Do not use Type P3 | See table contents below | See table contents below |
| Where pipes are installed outdoors, provide pipe coatings in accordance with Section 23 21 13.23 – Piping, Valves & Fittings (Except Plumbing). | See table contents below | See table contents below | See table contents below |
| Hot fluid such as heating water services, heating glycol, low pressure steam and condensate piping, etc. | Type P1 | Per Table 2 | Per insulation type; for high temperature heating water do not use PVC; see Section 23 21 13.23 for more info on temperatures. |
| Domestic hot water piping | Type P1 | Per Table 2 | Per insulation type |
| Refrigerant liquid and suction piping | Type P3 | 25 mm (1 in.), unless a greater thickness is required by the manufacturer's written instructions. | Per insulation type |
| Domestic cold water piping | Type P1 or P3 | Per Table 2 | Per insulation type |
| Piping serving pumps for cold fluid systems such as chilled water, domestic water, etc. and located inside air handling or air conditioning units | Type P3 | 25 mm (1 in.) | Per insulation type |
| Drainage piping 75 mm (3 in.) and smaller as indicated below: Storm drainage: roof drain sump; all horizontal or sloping storm piping; all elbows connecting the horizontal storm drainage piping to the vertical leaders; and where the roof drain is less than 3000 mm (10 ft.) horizontally from the vertical leader, insulate the first 3000 mm (10 ft.) of pipe length (horizontal and vertical) closest to the roof drain. | Type P1 or P3 | 12 mm (1/2 in.) | Per insulation type |

| | | | |
|--|--|--|---|
| Sanitary drainage: sanitary drainage pipes from urinals, direct and indirect drains from drinking fountains, floor drains from air conditioning apparatus, all horizontal drainage carrying chilled condensate, all piping passing through areas with relative humidity of 70% or higher, and sanitary drainage pipe from barrier free lavatories. | | | |
| <p>Drainage piping larger than 75 mm (3 in.) as indicated below:</p> <p>Storm drainage: roof drain sump; all horizontal or sloping storm piping; all elbows connecting the horizontal storm drainage piping to the vertical leaders; and where the roof drain is less than 3000 mm (10 ft.) from the vertical leader insulate the first 3000 mm (10 ft.) of pipe closest to the roof drain and the exposed portion of the roof drain.</p> <p>Sanitary drainage: sanitary drainage pipes from urinals; direct and indirect drains from drinking fountains; floor drains from air conditioning apparatus; all horizontal drainage carrying chilled condensate; all piping passing through areas with relative humidity of 70% or higher; and sanitary drainage pipe from barrier free lavatories.</p> | Type P1 or P3 | 25 mm (1 in.) | Per insulation type |
| Electrical heat traced piping – insulated for the entire length of piping | As specified for the service being traced; for services not specifically designated, insulate as specified for heating water | <p>For pipes 250 mm (10 in.) and smaller: minimum 38 mm (1-1/2 in.) or thicker as required for the service in question.</p> <p>For pipes 300 mm (12 in.) and larger: minimum 50 mm (2 in.) or thicker as required for the service in question.</p> | As specified for the service being traced |

| | | <p>Thickness of insulation over fittings, valves, and other appurtenances to match the pipe insulation.</p> <p>Provide thicker insulation as required by heat tracing manufacturer's installation requirements.</p> | |
|---|--------------------------|---|--|
| Duct Application | Insulation | Thickness | Jacket |
| Flexible duct connections do not require insulation except where a factory applied insulation has been specified with the flexible duct connection. | See ductwork spec | See ductwork spec | See ductwork spec |
| Exposed insulation in mechanical rooms | See table contents below | Increase thickness as necessary to give 12 mm (1/2 in.) thickness over flanges and angles. | See table contents below |
| Ductwork internal to the building within conditioned spaces | Type D2 | 25 mm (1 in.) | Per insulation type |
| Ductwork in conditioned concealed spaces and on round duct smaller than 600 mm (24 in.) | Type D1 | 38 mm (1-1/2 in.) | Per insulation type |
| Ductwork external to the building | Type D3 or D4 | <p>2 layers of 50 mm (2 in.)</p> <p>Provide sloped extruded polystyrene insulation support on top of ductwork to maintain slope at a minimum of 5%.</p> <p>Cover all flanges by a minimum of 12 mm (1/2 in.).</p> | Per insulation type for Type D3 or Insulation jacketing system for Type D4 |

| | | | |
|---|---------------------|------------------------------|---------------------|
| All supply ductwork from fans to air outlets (e.g. diffusers, grills, etc.) | Per indoor ductwork | Per indoor ductwork | Per indoor ductwork |
| All supply ductwork from VAV box for variable volume systems up to and including terminal grill or diffuser. | Per indoor ductwork | Per indoor ductwork | Per indoor ductwork |
| | | | |
| Equipment Application | Insulation | Thickness | Jacket |
| Radiant heating panels | Type E1 | 25 mm (1 in.) | Per insulation type |
| Cold water service: valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges, and other irregular shaped objects | Type E6 | To suit service, per Table 2 | Per insulation type |
| Hot water service <= 66 deg. C. (150 deg. F.): valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges, and other irregular shaped objects | Type E6 or E2 | To suit service, Per Table 2 | Per insulation type |
| Hot water service > 66 deg. C. (150 deg. F.): valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges, and other irregular shaped objects | Type E2 | To suit service, Per Table 2 | Per insulation type |
| Pumps for domestic water | Type E6 | 25 mm (1 in.) | Per insulation type |

3.1.16. Hot Services

3.1.16.1. On hot services, insulate valves, fittings, couplings, unions, flanges and all other appurtenances through which the fluid passes, using mitred sections of preformed insulation of a thickness equal to the adjoining pipe insulation, and securely wire in place.

3.1.16.2. For domestic hot water piping, apply insulation with all joints butted firmly together, and bond securely, sealing flaps by pasting down to give a smooth finish.

3.1.16.3. Provide removable sections at access doors/manholes and all components requiring servicing.

3.1.17. Cold Services

3.1.17.1. Protect insulation by means of sheet steel shields at each hanger or support on the following:

3.1.17.1.1. Domestic cold water piping 75 mm (3 in.) and larger

3.1.17.2. Provide Type P5 closed cellular glass insulation inserts the full length of shields at all hangers and supports.

3.1.17.3. For domestic cold water piping less than 75 mm (3 in.) where hangers on cold water lines penetrate vapour barrier, ensure that the penetration is properly sealed with insulation and vapour barrier continued up hanger a further 75 mm (3 in.).

3.1.17.4. Where sheet metal shields are used, refer to Section 20 05 29 - HANGERS AND SUPPORTS.

3.1.17.5. On cold water service valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges and other irregular shaped objects, cut and mitre insulation as necessary. Bond and seal edges of insulation to the adjacent surfaces.

- 3.1.18. Ductwork and Equipment
- 3.1.18.1. Butt joint insulation and attach with pins and speed washers, one per 0.186 sq.m. (2 sq.ft.), but not more than 450 mm (18 in.) apart in any direction. Apply fire resistive adhesive in 100 mm (4 in.) wide strips on 300 mm (12 in.) centres. Seal all joints with adhesive and apply vapour barrier tape. Install pins of suitable length for the thickness of insulation and clip flush after final installation of washers. Tack weld pins to sheet metal.
- 3.1.18.2. On exposed insulation in mechanical rooms, provide corner beads to protect corners to a height of 2135 mm (84 in.) above floor and provide channels at floor line to finish off insulation on apparatus.
- 3.1.18.3. Coordinate with Sheet Metal Contractor to ensure duct insulation is applied prior to ductwork being installed to underside of slabs, beams or other services or behind other duct risers and shafts.
- 3.1.19. Apply fire resistant duct insulation directly onto the ductwork and plenums in strict accordance with the manufacturer's written instructions and Listing. Tested to CAN/ULC-S144 "Standard Method of Fire Resistance Test – Grease Duct Assemblies," ISO Standard 6944-1 "Fire containment - Elements of building construction - Part 1: Ventilation ducts," and ISO Standard 6944-2 "Fire containment - Elements of building construction - Part 2: Kitchen extract ducts" as a gypsum shaft alternative per NFPA 96 "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations" guidelines.
- 3.1.20. Except where other methods of fire rating are shown on the Drawings, where fire wrap systems for pipes are acceptable to the local authority having jurisdiction, install fire wrap system, in accordance with the CCMC listing and the manufacturer's written instructions.
- 3.1.21. TABLE 2: MINIMUM PIPE INSULATION THICKNESS/PERFORMANCE (BASED ON ASHRAE 90.1 AND NATIONAL ENERGY CODE FOR BUILDINGS)
- 3.1.22. Minimum Pipe Insulation Thickness - mm (in.)
- 3.1.22.1. Heating Systems (Steam, Steam Condensate, Heating Glycol and Heating)

| Fluid Design Operating Temp. range deg. C. (deg. F.) | Insulation Conductivity | | Nominal Pipe Diameter - mm (in.) | | | | | |
|--|--|--|---|------------------------|--------------------------|--------------------------|------------------|-------------------------|
| | Conductivity [W/(m-K)] [(Btu-in.)/ h-sq.ft. – deg. F.] | Mean Rating Temp deg. C. (deg. F.) | Runouts ^b Up to 51 (2.0) | Less than 25 (1) | 25-32 (1 to 1-1/4) | 38-75 (1-1/2 to 3) | 100-150 (4-6) | 200 (8) and up |
| Above 177 | 0.049 | 121 | 87 | 114 | 127 | 127 | 127 | 127 |
| Above (350) | (0.34) | (250) | (3.5) | (4.5) | (5.0) | (5.0) | (5.0) | (5.0) |
| 122-177 | 0.045 | 93 | 50 | 76.2 | 101.6 | 114 | 114 | 114 |
| (251-350) | (0.32) | (200) | (2.0) | (3.0) | (4.0) | (4.5) | (4.5) | (4.5) |
| 94-121 | 0.043 | 66 | 38.1 | 65 | 65 | 76.2 | 76.2 | 76.2 |
| (201-250) | (0.30) | (150) | (1.5) | (2.5) | (2.5) | (3.0) | (3.0) | (3.0) |
| 61-93 | 0.042 | 52 | 25.4 | 38.1 | 50.8 | 50.8 | 50.8 | 50.8 |
| (141-200) | (0.29) | (125) | (1.0) | (1.5) | (2.0) | (2.0) | (2.0) | (2.0) |
| 41-60 | 0.040 | 38 | 25.4 | 25.4 | 38.1 | 38.1 | 38.1 | 38.1 |
| (105-140) | (0.28) | (100) | (1.0) | (1.0) | (1.5) | (1.5) | (1.5) | (1.5) |

- 3.1.22.2. Domestic and Service Hot Water Systems^c

| Fluid Design Operating Temp. range deg. C. (deg. F.) | Insulation Conductivity | | Nominal Pipe Diameter - mm (in.) | | | | | |
|--|--|--|---|------------------------|--------------------------|--------------------------|------------------|-------------------------|
| | Conductivity [W/(m-K)] [(Btu-in.)/ h-sq.ft. – deg. F.] | Mean Rating Temp deg. C. (deg. F.) | Runouts ^b Up to 51 (2.0) | Less than 25 (1) | 25-32 (1 to 1-1/4) | 38-75 (1-1/2 to 3) | 100-150 (4-6) | 200 (8) and up |
| 41-60 | 0.040 | 38 | 25.4 | 25.4 | 38.1 | 38.1 | 38.1 | 38.1 |

3.1.22.3.

| | | | | | | | | |
|-----------|--------|-------|-------|-------|-------|-------|-------|-------|
| (105-140) | (0.28) | (100) | (1.0) | (1.0) | (1.5) | (1.5) | (1.5) | (1.5) |
|-----------|--------|-------|-------|-------|-------|-------|-------|-------|

Cooling Systems (Chilled Water, Chilled Glycol, Brine and Refrigerant) and Domestic Cold Water

| Fluid Design Operating Temp. range deg. C. (deg. F.) | Insulation Conductivity | | Nominal Pipe Diameter - mm (in.) | | | | | |
|--|--|--|---|------------------------|--------------------------|--------------------------|------------------|-------------------------|
| | Conductivity [W/(m-K)] [(Btu-in.)/ h-sq.ft. – deg. F.] | Mean Rating Temp deg. C. (deg. F.) | Runouts ^b Up to 51 (2.0) | Less than 25 (1) | 25-32 (1 to 1-1/4) | 38-75 (1-1/2 to 3) | 100-150 (4-6) | 200 (8) and up |
| 5-16 | 0.039 | 24 | 25.4 | 25.4 | 25.4 | 25.4 | 25.4 | 25.4 |
| (40-60) | (0.27) | (75) | (1.0) | (1.0) | (1.0) | (1.0) | (1.0) | (1.0) |
| Below 4.4 | 0.038 | 10 | 25.4 | 25.4 | 38.1 | 38.1 | 38.1 | 38.1 |
| Below (40) | (0.26) | (50) | (1.0) | (1.0) | (1.5) | (1.5) | (1.5) | (1.5) |

^a Piping installed exterior to the building shall meet the minimum insulation requirements of Runouts for Heating Systems with a fluid design operating temperature above 177 Deg. C. (350 Deg. F.) or the thickness required by the fluid design operating temperature range, whichever is most stringent.

^b Runouts to individual terminal units not exceeding 3.7 m (12 ft.) in length located within Partitions within Conditioned Spaces.

^c Applies to recirculating sections of service or domestic hot water systems and first 2.4 m (8 ft.) from storage tank for non-recirculating systems.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Clean thoroughly all fixtures and equipment from grease, dirt, plaster or any other foreign material. Chrome-plated fittings, piping and trim shall be polished upon completion.
- 3.1.2. Fixtures and equipment shall be properly protected from damage during the construction period and shall be cleaned and polished in accordance with manufacturer's written directions. Motors and equipment bearings shall be protected with plastic sheets, tied or taped in place. Aluminum fin heating or cooling elements shall be protected with cardboard covers.
- 3.1.3. Any dirt, rubbish, or grease on walls, floors or fixtures accumulated from the Work of the Mechanical Division shall be removed promptly from the premises by this Division.
- 3.1.4. Any unpainted steel surfaces, installed for longer than one year prior to the completion date, shall be prime coated under this Division.
- 3.1.5. During construction protect all services and equipment from dirt and debris, by using temporary caps over the open ends of pipes ductwork and equipment connections.
- 3.1.6. All equipment installed or stored on site shall be maintained in accordance with manufacturer's recommended instructions (i.e. rotate shafts on fans, pumps, etc).
- 3.1.7. Refinish and restore to the original condition and appearance all mechanical equipment which has sustained damage to the manufacturer's prime and finish coats of enamel or paint. Materials and work quality shall be equal to the manufacturer's original.
- 3.1.7.1. All cleaning and protective measures shall be in accordance with the SMACNA - IAQ Guidelines for Occupied Buildings under Construction and the IAQ Management Plan developed by the General Contractor to conform to LEED requirements.
- 3.1.8. Comply with CSA Z317.2 "Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities" requirements by cleaning supply and return ducts, including registers, grills, diffusers, and other air distribution equipment, in accordance with NADCA "General Specifications for the Cleaning of Commercial Heating, Ventilation and Air Conditioning Systems" and verifying cleanliness of HVAC system in accordance with NADCA "Assessment, Cleaning & Restoration of HVAC Systems." Additionally, comply with the requirements of CSA Z317.13 "Infection control during construction, renovation, and maintenance of health care facilities."

END OF SECTION

PART 1 GENERAL**1.1. WORK INCLUDED**

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Comply with all requirements of Section 20 05 02 - AS-BUILT DRAWINGS.
- 1.1.3. Comply with all requirements of Section 20 05 03 - SHOP DRAWINGS.
- 1.1.4. Comply with all requirements of Section 20 08 00 - COMMISSIONING.
- 1.1.5. Comply with all requirements of Section 01 78 00 - CLOSEOUT SUBMITTALS.

PART 2 PRODUCTS**2.1. REQUIREMENTS FOR MANUALS**

- 2.1.1. Three copies of complete and approved operating and maintenance instructions for all mechanical equipment and systems shall be supplied before Substantial Completion. Manuals shall be also submitted in electronic format. Electronic manuals shall be prepared in Adobe PDF format with all sections bookmarked for quick reference and submitted on a portable data storage device.
- 2.1.2. Binders shall be three-ring, hard-cover, loose-leaf type and identified on the binding edges as "Maintenance Instructions and Data Book", for "(Project Name)".
- 2.1.3. Terminology used in all the Sections shall be consistent.
- 2.1.4. Include the data and requirements noted in this specification section in both hardcopy and electronic versions of all manuals. Divide pages in the hardcopy manuals by tabs and sub-tabs as per the clauses and sub-clauses below. Provide only searchable PDF files as part of electronic version of the manuals and divide PDF document(s) using section coverpages and PDF bookmarks as per the clauses and sub-clauses below.
- 2.1.5. Volume One shall contain the master index of all systems, the name of the Contractor, Mechanical Subcontractors and the date of Substantial Performance of the Work.
- 2.1.6. Volume One shall contain a section with all necessary warranty information.
- 2.1.7. Each binder shall have a complete index for all volumes.
- 2.1.8. Each binder shall be no more than half filled.
- 2.1.9. There shall be a separate section for all materials used on the Project which fall under the WHMIS legislation. There shall be a hazard data sheet for each of the materials.
- 2.1.10. There shall be a separate section for all Insurance Certificates, Test Certificates, Verification Forms and Test Forms.
- 2.1.11. All relevant information relating to a system or Product shall be contained within one binder.
- 2.1.12. The manual sections shall follow the Specification sections.
- 2.1.13. Any diagrams, installation drawings, flow charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved they shall be carefully folded and contained within a clear plastic wallet within the manual.

2.2. DATA FOR MANUALS

- 2.2.1. Equipment data shall contain:
 - 2.2.1.1. Operating instructions
 - 2.2.1.2. Operating conditions such as temperature and pressure

- 2.2.1.3. Location of equipment
- 2.2.1.4. Maintenance instructions and schedules for one year routine
- 2.2.1.5. Recommended list of spare parts
- 2.2.1.6. Lubrication schedule
- 2.2.1.7. A trouble shooting table showing where to look for problems under various conditions of malfunction
- 2.2.1.8. All wiring diagrams
- 2.2.1.9. Equipment operating curves
- 2.2.1.10. Equipment nameplate data and serial numbers
- 2.2.2. System data shall contain:
 - 2.2.2.1. A listing of all systems
 - 2.2.2.2. A valve schedule and locations
 - 2.2.2.3. Equipment name tags
 - 2.2.2.4. Filter schedule
 - 2.2.2.5. An electric pipe tracing schedule including location and electrical service location
 - 2.2.2.6. Cleaning, maintaining and preserving instructions for all material, Products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.
- 2.2.3. Subcontractor manuals are required for:
 - 2.2.3.1. BAS
 - 2.2.3.2. Water treatment
 - 2.2.3.3. Sprinkler system
 - 2.2.3.4. Piping and air balancing
- 2.2.4. As-built documentation shall contain:
 - 2.2.4.1. Reviewed As-built Shop Drawings
 - 2.2.4.2. As-built construction drawings
 - 2.2.4.3. Originals of test forms
 - 2.2.4.4. Originals of test certificates
 - 2.2.4.5. Cyber Security Report Letter and backup schedule as required by Section 20 05 00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

2.3. OPERATING INSTRUCTIONS

- 2.3.1. Instruct the Owner's representative in all aspects of the operation and maintenance of systems and equipment.
- 2.3.2. Comply with all requirements of Section 20 08 00 - COMMISSIONING, for duration of tests.
- 2.3.3. Instruct the Owner for a minimum of five (5) Working Days.
- 2.3.4. Arrange for and pay for the services of engineers and other manufacturer's representatives required for instruction on the systems and the equipment as requested by the Engineer's Representative and/or the Owner.

- 2.3.5. At the time of final review, provide a sheet for each system and piece of equipment showing the date instructions were given. Each sheet shall show the duration of instruction, name of persons receiving instruction, other persons present (manufacturer's representative, Engineer's Representative, etc.), system or equipment involved and signature of the Owner's staff stating that they understood the system installation, operating and maintenance requirements. This information shall be inserted in the manuals after all instructions have been completed.
- 2.3.6. Review information with the Owner's representative to ensure that all information required has been provided.
- 2.3.7. Mechanical equipment and systems included in the instruction requirements are:
- 2.3.7.1. Chillers and associated equipment
 - 2.3.7.2. Heating water generators and associated equipment
 - 2.3.7.3. Steam generators and associated equipment
 - 2.3.7.4. Automatic controls and instrumentation
 - 2.3.7.5. Water treatment and cleaning
 - 2.3.7.6. Life safety and fire protection
 - 2.3.7.7. Noise and vibration
 - 2.3.7.8. Condenser water distribution system
 - 2.3.7.9. Chilled water distribution systems
 - 2.3.7.10. Heating water distribution systems
 - 2.3.7.11. Steam distribution systems and condensate
 - 2.3.7.12. Air handling distribution and components
 - 2.3.7.13. Miscellaneous ventilation systems
 - 2.3.7.14. Diesel generator fuel supply and ventilation
 - 2.3.7.15. Humidification systems
 - 2.3.7.16. Medical gases
 - 2.3.7.17. Storm, sanitary and domestic water pumping and distribution system

2.4. TRIAL USAGE

- 2.4.1. The Owner shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties nor be construed as acceptance, and no claim for damage shall be made against the Owner for any injury or breakage to any part or parts due to the tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or work quality of any kind.

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. The standpipe system shall conform to applicable NFPA standards and to all local authorities' requirements.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. All wiring to annunciator panel - under Electrical Division.
- 1.2.2. Wiring of alarms to the main alarm panel - under Electrical Division.

1.3. SUBMITTALS

- 1.3.1. Submit Shop Drawings and/or catalogue cuts for all equipment supplied in accordance with Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Pipe, valves and fittings less than 1380 kPa (200 psi) working pressure shall be as follows:
 - 2.1.1.1. Pipe, black steel, Schedule 40, ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."
 - 2.1.1.2. Fittings for a minimum of 1207 kPa (175 psi) working pressure, 1035 kPa (150 psi) malleable iron ASME B16.3 "Malleable Iron Threaded Fittings: Classes 150 and 300," 860 kPa (125 psi) cast iron ASME B16.4 "Gray Iron Threaded Fittings: Classes 125 and 250," butt welding schedule 40 ASME B16.25 "Butt welding Ends," or roll grooved Victaulic, ASC Engineered Solutions Gruvlok or Johnson Controls Tyco Grinnell.
 - 2.1.1.3. Provide ULC Listed and FM Approved valves of the same manufacturer for the entire system.
 - 2.1.1.4. Acceptable valve manufacturers:
 - 2.1.1.4.1. Viking Nibco
 - 2.1.1.4.2. ASC Engineered Solutions Gruvlok
 - 2.1.1.4.3. MA Stewart W Series
 - 2.1.1.4.4. Victaulic
 - 2.1.1.4.5. Johnson Controls Tyco Grinnell
 - 2.1.1.5. Gate valves 50 mm (2 in.) and smaller, all bronze OS&Y screwed.
 - 2.1.1.6. Gate valves 65 mm (2½ in.) and larger iron body bronze mounted, OS&Y, flanged ends.
 - 2.1.1.7. Check valves 50 mm (2 in.) and smaller, all bronze replaceable seat, screwed ends.
 - 2.1.1.8. Check valves 65 mm (2½ in.) and larger iron body, bronze mounted, flanged ends.
 - 2.1.1.9. Gate valves 65 mm (2½ in.) and larger iron body bronze mounted, OS&Y, flanged ends.
 - 2.1.1.10. Check valves 65 mm (2½ in.) and larger iron body, bronze mounted, fanged ends.
 - 2.1.1.11. All grooved Products including couplings, fittings and valves shall be of one manufacturer.
- 2.1.2. Switches for supervised valves shall activate alarm when valve not fully open. Switch shall be complete with contacts for alarm and supervision. Switches shall be equal to Potter OS&Y-UA series. Plug-in type switches are not acceptable.

- 2.1.3. Provide pipe valves and fittings over 1380 kPa (200 psi) working pressure as follows:
 - 2.1.3.1. Pipe, black steel, Schedule 40, ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."
 - 2.1.3.2. Fittings, 2070 kPa (300 psi) malleable iron ASME B16.3 "Malleable Iron Threaded Fittings: Classes 150 and 300," 1720 kPa (250 psi) cast iron ASME B16.4 "Gray Iron Threaded Fittings: Classes 125 and 250," or butt welding schedule 40 ASME B16.25 "Buttwelding Ends" to suit maximum system pressure. Provide ULC Listed and FM Approved valves of the same manufacturer for the entire system.
 - 2.1.3.3. Acceptable valve manufacturers:
 - 2.1.3.3.1. Viking Nibco
 - 2.1.3.3.2. MA Stewart
 - 2.1.3.3.3. Victaulic
 - 2.1.3.3.4. Johnson Controls Tyco Grinnell
 - 2.1.3.4. Gate valves 50 mm (2 in.) and smaller all bronze, rising stem, screwed Class 200.
 - 2.1.3.5. Gate valves 65 mm (2½ in.) and larger, steel body, flanged or welded, Exalloy Stellite trim, OS&Y equal to Class 150 1030 kPa to 1930 kPa (150 psi to 280 psi) and Class 300 above 1930 kPa (280 psi).
 - 2.1.3.6. Check valves 50 mm (2 in.) and smaller all bronze, swing check, Class 200, to local authorities approval.
 - 2.1.3.7. Check valves 65 mm (2½ in.) and larger, steel body, flanged or welded Exalloy trim, equal to Class 150 1030 kPa to 1930 kPa (150 psi to 280 psi) and Class 300 above 1930 kPa (280 psi).
- 2.1.4. Connection between fire protection system and the domestic water system shall have a ULC listed backflow assembly conforming to CSA B64 Series "Backflow preventers and vacuum breakers" or to the requirements of the Authority Having Jurisdiction. The assembly shall incorporate a metered by-pass to detect leaks and unauthorized water use. All valves shall be supervised and shall be by one of the manufacturers listed in Section 22 11 13 - PIPES, VALVES AND FITTINGS (PLUMBING SYSTEM).
- 2.1.5. Minimum requirement for systems filled with untreated potable water provide a double check valve assembly equal to Zurn-Wilkins Model 350ADA. Spec Sheet Link: [model 350ada](#)
- 2.1.6. For systems that have chemical treatment or other substances added that contaminate the water the connection between the fire protection system and the domestic water system shall have a reduced pressure backflow preventer assembly with the features listed above and in conformance with CSA B64 Series "Backflow preventers and vacuum breakers."

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Installation shall conform to all applicable codes.
- 3.1.2. In all systems with fire pumps install low pressure alarm and wire to the building alarm panel.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Furnishing of bollards to protect the fire hose cabinets and piping - under Section 05600 [by the Architectural Division].

1.2.2. Finish painting for prime painted cabinets - under Section 09 90 00 - PAINTING AND COATING.

1.3. SUBMITTALS

1.3.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Fire hose cabinet equipment, hoses and racks shall be National Fire Equipment Ltd. or Wilson & Cousins, and shall be ULC listed and FM Approved.

2.1.2. Fire hose cabinets shall be National Fire Equipment Ltd., or Wilson & Cousins.

2.2. FIRE HOSE CABINETS

2.2.1. Cabinet shown as Type "FHC" shall be recessed type, 1.19 mm (0.0478 in. - 18 MSG) thick steel tub with baked white enamel interior corrosion resistant and maximum inside dimensions of 750 mm x 750 mm x 203 mm (30 in. x 30 in. x 8 in.) deep. Front shall be adjustable, 2 mm (0.0747 in. - 14 MSG) thick steel door and frame with hollow channel reinforcement and 12 mm (0.5 in.) turn back. Hinges shall be full length, semi-concealed piano type for 180 degree rotation. Glass shall be 5 mm (3/16 in.) clear. Door latch shall be flush stainless steel type with no visible mounting screws. All metal shall be prime coated with the exception of the door latch. National Fire Equipment Model Knight 200-2.

2.2.2. Cabinets shall contain a ULC listed hose rack and water stop complete with 30 m (100 ft.) of 38 mm, (1-1/2 in.) ULC labelled synthetic fire hose with forge line couplings, hydrolator valve, 38 mm (1-1/2 in.) shut-off valve and combination fog and straight stream nozzle. All metal parts shall be polished and chrome plated. ULC listed plastic chrome plated nozzles are acceptable.

2.2.3. Fire hose cabinets shall contain a 65 mm (2-1/2 in.) forged brass valve with local fire department threads, brass cap and chain. All metal parts shall be polished and chrome plated.

2.2.4. Where indicated, fire hose cabinet tub shall have rear knock-out openings for hose connections.

2.2.5. Each fire hose cabinet shall come with signage indicating "Fire Hose for use by Trained Personnel only." The lettering shall be 25 mm (1 inch) high with a 5 mm stroke.

2.2.6. Each fire hose cabinet shall come with signage indicating the inlet and outlet pressures of the 38 mm (1-1/2 in) and 65 mm (2-1/2 in) hose connections. The lettering shall be 25 mm (1 inch) high with a 5 mm stroke.

2.3. PRESSURE REDUCING VALVES

- 2.3.1. Adjustable pressure regulating valves shall be ULC listed. Provide pressure regulating valves for 38 mm (1-1/2 in.) hose connections where residual pressure will exceed 689 kPa (100 psi). Provide pressure regulating valves for 65 mm (2-1/2 in.) hose connections where static pressure will exceed 1207 kPa (175 psi). For system static pressures up to 1207 kPa (175 psi) the valve shall be equal to National Fire Equipment Model A156 and for system static pressures above 1207 kPa (175 psi) the valve shall be equal to Elkhart Model UR-25. Valves shall limit the pressure to 689 kPa (100 psi) for 38 mm (1-1/2") hose connections and 1207 kPa (175 psi) for 65 mm (2-1/2 in) hose connections.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Supply and install in each hose cabinet a ULC labelled fire extinguisher suitable for the distance and location served. Refer to Section 21 25 00 - PORTABLE FIRE EXTINGUISHERS.
- 3.1.2. Mount fire hose cabinets securely in concrete block walls, shimming the tub and mortaring tightly in place.
- 3.1.3. Where cabinets are mounted in stud partitions, provide 75 mm x 75 mm x 6 mm (3 in. x 3 in. x 1/4 in.) steel angle supports from floor below to floor above. Weld 75 mm x 225 mm x 6 mm (3 in. x 9 in. x 1/4 in.) plates top and bottom of angles and fasten each plate to structure with two 9 mm (3/8 in.) bolts.
- 3.1.4. For all free standing cabinets provide a steel angle support frame as specified for mounting in a stud partition.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Sprinkler system shall conform to NFPA 13 and to all authorities' requirements.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Low Voltage wiring of alarms, excess pressure pumps, flow switches, supervisory valves, and alarm horn to annunciator panel - under Electrical Division.
- 1.2.2. Power wiring to dry system air compressors - under Electrical Division.

1.3. DESCRIPTION OF SYSTEM

- 1.3.1. The sprinkler systems shall be wet type as shown, consisting of distribution and interconnecting piping, sprinkler heads, hangers and all necessary equipment to provide a complete sprinkler system ready for immediate operation.
- 1.3.2. The sprinkler systems shall be wet and/or dry type as shown, consisting of distribution and interconnecting piping, sprinkler heads, hangers, flush and test connections, sprinkler riser, pressure reducing valves, alarm check valves, dry alarm valves, pre-action alarm valve, supervised valves, drain valves, sprinkler pumps and controls, excess pressure pump, fire department connections, water motor gong, air compressors, and all necessary equipment to provide a complete sprinkler system ready for immediate operation.
- 1.3.3. Sprinkler system shall connect to water supply where shown on Drawings.

1.4. DENSITY AND AREA REQUIREMENTS

- 1.4.1. The following minimum density and area requirements shall be the basis of the hydraulic design. Any request for modifying the density requirement shall be submitted by the Contractor for review by the Engineer's Representative.

| Location Served | Hazard | Density L/m/sq. m. (gpm/sq. ft) | Area Sq. m. (sq. ft) | Remarks |
|---|---------------------|---------------------------------------|----------------------------|----------|
| Office areas | Light | 2.9 (0.07) | 279 (3000) | Wet Type |
| Basement storage and Mechanical rooms | Ordinary Group 1 | 4.9 (0.12) | 279 (3000) | Wet Type |

- 1.4.2. Where systems are hydraulically designed obtain water flow data of street mains. Minimum street pressure shall be 207 kPa (30 psi) if no information is available at the time of bid.

1.5. SUBMITTALS

- 1.5.1. Shop Drawings: Submit sprinkler drawing layouts in accordance with Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS and Section 20 05 03 - SHOP DRAWINGS showing all component parts complete with Shop Drawings of all valves and accessories to IAO (FM) and to the Engineer's Representative for review. These drawings shall be designed and bear the signed stamp of an engineer licensed to practice in the appropriate discipline and in the Place of the Work. The Contractor's design Engineer shall provide periodic review in accordance with all applicable requirements of their licence and the building code and shall sign and seal an occupancy letter indicating the installation is in conformance with their design.
- 1.5.2. Shop Drawings: Submit sprinkler drawing layouts in accordance with Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS and Section 20 05 03 - SHOP DRAWINGS showing all component parts complete with Shop Drawings of all pumps, starters, valves and accessories to IAO (FM) and to the Engineer's Representative for review. These drawings shall be designed and bear the signed stamp of an engineer licensed to practice in the appropriate discipline and in the Place of the Work. The Contractor's design Engineer shall provide periodic review in accordance with all applicable requirements of their licence and the building code and shall sign and seal an occupancy letter indicating the installation is in conformance with their design.
- 1.5.2.1. Clearly indicate on sprinkler layout drawings the location of all drain connections.
- 1.5.2.2. Prepare complete sprinkler layout drawings, arranging piping runs and sprinkler heads in proper relation with bus ducts, air conditioning ducts, piping, etc., and to ensure clear ceiling heights indicated on the Drawings. Where piping occurs in ceiling spaces, keep piping above level of top of lighting fixtures.
- 1.5.3. Submit flow and residual test results.
- 1.5.4. Submit hydraulic calculations in approved formats.
- 1.5.5. Samples: Submit samples of all hangers for review.
- 1.5.6. Operating and Maintenance Instructions:
- 1.5.6.1. Supply three approved hard covered loose-leaf binders containing three complete sets of manufacturer's operating and maintenance instructions, in accordance with Section 20 08 03 - OPERATING AND MAINTENANCE INSTRUCTIONS, showing all major equipment, control valves, wiring diagrams and schematics, and apparatus requiring maintenance. Spare part Suppliers, lists and addresses shall be supplied. Instructions shall be reviewed with the Owner to ensure a thorough understanding of the equipment and its operation.
- 1.5.6.2. At the completion of the installation submit a complete set of as-built drawings as outlined in Section 20 05 02 – AS-BUILT DRAWINGS. As-built drawings shall be complete including all valve tag numbers and symbols.
- 1.5.7. Spare Parts: Provide spare heads as follows:
- | Number of Heads of a Particular Type Used | Number of Spare Heads of each Type to be Provided |
|---|---|
| 0 to 299 heads | 6 spares |
| 300 to 1000 heads | 12 spares |
| Over 1000 heads | 24 spares |

1.6. QUALIFICATIONS

- 1.6.1. The installation company shall be a member of the Canadian Sprinkler Association and regularly engaged in this Work.
- 1.6.2. Acceptable sprinkler companies are:
- 1.6.2.1. Johnson Controls

- 1.6.2.2. Vipond Sprinklers
- 1.6.2.3. Paul & Douglas Sprinkler
- 1.6.2.4. Viking Fire Protection
- 1.6.2.5. Classic Fire + Life Safety
- 1.6.3. If the Mechanical Contractor is installing the sprinkler system, the Contractor shall retain one of the following acceptable sprinkler design companies :
- 1.6.3.1. Disano Sprinkler Design
- 1.6.3.2. Novus Fire Protection Consulting Inc.
- 1.6.3.3. Mirenda Incorporated

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. General:
 - 2.1.1.1. All components used in the sprinkler system shall be ULC Listed and FM Approved. UL Listed and/or FM Approved equipment not bearing a ULC listing shall only be acceptable if written approval from the local authority is obtained.
 - 2.1.1.2. All components used in the sprinkler system shall be manufactured in Canada or USA, whenever available.
- 2.1.2. Pipe, valves and fittings less than 1207 kPa (175 psi) working pressure shall be as follows:
 - 2.1.2.1. Pipe, black steel, Schedule 40, ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."
 - 2.1.2.2. Fittings for a minimum of: 1207 kPa (175 psi) working pressure, 1035 kPa (150 psi) roll grooved Victaulic grade E, Type A, c/w FlushSeal Gasket.
 - 2.1.2.3. Dry pipe and fittings for all Projects shall be galvanized.
 - 2.1.2.4. Provide ULC Listed and FM Approved valves of the same manufacturer for the entire system.
 - 2.1.2.5. Acceptable valve manufacturers:
 - 2.1.2.5.1. Viking Nibco
 - 2.1.2.5.2. ASC Engineered Solutions Gruvlok
 - 2.1.2.5.3. MA Stewart W Series
 - 2.1.2.5.4. Victaulic
 - 2.1.2.5.5. Johnson Controls Tyco Grinnell
 - 2.1.2.6. Gate valves 50 mm (2 in.) and smaller Victaulic series 707C or 766 models.
 - 2.1.2.7. Ball valves 50 mm (2 in.) and smaller shall be WATTS #6000.
 - 2.1.2.8. Butterfly valves 50 mm (2 in.) and smaller may be used as an alternative to specified gate valves, bronze body, screwed ends, stainless steel disc and stem.
 - 2.1.2.9. Gate valves 65 mm (2-1/2 in.) and larger iron body bronze mounted, OS&Y flanged or grooved ends.
 - 2.1.2.10. Butterfly valves 65 mm (2-1/2 in.) and larger shall be Victaulic butterfly valves.
 - 2.1.2.11. Check valves 50 mm (2 in.) and smaller, all bronze replaceable seat, screwed ends.
 - 2.1.2.12. Double Check valves 65 mm (2-1/2 in.) and larger shall be Watts BFG models or Watts 757 DCDA BFG models depending on City of Toronto requirements.

- 2.1.2.13. All grooved Products including couplings and fittings shall be of one manufacturer.
- 2.1.2.14. Provide fittings with grooved connections at all legs of the fitting or couplings equal to Victaulic "Vic-Plus" Firelock #005..
- 2.1.3. No grooved fittings or Products shall be used except for those supplied by specified manufacturers.
- 2.1.4. Provide pipe valves and fittings over 1207 kPa (175 psi) working pressure as follows:
 - 2.1.4.1. Pipe, black steel, schedule 40, ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless" (up to 2070 kPa (300 psi)).
 - 2.1.4.2. Fittings, 2070 kPa (300 psi) malleable iron ASME B16.3 "Malleable Iron Threaded Fittings: Classes 150 and 300," 1720 kPa (250 psi) cast iron ASME B16.4 "Gray Iron Threaded Fittings: Classes 125 and 250," or butt welding schedule 40 ASME B16.25 "Buttwelding Ends" to suit maximum system pressure.
 - 2.1.4.3. Galvanized dry pipe and fittings for all FM Global Projects.
 - 2.1.4.4. Provide ULC Listed and FM Approved valves of the same manufacturer for the entire system.
 - 2.1.4.5. Acceptable valve manufacturers:
 - 2.1.4.5.1. Viking Nibco
 - 2.1.4.5.2. MA Stewart
 - 2.1.4.5.3. Victaulic
 - 2.1.4.5.4. Johnson Controls Tyco Grinnell
 - 2.1.4.6. Gate valves 50 mm (2 in.) and smaller all bronze, rising stem, screwed Class 200.
 - 2.1.4.7. Ball valves 50 mm (2 in.) and smaller may be used as an alternative to specified gate valves, bronze body, chrome plated brass ball, stainless steel stem, TFE seat.
 - 2.1.4.8. Gate valves 65 mm (2-1/2 in.) and larger, steel body, flanged or welded, Exalloy stellite trim, OS&Y equal to Class 150 1930 kPa (150 to 280 psi) and Class 300 above 1930 kPa (280 psi).
 - 2.1.4.9. Check valves 50 mm (2 in.) and smaller all bronze, swing check, Class 200, to local authorities' approval.
 - 2.1.4.10. Check valves 65 mm (2-1/2 in.) and larger, steel body, flanged or welded Exalloy trim, equal to Class 150 1930 kPa (150 to 280 psi) and Class 300 above 1930 kPa (280 psi).
 - 2.1.4.11. Express riser shall be welded pipe and fittings.
- 2.1.5. Combination test and drain valve 50 mm (2 in.) inlet, 50 mm (2 in.) outlet, sprinkler test orifice and sight glass. This valve may be used in lieu of separate 50 mm (2 in.) drain valve, 25 mm (1 in.) test valve, sprinkler test orifice and sight glass. Victaulic 720 TestMaster II.
- 2.1.6. Sight glasses shall be 1207 kPa (175 psi) working pressure.
- 2.1.7. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CSA S413 "Parking Structures" and shall be of corrosion resistant material or shall have an effective, durable, corrosion resistant coating.
- 2.1.8. Provide approved type backflow prevention complete with supervised valves, on glycol loops.
- 2.1.9. The pressure reducing valves on the sprinkler down-feed riser shall be hydraulically operated globe valve with ULC label rated at 1207 kPa (175 psi) working pressure. Valves to be sized for maximum 69 kPa (10 psi) pressure drop at 31.5 L/s (500 USGPM) flowing. Singer 106-PR-8702 or Cla-val 90G-21.
- 2.1.10. Pressure reducing valve stations shall consist of two valves each sized for 100 % flow in parallel each with supervised isolating valves to permit servicing. All isolating valves on sprinkler system shall be located not higher than 1828 mm (72 in.) above the floor.

- 2.1.11. Alarm flow switches shall be ULC Listed and equal to Potter VSR-F. Wiring to annunciator panel shall be by the Electrical Division.
- 2.1.12. Switches for supervised valves shall indicate a trouble when valve not fully open. Switch shall be complete with contacts for alarm and supervision. All wiring to annunciator panel shall be by the Electrical Division. Plug in type switches are not acceptable. Switches shall be equal to Potter OSYSU.
- 2.1.13. Alarm check valve shall be complete with all appurtenances including contacts for wiring to the building fire alarm system for low pressure and flow, water gong mounted where shown or directed, electric alarm bell mounted where shown or directed, and all valve, gauges, fittings and drains. Victaulic Series 751 Firelock, Johnson Controls Tyco Grinnell AV-1-175/AV-1-300, or Viking Model J-1.
- 2.1.14. Provide automatic air maintenance device with the following features:
 - 2.1.14.1. Equal to Reliable Model A Automatic Pressure Maintenance Device.
 - 2.1.14.2. ULC Listed & FM Approved.
 - 2.1.14.3. Complete with line size by-pass, servicing valves, pressure regulator and orifice and check valve.
 - 2.1.14.4. Minimum inlet pressure rating: 150 PSI.
 - 2.1.14.5. Outlet pressure range of at least 5 to 50 PSI.
 - 2.1.14.6. 12.7 mm (1/2 in.) threaded inlet and outlet.
- 2.1.15. Excess pressure pump shall be capable of raising the system pressure 517 kPa (75 psi) above the city water pressure. Capacity shall be 0.12 L/s (2 USGPM) when driven by a 0.25 kW (1/3 hp) motor. Pumps shall be mounted on a bracket adjacent to the alarm check valve. Pumps shall be automatic start/stop from pressure switch set to start at 760 kPa (110 psi) and stop at 830 kPa (120 psi). Provide a trouble alarm to show loss of excess pressure.
- 2.1.16. Pressure switches shall be ULC listed and shall alarm on low pressure in system. Pressure switches shall be suitable for wet systems, dry systems or pre-action systems as applicable. Potter PS40A or PS120A as applicable.
- 2.1.17. Pressure gauges shall be 6 mm (1/4 in.) NPT, (3-1/2 in) dial, 1207 kPa (175 psi) working pressure.
- 2.1.18. Sprinkler zone control cabinets shall be recessed type, 1.19 mm (0.0478 in. - 18 MSG) thick steel tub with baked white enamel interior corrosion resistant and maximum inside dimensions of 750 mm x 750 mm x 225 mm (30 in. x 30 in. x 9 in.) deep. Front shall be adjustable, 2 mm (0.0747 in. - 14 MSG) thick steel door and frame with hollow channel reinforcement and 12 mm (0.5 in.) turn back. Hinges shall be full length, semi-concealed piano type for 180 degree rotation. Glass shall be 5 mm (3/16 in.) clear. Door latch shall be flush stainless steel type with no visible mounting screws. All metal shall be prime coated with the exception of the door latch. National Fire Equipment CV-200.
- 2.1.19. Sprinkler heads shall be the automatic spray type, ULC listed and as approved by IAO or FM as applicable. Where heads are located close to heating coils, unit heaters or other hot equipment, they shall be of the high temperature type to suit regulations.
- 2.1.20. Sprinkler heads in unfinished areas with no ceiling indicated as light hazard shall be quick response, standard coverage, bronze heads, upright. Reliable Model F1FR, Viking Microfast Model M, Tyco TY3131, Victaulic V2704.
- 2.1.21. Sprinkler heads in areas with acoustic or gypsum wall board ceiling indicated as light hazard or ordinary hazard shall be quick response, concealed type with white cover plate. Reliable Model G5, Viking Mirage, Tyco RFII, Victaulic V2708.T
- 2.1.22. Sprinkler heads in sidewall application indicated as light hazard shall be quick response, extended or standard coverage, fully concealed type with white cover plate equal to: Viking VK480 when in residential suites, Viking VK680 when in other light hazard areas or equal.

- 2.1.23. Window sprinkler heads shall be Tyco Model WS horizontal or pendent vertical sidewall and installed to comply with Architectural Details.
- 2.1.24. Provide extended coverage sprinkler heads only as required by NFPA to satisfy general sprinkler head layouts as shown without reducing the area of protection.
- 2.1.25. Unless otherwise specified, hangers shall conform to the requirements of NFPA 13 "Standard for the Installation of Sprinkler Systems."
- 2.1.26. Connection between fire protection system and the domestic water system shall have a ULC listed backflow assembly conforming to CSA B64 Series "Backflow preventers and vacuum breakers" or to the requirements of the Authority Having Jurisdiction. The assembly shall incorporate a metered by-pass to detect leaks and unauthorized water use. All valves shall be supervised and shall be by one of the manufacturers listed in Section 22 11 13 - PIPES, VALVES AND FITTINGS (PLUMBING SYSTEM).
- 2.1.26.1. Minimum requirement for systems filled with untreated potable water provide a double check valve assembly equal to Zurn-Wilkins Model 350ADA.
- 2.1.26.2. For systems that have chemical treatment or other substances added that contaminate the water the connection between the fire protection system and the domestic water system shall have a reduced pressure backflow preventer assembly with the features listed above and in conformance with CSA B64 Series "Backflow preventers and vacuum breakers."
- 2.1.27. Site main shall be ductile iron (cement lined ductile iron) (JM Eagle Blue Brute plastic pipe with CIMJ fittings).
- 2.1.28. In lieu of rigid pipe offsets or return bends for sprinkler drops, a flexible stainless steel sprinkler drop system may be used to locate sprinklers. The drop system shall consist of a UL Listed and FM Approved braided type 304 stainless steel hose for sprinkler services up to 1207 kPa (175 psi). The hose shall have a bend radius of 50 mm (2 in.) to allow for proper installation in confined spaces. The braided hose assembly shall be listed for a minimum of 5 bends per 915 mm (36 in.) of length. The flexible drop shall attach to the ceiling grid using a one-piece open gate bracket. The bracket shall allow installation before the ceiling system is in place. All hoses shall be factory tested to 2758 kPa (400 psi).

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Spacing of sprinklers shall suit the hazard of the occupancy shown. Where specific locations of sprinkler heads have been shown on Drawings, these shall be maintained. Sizing of piping shall be based on hydraulic design. Submit all calculations to the city, the Owner's Insurers and the Engineer's Representative for review. The calculations shall be designed and bear the signed stamp the engineer.
- 3.1.2. Most sprinkler heads are not shown on the Drawings. The Sprinkler Contractor is fully responsible for reviewing the Architectural and Interior Drawings, including all ceiling details and providing concealed lines and heads in the bulkheads and ceiling indicated on the Drawings unless specifically noted otherwise. Bulkheads will not be added to reduce the length of sprinkler branches.
- 3.1.3. For exposed structures the sprinkler head layout, where shown, is to assist in design, layout, and coordination. Ensure that all heads required to suit as-built beam, ducts or other obstructions are provided. Where specific pipe locations have been indicated these shall be maintained.
- 3.1.4. Supply and install where directed spare heads and any special types of wrenches in a cabinet.
- 3.1.5. Installation shall conform to all applicable codes.
- 3.1.6. Review all other Sections of the Specifications and include for all Work that may affect this section. Pay particular attention to the requirements for valve tags and identification.

- 3.1.7. Fully coordinate the sprinkler piping with that of other trades on the job. Mains and branches shall be run so as not to interfere with the building's structure, electrical, plumbing, ventilation and heating installations. Sprinkler heads shall be located in the centre and/or quarter points of ceiling tile as shown on the reflected ceiling plans.
- 3.1.8. Remove and reinstall sprinkler piping and heads installed without coordination with other trades. Work at the cost of this division.
- 3.1.9. Co-ordinate with the plumbing trades to ensure proper connections and drains are available. This Section shall pay for any costs associated with ensuring proper drainage is provided.
- 3.1.10. Provide all alarm, supervisory, and trouble points as required by code and coordinate with the Fire Alarm Annunciator Supplier and installer to ensure all points are included in the annunciator.
- 3.1.11. In all office areas, any additional sprinkler heads added to the floor because of increased requirements, shall be piped directly from the loop main.
- 3.1.12. Supply and install all insulation and electric tracing for sprinkler systems in accordance with the Insulation and Electric Tracing Sections. Supply and install a low temperature alarm sensor and loss of power sensor on all piping that is traced.
- 3.1.13. Flexible stainless steel sprinkler drop systems are not permitted in natatoriums, natatorium change rooms or natatorium service rooms.
- 3.1.13.1. Install as per NFPA and manufacturer's written instructions and technical bulletins.
- 3.1.13.2. Adjust from factory pressure setting to suit required site conditions.
- 3.1.13.3. Commission and test configuration through range of operation.

3.2. TESTING OF SYSTEMS

- 3.2.1. All testing shall be executed in accordance with the latest regulations of NFPA 13 "Standard for the Installation of Sprinkler Systems" and with any other regulations that the authoritative inspector demands.
- 3.2.2. Make all required arrangements, pay for, perform and witness flow and residual tests at the site before making hydraulic calculations. A copy of these results shall be submitted with the Shop Drawings.
- 3.2.3. Arrange for proper drainage from test/drain connections including but not limited to:
 - 3.2.3.1. Main drain test connections.
 - 3.2.3.2. On-floor test connections.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Finish painting for prime painted cabinets - under Section 09 90 00 - PAINTING AND COATING.

1.3. SUBMITTALS

1.3.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Portable fire extinguishers shall be rated and identified in accordance with CAN/ULC-S508 "Standard for the Rating and Fire Testing of Fire Extinguishers." All ratings identified below shall be considered as a minimum.

2.1.2. Provide 6A80BC rating, 4.53 kg (10 lbs.) multi-purpose dry chemical powder type and ULC labelled in Mechanical and Electrical Rooms.

2.1.3. Provide 1-A:K rating, 6 L (1.59 USgal.) wet chemical type, stainless steel, and ULC labelled in kitchens in addition to general coverage extinguishers.

2.1.4. Provide 4A80BC rating, 4.53 kg (10 lbs.) multi-purpose dry chemical powder type and ULC labelled (ammonium phosphate) in general areas.

2.1.5. Extinguishers in non-finished areas not accessible to the general public shall be mounted on wall brackets.

2.1.6. Portable fire extinguisher cabinets in finished areas shown as Type "FE" shall be recessed type flush mounted, 1.19 mm (0.0478 in. - 18 MSG) thick steel tub with black enamel interior and maximum inside dimensions of 254 mm x 762 mm x 203 mm (10 in. x 30 in. x 8 in.) deep. Front shall be adjustable with black enamel trim, 1.2 mm (0.05 in. - 18 USG) thick 304 stainless steel No. 4 vertical grain satin finish door. Glass shall be 5 mm (3/16 in.) clear. Latch shall be concealed. National Fire Equipment Model CTE300-20.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Spacing of extinguishers shall conform to the Authority Having Jurisdiction. Maximum spacing for Class B fires in ordinary hazard occupancies shall be 9 m (29.5 ft.) for 10 BC extinguisher and 15 m (49.2 ft.) for 20 BC extinguishers, but in no case shall there be less than one extinguisher in each electrical room, kitchen or mechanical room. Maximum spacing for Type A extinguishers in Class A fires shall be 22.9 m (75 ft.).

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

2.2. FINISHED AREAS

- 2.2.1. Cleanouts in finished areas with membrane floors shall be coated cast iron body with adjustable nickel bronze frame and round scoriated gas tight access cover with secondary gas tight plug. J.R. Smith 4020-F-C, Zurn ZN 1400-KC, Mifab C1100C-R-1-34, Watts CO-100-C-R-1-34G.
- 2.2.2. Cleanouts with recess for tile shall be similar to cleanouts in finished areas with membrane floors but shall have 3 mm (1/8 in.) tile recess. J.R. Smith 4140-F-C, Zurn ZN 1400-X-KC, Mifab C1100C-UR-1-34, Watts CO-100-C-R-1-34G.
- 2.2.3. Cleanouts for carpeted areas shall be similar to cleanouts in finished areas but shall have stamped stainless steel carpet marker. J.R. Smith 4020-Y, Zurn ZN 1400-CM, Mifab C1100-RC-1-34, Watts CO-100-C-R-1-34G.

2.3. NON-FINISHED AREAS

- 2.3.1. Cleanouts in non-finished areas shall be all coated cast iron body with heavy duty cast iron or ductile iron top. J.R. Smith 4220-F-C, Zurn Z-1400-KC, Mifab C1100-XR-4-34, Watts CO-100-C-R-1-34G.
- 2.3.2. Cleanouts at the base of each vertical stack and rain water leader shall be either Daisy or Barrett type.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Cleanouts in furred ceiling spaces shall extend up through floor slab above, except where the Engineer's Representative gives specific approval to its location in the ceiling space.
- 3.1.2. Cleanouts shall be installed in horizontal drains at each change of direction and as required.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Pipes and fittings shall be in accordance with the following unless specified otherwise by local authorities.
- 2.1.2. All valves on potable water systems shall be equal in performance to the models specified, shall be lead free or low lead meeting the requirements of CSA B125.3 "Plumbing fittings," CSA B125.14 "Manually operated valves for use in plumbing systems," NSF/ANSI 372 "Drinking Water System Components - Lead Content," NSF/ANSI 61 "Drinking Water System Components - Health Effects," NSF/ANSI 14 "Plastics Piping System Components and Related Materials," and/or ANSI/AWWA C550 "Protective Interior Coatings for Valves and Hydrants" as applicable.
- 2.1.3. All city and domestic water, above ground, 75 mm (3 in.) and smaller, less than 1380 kPa (200 psi) working pressure:
- 2.1.3.1. Pipe: Copper Tubing, Type "L", Hard Drawn, ASTM B88 "Standard Specification for Seamless Copper Water Tube." Fittings: wrought copper solder joint pressure fittings, ANSI/ASME B16.22 "Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings" or cast copper alloy solder joint pressure fittings, ANSI/ASME B16.18 "Cast Copper Alloy Solder Joint Pressure Fittings."
- 2.1.3.2. Joints made with 95-5 tin antimony, 96-6 tin silver, or 96-4 tin silver solder, ASTM B32 "Standard Specification for Solder Metal."
- 2.1.3.3. Grooved end copper fittings designed to accept grooved end couplings of the same manufacturer. Fittings shall be wrought copper or bronze casting, conforming to ASTM B75/B75M "Standard Specification for Seamless Copper Tube." Victaulic Copper Connection Fittings.
- 2.1.3.6. Couplings to be designed with angle bolt pads to provide a rigid joint.
- 2.1.3.6.1. Installation ready for direct stab installation without field disassembly, complete with grade P fluoroelastomer gasket, rated for -18 deg. C. to 82 deg. C. (0 deg. F. to 180 deg. F.). Victaulic 607.
- 2.1.3.6.2. Stainless steel pipe may be used as an alternative material if acceptable to Local Authorities. Follow applicable codes for stainless steel pipe joints. Stainless steel pipe to conform to ASTM A312 "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes." Stainless steel fittings to conform to ASTM A403 "Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings."
- 2.1.3.6.3. Schedule 10 Type 304/304L to ASTM A312.
- 2.1.3.6.4. Butterfly valves, bubble-tight service up to 2065 kPa (300 psi) with cast brass bronze body, aluminum-bronze disc, pressure-responsive grade P fluoroelastomer seat, and stainless steel stem. Victaulic 608N.
- 2.1.3.7. Gate valves, 860 kPa (125 psi) WSP or 1380 kPa (200 psi) non-shock WOG with lead free bronze body, rising stem screwed. Kitz 827/828, Toyo 206A-LF/207A-LF, Apollo 101T-LF.

- 2.1.3.8. Globe valves, 860 kPa (125 psi) WSP or 1380 kPa (200 psi) non-shock WOG with lead free bronze body, solder ends or with screwed to solder adapter and composition disc for water service. Kitz 811/812, Toyo 211A-LF/212A-LF, Apollo 120S-LF.
- 2.1.3.9. Check valves 860 kPa (125 psi) WSP or 1380 kPa (200 psi) non-shock WOG with lead free bronze body, swing check, solder ends. Kitz 822/823, Toyo 236A-LF/237A-LF, Apollo 161S-LF.
- 2.1.3.10. Non-slam check valves downstream from pumps, ANSI Class 150, 1032 kPa (150 psi) WSP pressure rating, dual flapper design with 316 stainless steel body and stainless steel check, renewable disc and resilient seat for flanged installation. Non-slam check valves shall be Velan-ProQuip Model DDD11-1D, Duo CHEK II H15CMF3-14, Mueller 72-HHH-3-H, or NCI/SSI 150WTTTV-T.
- 2.1.3.11. Strainers shall be lead free bronze Y body equal to Colton Industries Model 125YTB, Mueller LF351.
- 2.1.3.12. Drain valves and blow-off valves shall be 4137 kPa (600 psi) WG 19 mm (3/4 in.) ball valves with lead free, bronze body or forged brass body, solid ball, male threaded garden hose end, brass cap and chain equal to Watts B6000, Toyo 5046-LF, Kitz 868C or Apollo 78-100. Hose bibs shall be for 860 kPa (125 psi) non-shock, bronze body with composition disc and 19 mm (3/4 in.) garden hose thread, complete with a ULC vacuum breaker.
- 2.1.3.13. Pipe sizes 12 mm (1/2 in.) to 50 mm (2 in.) Schedule 10 Type 304/304L to ASTM A312/A312M "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes."
- 2.1.3.13.1. Vic-Press 304 ASTM A312 stainless steel housings with ASTM A276 "Standard Specification for Stainless Steel Bars and Shapes" and A312 outlets and austenitic stainless steel plain or grooved ends, type 304, complete with synthetic rubber Grade "H" (HNBR) seals rated for applicable services to 82 deg. C (180 deg. F).
- 2.1.4. All domestic water above ground 75 mm (3 in.) and smaller, over 1380 kPa (200 psi) working pressure and under 2070 kPa (300 psi) working pressure:
 - 2.1.4.1. Pipe: Copper Tubing, Type "L", Hard Drawn, ASTM B88 "Standard Specification for Seamless Copper Water Tube."
 - 2.1.4.2. Joints, brazed.
 - 2.1.4.3. Grooved end copper fittings designed to accept grooved end couplings of the same manufacturer. Fittings shall be wrought copper or bronze casting, conforming to ASTM B75/B75M "Standard Specification for Seamless Copper Tube." Victaulic Copper Connection Fittings.
 - 2.1.4.4. Couplings to be designed with angle bolt pads to provide a rigid joint.
 - 2.1.4.4.1. Installation ready for direct stab installation without field disassembly, complete with grade P fluoroelastomer gasket, rated for -18 deg. C. to 82 deg. C. (0 deg. F. to 180 deg. F). Victaulic 607.
 - 2.1.4.5. Stainless steel pipe is an acceptable alternative where accepted by authorities having jurisdiction. Follow applicable codes for stainless steel pipe joints. Stainless steel pipe to conform to ASTM A312 "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes." Stainless steel fittings to conform to ASTM A403 "Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings."
 - 2.1.4.6. Butterfly valves, bubble-tight service up to 2065 kPa (300 psi) with cast brass bronze body, aluminum-bronze disc, pressure-responsive grade P fluoroelastomer seat, and stainless steel stem. Victaulic 608N.
 - 2.1.4.7. Gate valves, 1035 kPa (150 psi) WSP or 2070 kPa (300 psi) non-shock WOG, lead free bronze body solder ends or screwed to solder adapter. Kitz 827/828, Toyo 206A-LF/207A-LF.

- 2.1.4.8. Globe valves, 1035 kPa (150 psi) WSP or 2070 kPa (300 psi) non-shock WOG, lead free bronze body solder ends or screwed to solder adapter, composition disc. Kitz 811/812, Toyo 211A-LF/212A-LF, Apollo 120S-LF.
- 2.1.4.9. Check valves, 1380 kPa (200 psi) WSP or 2760 kPa (400 psi) non-shock WOG, lead free bronze body swing check, solder or screwed ends to solder adapters. Kitz 822/823, Toyo 236A-LF/237A-LF, Apollo 161S-LF.
- 2.1.4.10. Non-slam check valves downstream from pumps, dual flapper design with stainless steel body, check, renewable disc and resilient seat for flanged installation equal to Velan Proquip 2070 kPa (300 psi) pressure rating model 4DD111, Duo CHEK II S-3 G30CPF 559, Mueller Sure Check #74-HHH-6-H, or NCI/SSI 150WTTTV-T.
- 2.1.4.11. Strainers shall be lead free bronze Y body equal to Colton Industries model B509 or Mueller LF352.
- 2.1.4.12. Drain valves and blow-off valves shall be 4137 kPa (600 psi) WG 19 mm (3/4 in.) ball valves with bronze or forged lead free brass body, solid ball, virgin teflon seat and packing, male threaded hose end, cap and chain. Equivalent to Watts B6000, Toyo 5046-LF, Kitz 868C or Apollo 78-100.
- 2.1.4.13. Pipe sizes 12 mm (1/2 in.) to 50 mm (2 in.) Schedule 10 Type 304/304L to ASTM A312/A312M "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes."
- 2.1.4.13.1. Vic-Press 304 ASTM A312 stainless steel housings with ASTM A276 "Standard Specification for Stainless Steel Bars and Shapes" and A312 outlets and austenitic stainless steel plain or grooved ends, type 304, complete with synthetic rubber Grade "H" (HNBR) seals rated for applicable services to 82 deg. C (180 deg. F).
- 2.1.5. For storm and sanitary drains above ground 65 mm (2 1/2 in.) and smaller, provide copper type "L" conforming to ASTM B88 PVC. Fittings: Wrought copper PVC. Joints: Soldered joint PVC solvent.
- 2.1.6. For storm and sanitary drains above ground 75 mm (3 in.) and larger, provide Cast Iron conforming to standard CSA-B70. Fittings: Cast Iron. Joints: Mechanical joint.
- 2.1.7. For vent pipe provide DWV Copper conforming to ASTM B306, Cast Iron conforming to standard CSA-B70. Fittings: Wrought copper Cast iron. Joints: Soldered joint, mechanical joint, pressed (Viega, Apollo or approved equivalent).
- 2.1.7.1. For cast iron pipe fittings on sanitary and storm, provide fittings equal to Bibby-Ste-Croix Husky SD 4000 heavy duty fittings in the following areas:
 - 2.1.7.1.1. All vertical to horizontal pipe connections.
 - 2.1.7.1.2. All joints in the Lobby and other amenity areas.
 - 2.1.7.1.3. Horizontal to horizontal connections within 3 m of the vertical to horizontal connection.
- 2.1.8. Storm and sanitary, not buried, inside the building, to CSA B1800 "Thermoplastic nonpressure piping compendium":
 - 2.1.8.1. For Buildings that are not classified as High Buildings: PVC DWV Schedule 40 and fittings, meeting flame-spread rating not more than 25, per CAN/ULC-S102.2 "Standard Method of Testing for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies," with pipe manufacturer's approved solvent weld joints or pipe manufacturer's approved mechanical joint couplings.
- 2.1.9. Vent stack covers:
 - 2.1.9.1. 1100-0T alloy aluminum with vandal proof removable cap
 - 2.1.9.2. EPDM base seal

- 2.1.9.3. PVC coated deck flange or bituminous deck flange as required to suit roof membrane
- 2.1.9.4. Insulated for inverted steel roof construction with insulation on top of deck
- 2.1.9.5. Uninsulated for concrete roof construction
- 2.1.9.6. Uninsulated: Thaler Metal Industries SJ-24/SJ-25
- 2.1.9.7. Insulated: Thaler Metal Industries SJ-26/SJ-27
- 2.1.10. Sump and sewage pump discharge, non potable, buried:
- 2.1.10.1. Type "L" copper, brazed; or
- 2.1.10.2. Schedule 80 PVC pressure piping conforming to CSA B137.3 "Rigid polyvinylchloride (PVC) pipe and fittings for pressure applications."
- 2.1.11. Laboratory drains and vents shall be in accordance with Section 22 63 53 - LABORATORY LIQUID SYSTEMS.
- 2.1.12. Butterfly valves may be used in lieu of gate valves in size 65 mm (2-1/2 in.) and over in systems 1380 kPa (200 psi) and less. Where specifically shown on Drawings, butterfly valves must be used. Install between 860 kPa (125 psi) flanges.
- 2.1.12.1. Valves shall have NSF/AWWA coated iron body, one piece or split alloy steel shaft, top and bottom bearings, lead free bronze disc or coated iron disc with stainless steel trim and resilient elastomer replaceable seat with integral reinforcing ring or keyed to body.
- 2.1.12.2. Body shall have threaded lugs.
- 2.1.12.3. Valve shall have bubble tight shut-off to 1035 kPa (150 psi) pressure in either direction when the piping and connecting flange is removed from one side of the valve.
- 2.1.12.4. Valves 100 mm (4 in.) and smaller shall have lever operator with lock.
- 2.1.12.5. Valves larger than 100 mm (4 in.) shall have worm gear manual operator with indication of valve opening.
- 2.1.12.6. Butterfly valves for grooved end systems shall be Victaulic 608N for copper and Victaulic 861 for stainless steel.
- 2.1.13. Backflow Preventers – Reduced Pressure Back Flow Preventer:
- 2.1.13.1. Reduced pressure zone assemblies to prevent the reverse flow of polluted water from entering into the potable water supply due to backsiphonage and or backpressure.
- 2.1.13.2. Lead Free bronze body construction (1/4 to 2 in.).
- 2.1.13.3. Lead Free epoxy coated ductile or cast iron (2 1/2 to 10 in.).
- 2.1.13.4. Two, in-line independent check valves, replaceable check seats with an intermediate relief valve, and ball valve test cocks.
- 2.1.13.5. Maximum Working Pressure: 1207 kPa (175 psi).
- 2.1.13.6. BEECO FRP, Zurn-Wilkins 975XL2/375A or Watts LF009/LF909 Series.
- 2.1.14. Ball valves 50 mm (2 in.) and smaller shall be lead free, bronze body or forged brass 4137 kPa (600 psi) WOG, virgin Teflon seat, TFE stem packing and thrust washer, 1/4 turn open-closed operation with solid ball. Ball valves shall be Watts No. LFB-6000, Toyo 5044A-LF/5049A-LF, Kitz 858/859, Apollo 70LF-100/200, or NCI 600FP-T/S. Stem extensions shall be provided on all ball valves. Ball valves may be substituted for gate valves only.
- 2.1.15. Except where special features are required or unless otherwise approved or noted, all valves shall be of one manufacturer with the manufacturer's name and the pressure rating clearly marked on the outside of the valve body.

- 2.1.16. Pressure Reducing Valves:
- 2.1.16.1. For all sizes of grooved piping, provide pressure reducing valves equal to Victaulic Series 386-SB single branch pressure reducing valve stations with intergral low flow bypass. For single stage pressure reducing valves, provide valves equal to Victaulic 386A-SB. For two stage pressure reducing valve stations, provide valves equal to Victaulic 386B-SB. Provide valves at capacity shown in PRV Schedule and with a pressure drop not exceeding 69 kPa (10 psi) under full flow. Provide valves that maintain downstream pressure within a range of plus or minus 35 kPa (5 psi). Provide required outlet pressure, inlet pressure, and flow rate as shown. Alternate manufacturers will not be accepted.
- 2.1.16.1.1. Provide pressure reducing station that is complete with inlet and outlet isolation valve, stainer, and pressure reducing valve with integral low flow by-pass.
- 2.1.16.2. For 65 mm (2-1/2 in.) and larger, non grooved, provide Cla-Val 90-01 or equal with capacity shown and a pressure drop not exceeding 69 kPa (10 psi) under full flow. Provide valve that maintains downstream pressure within a range of plus or minus 35 kPa (5 psi). Provide required outlet pressure, inlet pressure and flow rate as shown. Alternate manufacturers will not be accepted.
- 2.1.16.2.1. Provide valve that maintains a constant downstream pressure regardless of fluctuations in demand and that also prevents a pressure rise when demand is zero.
- 2.1.16.2.2. Provide valve that is single-seated, hydraulically operated, pilot controlled diaphragm type globe valve. Provide valve stem that is top and bottom guided and actuated by a resilient diaphragm. Provide cast iron, flanged valve body and cover. Provide bronze trim. Provide replaceable valve seat. Do not provide external packing glands. Provide valve that is NSF/ANSI 61 "Drinking Water System Components - Health Effects" and NSF/ANSI 372 "Drinking Water System Components - Lead Content" compliant.
- 2.1.16.2.3. Provide pilot control that is a direct acting, adjustable, spring-loaded valve with bronze body and stainless steel trim.
- 2.1.16.2.4. Factory assemble main valve, pilot control valve, and all trim into one unit.
- 2.1.16.2.5. Provide valve that is Class 125 for low pressure systems less than 1380 kPa (200 psi) working pressure and Class 250 for high pressure systems greater than 1380 kPa (200 psi) working pressure.
- 2.1.16.2.6. See Drawing for capacities and operating pressures.
- 2.1.16.2.7. For isolation valves, provide full port ball valves for 64 mm (2-1/2 in.) and smaller and butterfly valves for 76 mm (3 in.) and larger.
- 2.1.16.2.8. For combination pressure reducing and check valve, provide Cla-Val 90-01-D and as specified for the pressure reducing valve, but with a check valve and isolation valve.
- 2.1.16.3. 50 mm (2 in.) and smaller: Threaded lead free water pressure reducing valve and integral strainer, suitable for 2068 kPa (300 psi) incoming pressure with downstream pressure adjustable range from 172 to 517 kPa (25 psi to 75 psi). Provide thermal expansion by-pass check valve that allows water to flow back to main when the downstream pressure exceeds setpoint.
- 2.1.16.3.1. Materials:
- 2.1.16.3.1.1. Lead free copper silicon alloy body
- 2.1.16.3.1.2. Sealed spring cage with stainless steel fasteners
- 2.1.16.3.1.3. High temperature reinforced diaphragm
- 2.1.16.3.1.4. Replaceable seat
- 2.1.16.3.1.5. Stainless steel strainer

- 2.1.16.3.2. Acceptable Manufacturers:
- 2.1.16.3.2.1. Watts LFU5B-Z3 Cash Acme E3 See Drawings for capacities and operating pressures.
- 2.1.17. Provide extendable backwater valve complete PVC extendable valve body and normally open cassette for services 100 mm (4 in.) and smaller. Extend to grade with PVC DWV pipe and provide 19 mm (3/4 in.) cassette pipe extension to grade for cassette retrieval. Provide cleanout access suitable for floor finish in accordance with Section 22 05 76 - CLEANOUTS. Backwater Valve shall be Mainline Adapt-A-Valve Model ML-#XP to suit size of drain.
- 2.1.18. Water hammer arresters shall be stainless steel bellows type and shall bear the Plumbing and Drainage Institute seal of approval. JR Smith 5000 Series, Zurn Z1700, Mifab WHB, Watts SS Series. Piston type are not permitted.
- 2.1.19. Exterior site sewers shall be PVC non-pressure, SDR 28, cement, or concrete of class and type to suit depth of trench and bedding. PVC non-pressure sewer piping shall be IPEX for sizes 100 mm (4 in.) to 150 mm (6 in.) conforming to CSA B182.1 "Plastic drain and sewer pipe and pipe fittings" and ASTM D3034 "Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings." For sizes 200 mm (8 in.) to 375 mm (15 in.) shall be IPEX conforming to CSA B182.2 "PSM type polyvinylchloride (PVC) sewer pipe and fittings" and ASTM D3034. For size 450 mm (18 in.) to 1200 mm (48 in.) shall be IPEX conforming to CSA B182.4 "Profile polyvinylchloride (PVC) sewer pipe and fittings" and ASTM F794 "Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter." Sewers shall be laid in accordance with manufacturer's written instructions and in accordance with regulatory requirements.
- 2.1.20. Exterior site PVC pressure piping shall be IPEX Blue Brute conforming to AWWA C900 "Polyvinyl chloride (pvc) pressure pipe and fabricated fittings, 4 in. through 60 in. (100 mm through 1,500 mm)" and CSA B137.3 "Rigid polyvinylchloride (PVC) pipe and fittings for pressure applications" standards laid in accordance with the manufacturer's written instructions and in accordance with regulatory requirements.
- 2.1.21. Exterior site PVC pressure piping expansion joints for differential settlement and seismic movement:
- 2.1.21.1. Manufactured of ductile iron conforming to the material requirements of ASTM A536 "Standard Specification for Ductile Iron Castings" and ANSI/AWWA C153/A21.53 "Ductile-iron Compact Fittings for Water Service."
- 2.1.21.2. Pressure test each flexible expansion joint prior to shipment against its own restraint to a minimum of 2413 kPa (350 PSI) for 76 mm (3 in.) through 406 mm (16 in.) and 1724 kPa (250 PSI) for 457 mm (18 in.) and larger. Provide a minimum 2:1 safety factor, determined from the published pressure rating.
- 2.1.21.3. Provide flexible expansion joints that consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 20 degrees for sizes 102 mm (4 in.) through 305 mm (12 in.); 15° for sizes 356 (14 in.) through 914 mm (36 in.) and 12° for size 1219 mm (48 in.). Provide flexible expansion fitting that does not expand or exert an axial imparting thrust under internal water pressure. Provide flexible expansion fitting that does not increase or decrease the internal water volume as the unit expands or contracts. Provide minimum total linear travel of 203 mm (8 in.).
- 2.1.21.4. Line all internal surfaces (wetted parts) with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 "Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings." Provide EPDM sealing gaskets. Provide coatings that meet NSF/ANSI/CAN 61 "Drinking Water System Components."
- 2.1.21.5. Coat exterior surfaces with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16 "Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings."

- 2.1.21.6. Include polyethylene sleeves, meeting ANSI/AWWA C105/A21.5 "Polyethylene Encasement for Ductile-Iron Pipe Systems" for direct buried applications.
- 2.1.21.7. Provide manufacturer's certification of compliance to the above standards and requirements.
- 2.1.21.8. Provide flexible expansion joints: Force Balanced FLEX-TEND or Victaulic 257 Dynamic Movement Joint.
- 2.1.22. Automatic flow balancing valves up to 3/4 in. (21 mm) on domestic water recirculation system: Victaulic TA Series 76X – pressure independent balancing valves, factory set to automatically limit the flow to the desired set point.
- 2.1.23. Manual flow balancing valves up to 2 in. (50.8 mm): Victaulic TA Series 790 on domestic water recirculation system.
- 2.1.24. Thermostatic mixing valves
- 2.1.24.1. Thermostatic mixing valves shall be Lawler Series 801 (19 mm (3/4 in.) inlet and 25 mm (1 in.) outlet) High-Low Water Mixer combination thermostatic and pressure balanced water controller, liquid filled motor. The valve shall maintain output temperature for changes in inlet pressure and temperature. Valve construction shall be bronze body and stainless steel piston and liner. Mixing valve shall include a union end stop and check valve with removable strainer on each inlet. Complete with 0 - 200 deg. F. dial thermometer and shut off valve on tempered water outlet.
- 2.1.24.2. Main domestic hot water systems shall have a minimum of two mixing valves in parallel, sized for one-third and two-thirds of the design flow, respectively.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Valves shall be provided as shown and as required for the satisfactory operation and control of all equipment and shall be installed to enable each piece of equipment to be isolated.
- 3.1.2. Isolation valves shall be installed at the base of each riser and at each branch take-off. Where the equipment is to be isolated within easy view of and not more than 6000 mm (20 ft.) from the main, at the branch take-off, then the branch take-off valve may serve as the equipment isolating valve.
- 3.1.3. Drain valves shall be installed at each low point in the piping systems and at each tank.
- 3.1.4. Blow-off valves shall be provided on each 65 mm (2-1/2 in.) strainer and larger.
- 3.1.5. Globe valves shall be installed as shown and in each bypass.
- 3.1.6. Install manual flow balancing valves where shown on the Drawings or where required.
- 3.1.7. Install automatic flow balancing valves where shown on the Drawings or where required.
- 3.1.8. Install automatic flow balancing valves where shown on the Drawings and at each riser on domestic water recirculation system.
- 3.1.9. Where combined domestic water and fire protection services are provided, provide master isolation supervised shut off valve. Refer to Section 21 13 00 – SPRINKLER SYSTEMS for valve specifications.
- 3.1.10. Install building premise isolation back flow prevention as required by CSA B64.
- 3.1.11. Install reduced pressure backflow preventers where required by CSA B64 and in the following locations:
 - 3.1.11.1. Heating water systems make-up
 - 3.1.11.2. Glycol systems make-up (where provided)

- 3.1.12. PC4 jointing material shall not be used on buried piping. PC4 or similar jointing material shall be used for caulking waste pipes from sinks or dishwashers and other waste pipes carrying hot discharge liquids.
- 3.1.13. Connections between copper and steel pipe shall be made with brass or bronze fittings where other type of connection is not specified in regulations.
- 3.1.14. All piping shall run parallel with closest wall.
- 3.1.15. Piping in walk-in pipe spaces shall be installed as close to one wall as possible.
- 3.1.16. Each water hammer arrester shall be accessible for service and replacement. They shall be installed in compliance with the recommendations of the Plumbing and Drainage Institute as found in Standard PDI-WH 201 "Water Hammer Arresters."
- 3.1.17. Slope all drains and vents in accordance with the Plumbing Code but not less than the minimum slopes shown on the Drawings. Slope all water lines 25 mm in 12 m (1 in. in 40 ft.) unless shown otherwise.
- 3.1.18. Install vent piping in accordance with requirements of the authority having jurisdiction.
- 3.1.19. Vent stack covers shall be properly sized for each vent penetrating the roof. Division 23 shall supply vent stack covers for installation and flashing by the Roofing Contractor.
- 3.1.20. Refer to Section 22 63 53 - LABORATORY LIQUID SYSTEMS.
- 3.1.21. Provide an isolation valve downstream of all flow balancing valves on the domestic water distribution.
- 3.1.22. Provide a thermostatic mixing valve on discharge of domestic hot water systems.
- 3.1.23. PEX Plastic Piping:

Install plastic piping in accordance to manufacturer's latest recommendations. Do not use crimped fittings.

Provide each fixture with a dedicated DCW or DHW line from the suite manifold. Do not serve multiple suites from a single manifold.

Provide conduit for all piping installed within the slab or below grade. No joints are acceptable below grade or in slab. Co-ordinate layout of conduits with other Divisions. Do not install domestic hot and domestic cold water lines within the same conduit. Provide minimum 25 mm (1 in.) conduit unless specifically indicated on the Drawings.

Locate water shut-off valves for each manifold where shown.

Install plastic piping and associated fittings using a certified installer. Provide certification by the system manufacturer. Submit certifications to Engineer's Representative for review.

Where PEX manifolds are acceptable in accordance with the requirements of Part 2 of this section, ensure that PEX manifolds are only roughed in and installed once the building is enclosed and temperature controlled.

Provide minimum bend radius for cold bending of not less than 6 times the outside diameter of the pipe. If bends with a radius less than stated are required, use a bend support as supplied by piping manufacturer.

Seal PEX piping penetrating a fire separation per CAN/ULC-S115 "Standard Method of Fire Tests of Firestop Systems."

Provide documentation to verify piping has been installed in accordance with manufacturer's requirements to provide 25 year warranty.

- 3.1.24. Grooved pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All grooved Products to be from a single manufacturer. All couplings shall meet the manufacturer's standards for visual inspection. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Install in accordance with manufacturer's latest recommendations. A manufacturer's factory trained representative shall periodically visit the site and review the installation for best practices. The Contractor shall correct any identified deficiencies. Grooved Product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by the manufacturer prior to the completion of the Work.
- 3.1.25. Install flexible expansion joints in the locations indicated on the Drawings and as required by piping manufacturer.
- 3.1.26. Where site servicing expansion joints are required, provide signed and sealed engineered drawings for review and record.

3.2. FLUSHING AND DISINFECTING

- 3.2.1. Flush and disinfect all new or reworked domestic water piping, ensure water flows through all fixtures, hose outlets, service connections and/or any other potable water outlet. Remove sediment from aerators as required.
- 3.2.2. Provide circulating pumps, connections and valves as required for complete flushing and disinfection of the system.
- 3.2.3. When flushing is complete, disinfect the piping with a solution of chlorine in accordance with ANSI/AWWA C651 "Disinfecting Water Mains."
- 3.2.4. Test water samples from disinfected water system at a certified laboratory for purity and conformance with governing standards.
- 3.2.4.1. Submit a copy of the test results prior to building occupancy.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Circulators shall be Armstrong, Grundfos-Paco, Xylem Bell & Gossett, Patterson Pump Company, or Taco Industries in the line type with flanged inlet and outlet, mechanical seal and suitable for 125 psig working pressure.

2.1.2. For domestic water systems (potable) pump body shall be lead free bronze or stainless steel with impeller meeting the low lead requirements of NSF/ANSI/CAN 372 "Drinking Water System Components - Lead Content" for all wetted parts.

2.1.3. All systems except domestic water pump shall be cast iron, steel impeller and stainless steel shaft.

2.1.4. Pump capacity shall be as shown in the Pump Schedule.

P-DWHR-B.1 Armstrong Model Astro 230SS-TA, 4.0gpm at 12 ft.WC, 120V/1Ph/60Hz.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Support pump as shown on Standard Details.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Floor drains shall be J.R. Smith, Mifab, Watts, or Zurn.

2.2. FINISHED AREAS

- 2.2.1. Floor drains in finished areas and stainless steel top shall be all coated cast iron body, flashing clamp with seepage openings and adjustable 127 mm (5") diameter stainless steel heavy duty strainer with No. 4 satin finish, secured with SS screws, 100 mm (4") throat on strainer. Drain shall be complete with trap primer connection. J.R. Smith 2005-A05SS-P050, Zurn ZXSS-415-A5, Mifab F1000C-5-3, Watts FD-1100-C-5-3.
- 2.2.2. Floor drains in quarry or mosaic tiled areas shall be similar to floor drains in finished areas but with 127 mm x 127 mm (5" x 5") square nickel bronze strainer. J.R. Smith 2005-B05NB-P050, Zurn ZN-415-Y5, Mifab F1100C-S5-1, Watts FD-100-C-L5-1.
- 2.2.3. Floor drains in quarry or mosaic tiled areas and stainless steel top shall be similar to floor drains in finished areas but with 127 mm x 127 mm (5" x 5") square stainless steel strainer with No. 4 satin finish. J.R. Smith 2005-B05SS-P050, Zurn ZS-415-Y5, Mifab F1000C-S5-3, Watts FD-1100-C-L5-3.
- 2.2.4. Funnel floor drains in finished areas shall be similar to floor drains in finished areas but with minimum nominal 127 mm (5") dia. strainer, full opening for funnel and nominal 75 mm x 225 mm (3 in. x 9 in.) oval funnel. J.R. Smith 2005-A05-NB-3591-OT-P050, Zurn ZN-415-BF, Mifab F1100C-EG-1, Watts FD-100-C-EG-1.
- 2.2.5. Floor drains in Safety Sheet Vinyl Flooring Areas shall be similar to floor drains in finished areas but with 2 piece flashing clamp collar. J.R. Smith 2051, Zurn ZN-415-R9, Mifab F1100C-FC9-1, Watts FD-100-C-FC9-1.
- 2.2.6. Hub drains shall be similar to floor drains in finished areas but with cast iron hub. J.R. Smith 2005-2645, Zurn Z-415-S, Mifab F1100C-DD-50, Watts FD-100-DD-50.
- 2.2.7. Elevator pit drains: Vertical wall or angled scupper drain, coated cast iron body, secured cast iron grate, clamping collar. Zurn Z187 or Z629-C-LV, J.R. Smith 1510 or 2090-C, Mifab R1310-50, Watts RD-270-50.
- 2.2.8. Electronic automatic trap seal primer system with 12 mm (1/2 in.) connection, complete with integral ball valve and CSA B64 backflow prevention to the requirements of the Authority Having Jurisdiction. Pre-pipe the unit with a copper manifold and distribution system suitable for the number of drains served. Provide electrical components with a single point power connection at 120 V. Include with unit a manual override switch and 24 hour timer with relay and adjustable delay. Factory assemble all components and install into a coated steel box with access door for surface mounted installation. Mifab MI 100-UA series; Zurn Z1020 series; Precision Plumbing Products PT Series; or Smith Fluid Controls 270/271/272 Series.
- 2.2.9. Where acceptable to the Authority Having Jurisdiction, provide trap seal protection device in lieu of hydronic. Trap seal protection is permitted in the following locations:

- 2.2.9.1. Trap Guard Pro Vent System, preassembled inline floor drain trap sealer, commercial grade ABS housing and proprietary neoprene diaphragm with soft rubber sealing gasket, ASSE 1072 "Performance Requirements for Barrier Type Trap Seal Protection for Floor Drains" AF-GW rating or approved equal. Install in accordance with manufacturer's recommendations.
- 2.2.9.2. The use of a trap seal protection device does not negate the requirement for the installation of a trap.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Provide floor drains in air plenums on the suction and discharge side of fans with deep seal traps.
- 3.1.2. Provide electronic trap seal primer assemblies for all floor drain traps. Trap primer shall be installed at the nearest cold water served fixture or faucet, except drinking fountains.
 - 3.1.2.1. Provide access to primer assembly for repair or replacement.
 - 3.1.2.2. Provide a globe valve on the water supply for regulation and shut-off.
 - 3.1.2.3. Where integral backflow prevention is not sufficient to meet the requirements of CSA B64, provide a reduced pressure backflow prevention device on the water supply to the trap seal primer in a suitable location and discharge piped to drain.
- 3.1.3. Provide a running trap and cleanout for each pit drain. For elevator pits provide an external backwater valve in accordance with Section 22 11 13 - PIPES, VALVES AND FITTINGS (PLUMBING SYSTEM).
- 3.1.4. Provide a backwater valve in accordance with Section 22 11 13 - PIPES, VALVES AND FITTINGS (PLUMBING SYSTEM) on floor drains within walk-in coolers before connecting to sanitary drainage system.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Interceptors shall be J.R. Smith, Zurn, Mifab, or Watts.

2.1.2. High capacity interceptors shall be Proceptor.

2.2. STANDARD GREASE INTERCEPTOR (STAINLESS STEEL)

2.2.1. Grease interceptors shall be fabricated entirely of stainless steel construction. Interceptor shall be at minimum rated for a 76 lpm (20 USGPM) flow rate and a 18.2 kg (40 lb) grease holding capacity unless shown otherwise. Interceptor extensions shall be provided as required to suit invert of drains.

2.2.2. Unit shall include: removable baffle assembly and cross bar, deep seal trap, cleanout, securing bolt(s) or lock and lift ring(s), internal flow control fittings, internal air relief bypass and stainless steel non skid, rectangular gasketed lid(s). Mifab MI-G-SS Series, J.R. Smith 8000E-SS Series, Zurn ZS-1170 Series, Watts WD Series.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Provide auxiliary flow control for interceptors installed with a head of more than 1500 mm (5 ft).

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Refer to Section 22 44 00 – LABORATORY FURNITURE AND FIXTURES for supply, installation, connection requirements for laboratory systems.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 – SHOP DRAWINGS.
- 1.2.2. Confirm project LEED requirements and required water use reductions prior to submitting Shop Drawings. Include page in Shop Drawings confirming that coordination with LEED Consultant has occurred prior to submitting Shop Drawings.

1.3. REFERENCES

- 1.3.1. Comply with CSA B45 Series of standards for fixtures.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Plumbing fixtures shall be as indicated and specified with all required supports, accessories, drainage, vent and water connections to make the fixtures complete.
- 2.1.2. Fittings that supply water to a fixture shall not exceed the maximum flow rates in accordance with the following:
 - 2.1.2.1. Part 7 of the Building Code
- 2.1.3. Provide fixtures from American Standard, T&S Brass, Toto, Kohler, Franke, Zurn, Blanco, Mirolin or Novanni, equivalent to the fixtures specified. American Standard – Eljer and Placidus are not permitted. Provide white vitreous china fixtures unless indicated otherwise.
- 2.1.4. Provide Fixtures and Trim equal to Product Specification sheets.
- 2.1.5. Carriers shall be furnished for all wall hung water closets, urinals, and lavatories. Carriers shall be in conformance with Section 22 42 46 - FIXTURE CARRIERS.

2.2. WATER CLOSETS

- 2.2.1. All tanks of water closets shall be internally lined with anti-sweat insulation except pressure assist water closets.
- 2.2.2. All flush valves shall have non-syphon by-pass and factory set rate of flow.
- 2.2.3. Water closets shown as type "WC-1 - Wall hung" (Barrier Free Design) shall be "High Efficiency", wall hung for flush valve, vitreous china, elongated syphon jet flush action bowl, 2-1/8" (54 mm) fully glazed internal trapway, 10" x 12" (254 mm x 305 mm) large water surface, 4.2 L (1.1 gal) per flush, 1-1/2" (38 mm) back spud, for use with concealed flush valve. American Standard AFWall Elongated 3353.101.020.020 HET, Zurn Z5617-BWL, Kohler Kingston High Efficiency Bowl K-84323-0.
 - 2.2.3.1. Electronic "No Touch" flush valve unit for WC unit above shall be a safe 24 V system with fixed program-automatic 8 second blocking time, field adjustable flush delay setting, volume and sensing range, and manual over ride capability. Both a modular junction box and 120 to 24VAC transformer are to be supplied with valve. The flush valve shall be high efficiency 4.2 L (1.1 US gal.) per flush, factory set flow, concealed quiet action, diaphragm flush and renewable seat with wheel handle angle pressure loss check stop. Unit to be supplied with metal recessed box and

vandal resistant stainless steel face, measuring approximately 355 mm x 355 mm (14 in. x 14 in.) for both valve and sensor housing. Delta Commercial 1600T6103ARI and 1600T6103ATR with RP32508 transformer, Sloan "Royal Optima" 152-1.28 WB-ES-S with EL-154 transformer, Sloan Royal 152 ESS-1.28-ES-S, Zurn ZEMS6152AV-HET-BX12 with P6000-HW6 power converter.

- 2.2.3.2. Seat for WC unit above shall be elongated heavy-duty solid plastic toilet seat, open front with cover, with stainless steel stainless steel check hinge and stainless steel posts, washers, and nuts. Bemis 1950SS, Centoco 820STS-001, Kohler Lustra K-4650-EB, Olsonite 46SS, ZURN Z5957SS-EL.

2.3. LAVATORIES

- 2.3.1. Lavatories shown as type "L-1 - Wall hung (Barrier free design & general use)," tight space areas shall be 533 mm x 445 mm x 133 mm - 175 mm (21 in. x 17½ in. x 5¼ in. - 6-7/8 in.) deep, wall hung, vitreous china, rear overflow, for concealed arm support. Unit shall be provided with faucet holes to suit the faucet below. American Standard Murro 095x.000, Crane Serena 129, or Zurn Z5324-PED. Provide semi pedestal American Standard Murro 0059.020, Crane Serena 132, Kohler Pinoir K-2035 to cover exposed piping.

- 2.3.1.1. Faucet for lavatory unit above shall be 100 mm (4 in.) centreset, solid cast brass body with integral proximity sensor, with vandal-resistant 0.5 USGPM (1.9 L) flow spray outlet, control module, solenoid, strainer, circuitry, tempered water supplied by mixing valve with back checks and stops housed in 250 mm (10 in.) Sq. recessed metal box with 300 mm (12 in.) Sq. V.P. face, located in wall under basin. Flexible conduit from control module to faucet and solenoid to be provided. Each unit shall be supplied with a 120/24 VAC 50 VA Transformer (15 VA power required for each unit). Delta Commercial 591T0258TR and ELAVT0008ARI and RP32508 transformer, Kohler K-13463/K-13478-A-CP escutcheon with K-13480-NA power supply, Sloan ETF-600-A-VPB-MIX60-A with EL-154 transformer or Zurn Z-6915-XL-CWB-F-MV-SH22-ALBOX with P6000-HW6 Power converter. Drain for all lavatory units with exposed under counter installation shall be 32 mm (1¼ in.) size, polished chrome plated offset open grid, and cast brass lavatory waste strainer, 17 gauge tubular offset. Safety covers are to be supplied as per local codes. Delta Commercial 33T290, Kohler K-7131-A, McGuire 155WC, Zurn Z8746-PC.

- 2.3.3. Drain for all lavatory units with concealed under counter installation shall be 32 mm (1¼ in.) size, polished chrome plated inline open grid and cast brass lavatory waste strainer, 17 gauge straight tubular tailpiece. Delta Commercial 33T260, Kohler K-7129-A, McGuire 155A, Zurn Z8743-PC.

- 2.3.4. "P" trap for all lavatory units shall be polished chrome plated cast brass, adjustable body 32 mm (1¼ in.) size with cleanout plug, 17 gauge tubular wall bend. Safety covers are to be supplied as per local codes for exposed under counter installation. Delta Commercial 33T311, McGuire 8872C, Zurn Z8700-D-PC, Kohler K-8998.

- 2.3.5. Supplies for all lavatory units shall be a pair of chrome plated, heavy pattern angle lavatory supplies, lockshield, screw driver slot, stuffing box cartridge, 3/8 in. IPS brass inlet supply nipple, flexible braided stainless steel risers, and stainless steel wall flange. Delta Commercial 47T2512SD, McGuire H165LKN3RB, Zurn ZH8820-LR-LK-PC-3.

- 2.3.6. All lavatories for health care facilities shall have concealed overflows and laminar flow outlets. Modify specified trim model numbers above as required.

2.4. GENERAL SINK UNITS

- 2.4.1. Sinks shown as "CS-1" - Two Compartment Stainless Steel Sink (General use) shall be stainless steel three hole bar sink, 200 mm (8 in.) centers, 520 mm x 780 mm x 203 mm (20½ in. x 31 in. x 8 in.) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, double compartment, mirror finished rim, satin finished bowl with spillway, self-rimming with crumb cup strainers, and sound deadening. Aristaline LBD6408-1, Kindred QDL2031-8, Kohler K-3369 with K-8813 sink strainer, Architectural Metal Industries 2009-B-I or Novanni 2007EI.

- 2.4.1.1. Faucets for sink unit above shall be 200 mm (8 in.) centre, single control, brass body deckmount faucet, polished chrome plated finish, stainless steel rotating ball mechanism or ceramic disk

cartridge, brass spout and trim, 200 mm (8 in.) swing spout, and 2.1 USGPM (7.9 L) vandal resistant flow aerator and vandal resistant 150 mm (6 in.) handle. American Standard 2021.600.002, Delta Commercial 100LF-HDF, Kohler K-15171-F, Zurn Z82300-XL-CP8-2M.

- 2.4.2. Sinks shown as "CS-2" – shall be American Standard ICS Sink with Everclean Model #9118.111.
- 2.4.2.1. Faucet for sink unit above shall be American Standard SELECTRONIC IC Electronic Proximity Lavatory Faucet with Laminar Flow In Spout Base. Plain Spout End. Model #605B193.002.
- 2.4.3. Sinks shown as "CS-3" - One Compartment Stainless Steel Sink (General use) shall be stainless steel three hole sink, 200 mm (8 in.) centers, 520 mm x 508 mm x 203 mm (20½ in. x 20 in. x 8 in.) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, single compartment, mirror finished rim, satin finished bowl, self-rimming with crumb cup strainer, and sound deadening. Aristaline LBS6808-1, Kindred QSL2020-8, Kohler K-3363-3 with K-8813 sink strainer, Architectural Metal Industries 1017-B-I or Novanni 1017EI.
- 2.4.3.1. Faucets for sink unit above shall be 200 mm (8 in.) centre, single control, brass body deckmount faucet, polished chrome plated finish, stainless steel rotating ball mechanism or ceramic disk cartridge, brass spout and trim, 200 mm (8 in.) swing spout, and 2.1 USGPM (7.9 L) vandal resistant flow aerator and vandal resistant 150 mm (6 in.) handle. American Standard 2021.600.002, Delta Commercial 100LF-HDF, Kohler K-15171-F, Zurn Z82300-XL-CP8-2M.
- 2.4.4. "P" trap for all sink units shall cast brass 38 mm (1½ in.) with union, cleanout, and escutcheon, Delta Commercial 33T360, McGuire 8912C, or Zurn Z8702BD-PC.
- 2.4.5. Supplies for all sink units shall be a pair of chrome plated, heavy pattern angle lavatory supplies, lockshield, screw driver slot, stuffing box cartridge, 3/8 in. IPS brass inlet supply nipple, flexible braided stainless steel risers, and stainless steel wall flange. Delta Commercial 47P2512SD, McGuire H165LKN5RB, Zurn ZH8820-LR-LK-PC-3.

2.5. SHOWERS

- 2.5.1. Shower valves shown as "SH-1" shall be concealed in-wall, single lever pressure balancing control, polished chrome plated finish metal trim, integral stops and checks, 57 mm (2¼ in.) vandal resistant metal lever handle with shower unit only, brass adjustable spray shower head arm & flange, and flow of shower head not to exceed 1.5 USGPM (5.7 L). American Standard 2000.501.002, Delta Commercial R10000-UNWS with T13H123, Kohler Coralais K-TS15611-4/K-8304-KS pressure-balancing valve with stops, Powers P902G-K1-0-0-0-0.
- 2.5.2. Shower valves shown as "SH-1 (Alt)" shall be of solid brass construction requiring 38 mm (1½ in.) wall cavity suitable for back to back installation as required, valve to maintain a balance between hot and cold water, lever volume control and temperature adjustment dial complete with high temperature limit stop, and hand shower on 760 mm (30 in.) offset slide rail, 1800 mm (71 in.) metal flexible hose, inline vacuum breaker. Delta Commercial T13H153-25, Kohler K-TS15621-4/K-8304-KS/K-8520, Symmons S-96-1-X-LR-300B30V, Powers P902G-000-3-W0.

2.6. UTILITY SINK UNITS

- 2.6.1. Janitor sinks shown as "MS-1 - Floor Mounted (Square Unit)" shall be 610 mm x 610 mm x 250 mm (24 in. x 24 in. x 10 in.) deep, floor mounted, precast terrazzo with integral drain and strainer. Stern-Williams MTB-2424, Acorn 242410.
- 2.6.1.1. Faucets for janitor sink unit above shall be 200 mm (8 in.) centers, two handle, cast brass wall mount service sink faucet, 2.1 USGPM (7.9 L), polished chrome plated finish, ¼ turn ceramic disk cartridge, rigid pail hook spout, integral stops, color indexed 70 mm (2¾ in.) metal handles with vandal resistant screws, plain spout complete with body mounted vacuum breaker, hose threaded outlet and 1220 mm (48 in.) hose and stainless steel hanger. Chicago Faucet 305-VBRXK, Delta Commercial 28C2083 with 28T911, Kohler K-8905, Zurn Z841L1-XL-SSI-HH.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Provide necessary plates, brackets, cleats, supports, etc., for rigidly securing fixtures in place. Accurately lay out all roughing piping, avoiding offsets.
- 3.1.2. Examine fixtures for defects. Remove and replace any fixture which, in the opinion of the Engineer's Representative, is damaged. Make necessary adjustments to ensure fixtures function as per manufacturer's operating criteria. Clean and polish all fixtures and trim upon completion.
- 3.1.3. Ensure wall-mounted fixtures with back water connections have an adjacent access door, unless the pipe space is sufficiently wide to allow the water connection to be made from within the pipe space. For this, pipe space shall be 600 mm (24 in.) minimum clear width.
- 3.1.4. Fixtures shall be installed symmetrical with wall tile pattern, unless otherwise dimensioned or shown on Architectural Drawings.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Fixtures carriers shall be J.R. Smith, Zurn, or Mifab, or Watts.
- 2.1.2. Carriers shall be furnished for all wall hung water closets, urinals, lavatories, service sinks and drinking fountains. Carriers shall be floor mounted and supported independently of the wall. Carriers shall be suitable for each particular fixture. Carrier feet shall not project beyond finished wall.
- 2.1.3. All fixture carriers with integral cast iron fittings shall be certified to CSA B70 "Cast iron soil pipe, fittings, and means of joining" as required by Authority Having Jurisdiction.

2.2. WATER CLOSET CARRIERS

- 2.2.1. Carriers for water closets shown as "WC-1" shall be as described herein. Refer to Drawings for installation arrangement.
- 2.2.2. Carriers for water closets with single adjustable horizontal discharge shall be 100 mm (4") all coated cast iron fittings, rear anchor bolt factory assembled, face plate with rear anchor support, heavy duty legs, adjustable short cast iron nipple, plated hardware, cap nuts, test plug and protection cap. J.R. Smith 0211Y-2-M51-95, Zurn Z1203-N(L/R)4-29, Mifab MC-10-3-6, Watts CA-101-(L/R)-M3-M12. Carriers for back to back water closets with adjustable horizontal discharge shall be 100 mm (4") all coated cast iron fittings, factory assembled face plate with heavy duty legs, adjustable short cast iron nipple, plated hardware, cap nuts, test plug and protection cap. J.R. Smith 0211YD-2-95, Zurn Z-1203-ND4-29, Mifab MC-10D-6, Watts CA-101-D-M3. Carriers for water closets with single adjustable vertical stack discharge shall be 100 mm (4") all coated cast iron fittings, factory assembled face plate with rear anchor support, heavy duty legs, adjustable cast iron nipple, plated hardware, cap nuts, test plug and protection cap. J.R. Smith 0230Y-2-M51-95, Zurn 1204-N4-29, Mifab MC-12-3-6, Watts CA-121-M3-M12.
- 2.2.5. Carriers for back to back water closets with adjustable vertical stack discharge shall be 100 mm (4") all coated cast iron fittings, factory assembled face plate with heavy duty legs, adjustable cast iron nipple, plated hardware, cap nuts, test plug and protection cap. J.R. Smith 0230DY-2-95, Zurn 1204-ND4-29, Mifab MC-12D-3, Watts CA-121-D-M3-M12.
- 2.2.6. Carriers for water closets with single adjustable vertical stack discharge and offset fittings for compact installation shall be 100 mm (4") all coated cast iron fittings, factory assembled face plate with rear anchor support, heavy duty legs, adjustable cast iron nipple, plated hardware, cap nuts, test plug and protection cap. J.R. Smith 0410(L/R)Y-2-M51-95, Zurn 1209-N(L/R)4-29, Mifab MC-15-3-6, Watts CA-151-(L/R)L-M3-M12.
- 2.2.7. Carriers for back to back water closets with adjustable vertical stack discharge and offset fittings for compact installation shall be 100 mm (4") all coated cast iron fittings, factory assembled face plate with heavy duty legs, adjustable cast iron nipple, plated hardware, cap nuts, test plug and protection cap. J.R. Smith 0410DY-2-95, Zurn 1209-ND4-29, Mifab MC-15D-6, Watts CA-151-DL-M3.

2.3. LAVATORY CARRIERS

- 2.3.1. Carriers for wall-hung lavatories shown as L-1 shall be all coated with rectangular steel uprights and welded block base feet support and plate. J.R. Smith 800-M31, Zurn Z1224, Mifab MC-3, Watts CA-421.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Rigidly secure all fixture carriers to the floor using approved anchor bolts and inserts.
- 3.1.2. Verify the finished wall location and type of wall construction and elevation of finished floor before installation of carriers.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03 - SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Type "DF-1" Drinking Fountains: Wall hung fountain with stainless steel top, light grey vinyl covered steel enclosure, safety bubbler with front and side pushbar activation, laminar flow bottle filler with sensor activation, filter with visual filter status indicator, 0.37 kW (1/2 hp) refrigeration unit complete with overload protection and operating controls factory wired. Unit shall be capable of cooling 0.0084 L/s (8 USGPH) from 26.6 deg. C. (80 deg. F.) to 10 deg. C. (50 deg. F.) with 32.2 deg. C. (90 deg. F.) room ambient temperature. ADA compliant and CSA C22.2 No. 120 "Refrigeration equipment" and NSF/ANSI/CAN 61 "Drinking Water System Components - Health Effects" & 372 "Drinking Water System Components - Lead Content" certified. Elkay LZS8WSLP.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Provide necessary plates, brackets, cleats, supports, etc., for rigidly securing fixtures in place. Accurately lay out all roughing piping, avoiding offsets.
- 3.1.2. Examine fixtures for defects. Remove and replace any fixture which, in the opinion of the Engineer's Representative, is damaged. Make necessary adjustments to ensure fixtures function as per manufacturer's operating criteria. Clean and polish all fixtures and trim upon completion.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Test all plumbing systems in accordance with all applicable plumbing codes.
- 3.1.2. Test all fire protection systems in accordance with all applicable NFPA codes.
- 3.1.3. Compressed air system shall be tested to a minimum of 125% and a maximum of 150% of pressure setting of relief valve, using nitrogen for 24 hours and pressure drop shall not exceed 10% of the minimum pressure.
- 3.1.4. All other systems not covered by codes noted above shall be tested and proven tight over a period of 24 hours by a hydrostatic test. Remove vents and gauges and temporarily plug connections.
- 3.1.5. Test pressure for steam and water systems shall be:
- 3.1.5.1. 1-1/2 times the system working pressure but not less than 1035 kPa (150 psig), or
- 3.1.5.2. The maximum working pressure of expansion joints and vibration isolators.
- 3.1.6. Repair any leaks or defects and repeat the tests to the satisfaction of the Engineer's Representative.
- 3.1.7. After completion of the testing, balance the water systems. Adjust the circuits by means of balancing valves.
- 3.1.8. Where multiple branch hot or chilled recirculation lines are installed, the flow in these shall be balanced to ensure hot or chilled water, as applicable, at all fixtures or equipment.
- 3.1.9. Balance on water lines shall be obtained by inserting thermometers between the pipe and insulation of the various return lines and adjusting flow until all thermometers read the same appropriate system temperature.
- 3.1.10. Balance on water lines shall be obtained by inserting thermometers in thermometer wells provided for this purpose at each balancing valve and adjusting flow until all thermometers read the same appropriate system temperature.
- 3.1.11. Adjust bleed-off from cooling tower, evaporative condensers, spray coils and similar equipment to prevent lime deposits. Record bleed-off rate.
- 3.1.12. Submit report showing the balanced temperatures at all systems.
- 3.1.13. The balancing of the water and air systems shall be performed by the same balancing company.
- 3.1.14. Balance water flow to achieve the flow quantities within tolerance of plus and minus 5% of values indicated on the drawings.
- 3.1.15. Balancing company to review Mechanical Contractor's proposed access door locations and sizes per Section 20 05 63 – ACCESS DOORS AND ACCESSIBILITY and ensure that sufficient access is available.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. LEAKAGE TESTING

3.1.1. Duct Pressure Tests

3.1.1.1. Perform pressure tests before ductwork is concealed or insulated.

3.1.1.2. Follow SMACNA HVAC Air Duct Leakage Test Manual procedures.

3.1.1.3. Provide blower and all test equipment.

3.1.1.4. Test the percentage of ductwork indicated in the table below. If a test specimen fails to meet the specified air leakage criteria, modify fabrication methods to bring it into compliance and retest until acceptable duct air leakage is demonstrated. If pressure test fails any sample twice, increase percentage of ductwork tested as indicated in the rightmost column of the table below.

3.1.1.5. Include as a minimum, 5 transverse joints, typical seams, an access door, 2 branch connections and 1 elbow in test samples.

3.1.1.6. Ensure leakage amount does not exceed the allotted amount in the table below for the duct construction pressure class in question.

3.1.1.7. Seal any leaks causing noise.

3.1.1.8. Leakage Class:

| Duct Construction Pressure Class | Rectangular Leakage Class | Round Leakage Class | Amount of Ductwork to be Tested | Percentage of Ductwork to be Tested if Test Fails any Sample Twice |
|----------------------------------|---------------------------|---------------------|---------------------------------|--|
| 10 in. w.g. | 4 | 2 | 100 % | N/A |
| 6 in. w.g. | 4 | 2 | 100 % | N/A |
| 4 in. w.g. | 4 | 2 | 25 % | 50 % |
| 3 in. w.g. | 8 | 4 | 25 % | 50 % |
| 1/2, 1, and 2 in. w.g. | 16 | 8 | 10 % | 20 % |

3.1.1.9. Submit testing report, including leakage calculations, as a submittal complying with the requirements of Section 20 05 03 – SHOP DRAWINGS.

3.1.2. Do not commence insulation installation until testing report is submitted to Engineer's Representative and is reviewed by Engineer's Representative without requesting a resubmit.

3.1.3. Refer to Section 23 31 13 - DUCTWORK AND SPECIALTIES for pressure ratings of ductwork and systems.

3.2. SYSTEM BALANCING

- 3.2.1. Balance the complete air system including air volumes and control settings under maximum system pressure drop conditions (filter at replacement condition). Test the entire system for noise, tightness of joints and proper functioning of the system. Make noise tests under minimum system pressure drop conditions (highest air velocities and clean filter conditions). Make necessary alterations and repeat the tests until satisfactory operation is achieved.
- 3.2.2. Adjust minimum outside air controller and adjust return air and exhaust air damper linkages to ensure correct air quantities.
- 3.2.3. Employ one of the qualified Independent Balancing Companies to balance the air systems.
- 3.2.4. The Independent Balancing Company measures and reports upon the air volume at each diffuser, register and grille. Report shall also show the air quantity handled by each fan, the static pressure upstream and downstream of the fan, the fan speed and the motor current. Also to be reported upon are the air flow at outdoor, return and exhaust air dampers under conditions of minimum outdoor air.
- 3.2.5. Provide assistance to the air balancing company and shall provide control settings, new filters, and other incidentals and equipment required for the measurements.
- 3.2.6. Air volumes measured by the balancing company shall be within plus or minus 10% of those shown on Drawings for diffusers, grilles and registers and within 10% for fans.
- 3.2.7. In all cases where measurements by the balancing company show failure to comply with the Drawings and Specifications, engage the balancing company to rebalance the system at no increase to Contract Price.
- 3.2.8. The balancing of the air and water systems shall be performed by the same balancing company.
- 3.2.9. Balancing company to review Mechanical Contractor's proposed access door locations and sizes per Section 20 05 63 – ACCESS DOORS AND ACCESSIBILITY and ensure that sufficient access is available.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Provide all labour, materials, Products, equipment and services to supply, install, test and commission Building Automation System (BAS) with Direct Digital Control (DDC) for building mechanical and electrical systems and interface with other microprocessor based building subsystems as indicated on Drawings and described herein.

1.2. PROJECT SCOPE PHASE 1

- 1.2.1. Refer to "U OF T – Building Automation Systems, Design Standard & Guidelines" document for all controller programming, object naming conventions, operator workstation, training procedures, test procedures, and U of T forms only. Those sections will be considered part of this specification. U of T BAS Standard is included in general contract specifications issued for this project.
- 1.2.2. Install new network riser for BAS and future connection of other building systems. Ensure network allows for Rapid Spanning Tree Protocol (RTSP).
- 1.2.3. Use the existing network riser for the new BAS. Coordinate with the Owner and communications service provider for any network setup requirements and the activation of required ports on existing network switches and any requirements for additional network switches.
- 1.2.4. Remove all unused pneumatic controls and pneumatic tubing, cap the tubing at the main pneumatic risers.
- 1.2.5. Input/output wiring, if it is installed per this Specification, can be reused.
- 1.2.6. Approved controls contractor shall be Honeywell, Johnson Controls, Schneider Electric, Automated Logic.

1.3. SYSTEM OUTLINE

- 1.3.1. General
- 1.3.1.1. The documentation contained in this section and other Contract Documents pertaining to Building Automation System (BAS) is schematic in nature. The Contractor shall provide all required hardware and software necessary to implement the functions shown or implied in the Contract Documents.
- 1.3.1.2. The BAS shall be integrated with other building systems using a common backbone/ Base Building Network.
- 1.3.1.3. Control system to consist of high-speed, peer-to-peer network of microprocessor based DDC controllers and web-based operator interface.
- 1.3.1.4. Control system to consist of microprocessor based DDC controllers.
- 1.3.1.5. DDC controllers shall be based on open type protocols, BACnet as defined by ANSI/ASHRAE Standard 135 for potential future connection to Building Automation System (BAS).
- 1.3.1.6. Control system to consist of high-speed, peer-to-peer network of microprocessor based DDC controllers and integrate with existing BAS.
- 1.3.1.7. Each system, building floor plan and control device shall be displayed through point-and-click graphics.
- 1.3.1.8. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, passwords, engineering and programming software required for the ongoing maintenance and operation of the BMS.

- 1.3.1.9. Web based server with network interface card shall gather data from this system and generate web pages that can be accessed through web browser on any PC connected to the network.
- 1.3.1.10. Operators shall access the system through web browser and browser interface to perform normal operator functions.
- 1.3.1.11. BAS shall provide support for smart phones & portable devices via one or more of the current common standards: Apple iOS (iPhone, iPad), Android Open Source Project (Android devices), Windows Mobile Devices.
- 1.3.1.12. BAS to operate on building LAN communication infrastructure.
- 1.3.1.13. The intent of this Specification is to provide a system that is consistent with BMS systems throughout the Owner's facilities running the Niagara Framework. Any control vendor that shall provide additional BMS server software shall be unacceptable. Only systems that utilize the Niagara Framework shall satisfy the requirements of this section.
- 1.3.1.14. All control devices furnished with this Section shall be programmable directly from the Niagara Framework embedded toolset upon completion of this Project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.
- 1.3.1.15. OPEN NIC STATEMENTS - All Niagara software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*"and "accept.wb.in=*"and "accept.wb.out=*". All open NIC statements shall follow Niagara Open NIC specifications.
- 1.3.2. Functional Principals
 - 1.3.2.1. BAS to control mechanical and electrical equipment as specified in CONTROL SEQUENCES, SCHEMATICS AND EQUIPMENT SCHEDULES.
 - 1.3.2.2. Controls to control mechanical and electrical equipment as specified in CONTROL SEQUENCES.
 - 1.3.2.3. System architecture to be modular permitting expansion of application software, system peripherals and field hardware.
 - 1.3.2.4. Each controller to operate independently by performing its own specified control, alarm management, operator I/O and historical data collection receiving information from input field devices and controlling output field devices to perform the control sequences.
 - 1.3.2.5. DDC controller may control more than one system provided that points associated with those systems are connected to that same controller.
 - 1.3.2.6. DDC controllers to be configured so that main inputs and outputs from any control loop are located in that same controller.
 - 1.3.2.7. Global points used for control loop reset such as outdoor air temperature are exempt from this requirement.
 - 1.3.2.8. DDC controllers to be capable of operating with local closed loop programming, independent from the server if communication is interrupted.
 - 1.3.2.9. Where PID control loops are called for in the sequences, they are to be implemented within the controller.
 - 1.3.2.10. BAS server shall perform global control programs and data consolidation and storage, communicating and obtaining data from all controllers and transmitting instructions to all controllers.
 - 1.3.2.11. The supplied system must incorporate the ability to access all data including graphics, reports and alarm detection using standard Web Browsers without requiring proprietary operator interface and configuration programs. An Open Data Base Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

- 1.3.2.12. Support for the exchange of Comma-Separated Value (CSV) files must be provided.

1.4. CODES AND STANDARDS

- 1.4.1. Comply with rules and regulations of codes and ordinances of local, provincial, and federal authorities; such codes and ordinances, when more restrictive, take precedence over the Contract Documents.
- 1.4.2. Provide Products listed and classified by the testing firm acceptable to the authority having jurisdiction as suitable for the purpose indicated and specified.

1.5. STANDARD OF EQUIPMENT

- 1.5.1. Use only new Products and software that manufacturer is currently stocking and selling for use in new installations.
- 1.5.2. Do not use this installation as Product test site unless explicitly approved in writing.
- 1.5.3. Spare parts, software and technical support to be available for at least ten years after acceptance is certified.

1.6. OPEN PROTOCOL STANDARD

- 1.6.1. Intention of this Specification is to provide an integrated, open protocol BAS, BACnet as defined by ANSI/ASHRAE Standard 135.
- 1.6.2. BACnet devices on the lower tier network to support all BACnet functional groups, standard application services and standard object types necessary, but not limited to provide reading and writing functionality of all analog and binary inputs and outputs and change-of-value initiation and reporting between BACnet devices on the network.
- 1.6.3. All BACnet devices to be BTL tested. Provide Protocol Implementation Conformance Statement (PICS) for all BACnet devices.

1.7. SYSTEM COMMUNICATION ARCHITECTURE

- 1.7.1. New Riser is to be installed for the BAS. Ensure network allows for Rapid Spanning Tree Protocol (RTSP)BAS to be integrated into existing building network. A New Riser is to not be installed for the BAS.BAS shall use communication architecture consisting of at least two tiers. Each tier will utilize local area networks with totally open protocols based on industry leading standards.
- 1.7.4. The first tier of the BAS network shall be based on Ethernet (ISO 8802-3/IEEE 802-3) communications, providing a high-speed local area network for reliable peer-to-peer communications. Future connected systems shall have compatibility specifications to provide communication with the first tier LAN. The operator workstations shall also be supported on the high speed LAN Tier 1. Communication speed on first tier network shall be at rate of 10Mbps or higher.
- 1.7.5. The lower tiers of the BAS network shall be based on BACnet networks which provide the interconnection of DDC Controllers. Communication speed on lower tier network shall be at rate of 76Kbps or higher Connection to first tier network shall be provided on every floor of the building.
- 1.7.6. Tier 1 to be integrated into the IP Network. Coordinate with the Owner and communication service provider for required number of IP addresses, required number and location of Ethernet ports and subnets; identification of Internet socket port number requirements for external communication through Owner firewall.
- 1.7.7. The network communication is based on Ethernet (ISO 8802-3/IEEE 802-3) communications, providing a high-speed local area network for reliable communications. All connected systems shall be compatible with communication on the base building IP local area network. The operator workstations shall also be supported on the base building network.
- 1.7.8. Only directly connected field sensors are permitted to communicate without IP, but shall use BACNet communication. Connections to base building network are available on assigned floors.

- 1.7.9. Typical office floors field controllers, including but not limited to VAV, CAV, FCU, etc, shall be set up in a Daisy Chain configuration. Typical floor network shall not traverse floors.
- 1.7.10. If floor field controllers are IP-based and daisy-chained, the network shall be looped back around to the network switch from the last controller, in addition to a network connection at the first controller of the loop. As a result, the Field controllers in the loop will have 2 connections to the network switch for redundancy.
- 1.7.11. The BAS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.
- 1.7.12. The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. Microsoft, Firefox, and Chrome browsers (current released versions), and Windows as well as non-Windows operating systems.

1.1. **EQUIPMENT SUPPLIED FOR INSTALLATION UNDER OTHER SECTIONS**

- 1.7.13. Automatic control valves except otherwise noted.
- 1.7.14. Temperature sensor wells.
- 1.7.15. Terminal unit controllers DELETE IF TRANSFORMERS SHOULD BE INSTALLED IN CENTRAL LOCATION.including transformers. Ship to terminal unit manufacturer's facility for factory installation.
- 1.7.16. Motorized Dampers except otherwise noted. Verify damper sizes and connection type with Sheet Metal Contractor prior to ordering.
- 1.7.17. Dampers except otherwise noted. Verify damper sizes and connection type with Sheet Metal Contractor prior to ordering.

1.8. BAS PERFORMANCE

- 1.8.1. Graphic Display: Display the selected graphic representation at Operator Interfaces with current point object data at a minimum rate of twenty points in ten seconds.
- 1.8.2. Graphic Refresh: Update the selected graphic representation at Operator Interfaces with current point object data at a minimum rate of twenty points in ten seconds.
- 1.8.3. Data Scan: Update point object data at controllers and Operator Interfaces with current point object data at a minimum rate of once every ten seconds.
- 1.8.4. Binary Object Command: Controlled device will react within five seconds of an operator initiated command on a binary point object.
- 1.8.5. Analog Object Command: Controlled device will start to react within five seconds of an operator initiated command on an analog point object.
- 1.8.6. Alarmed Object Display: Alarm will annunciate visually and audibly at Operator Interfaces within five seconds on local area networks and within forty-five seconds on wide-area networks from the time the object entered the alarmed state.
- 1.8.7. Program Execution Rate: Provide ability to execute programs at a minimum rate of once every five seconds. Provide execution rates suitable for processes controlled.
- 1.8.8. PID Execution Rate: Provide adjustable execution rates for proportional-integral-derivative (PID) loops; update the controlled variable and command the controlled device at this same rate. Provide execution rates suitable for processes controlled.

- 1.8.9. Display and Report Accuracy: Provide minimum accuracy for point object data displayed at Operator Interfaces, reported to printers, reported to data files to Table 1: Display and Report Accuracy.

| Table 1: Display and Report Accuracy. | |
|--|--|
| Point Object | Accuracy |
| Room Air Temperature | +/-0.2 deg. C (+/-0.36 deg. F) from actual |
| Duct Air Temperature | +/-0.2 deg. C (+/-0.36 deg. F) from actual |
| Outside Air Temperature | +/-0.2 deg. C (+/-0.36 deg. F) from actual |
| Dew Point Temperature | +/-1.5 deg. C (+/-2.7 deg. F) from actual |
| Water Temperature | +/-0.2 deg. C (+/-0.36 deg. F) from actual |
| Relative Humidity | +/-2 % of actual for 20% to 80% RH at 25 deg. C (77 deg.F) |
| Water Flow | +/-1.2 % of actual for 3.0 to 30.0 ft/s |
| Air Flow, Terminal Unit | +/-5.0 % of actual |
| Air Flow, Fan Bell and Duct | +/-5.0 % of actual |
| Air Flow, Pressurized Space | +/-3.0 % of actual |
| Air Pressure, Duct | +/-0.45 % of scale length |
| Air Pressure, Room | +/-0.45 % of scale length |
| Fluid Pressure (other than air) | +/-0.45 % of scale length (see Note 1) |
| Electrical (current, voltage, power) | +/-1.2 % of actual (see Note 2) |
| Carbon Monoxide | +/-3.2 % of actual |
| Carbon Dioxide | +/-3.2 % of actual |
| Note 1: For both absolute and differential pressure. | |
| Note 2: Does not include utility grade meters. | |

- 1.8.10. Control Tolerance: Maintain controlled variable to control tolerance from set point to Table 2: Control Tolerance.

| Table 2: Control Tolerance. | | |
|---------------------------------|-------------------------------------|----------------------------------|
| Controlled Variable | Range | Control Tolerance from Set Point |
| Room Temperature | | +/-0.6 deg. C (+/-1.1 deg. F) |
| Duct Temperature | | +/-0.6 deg. C (+/-1.1 deg. F) |
| Humidity | | +/-5 % RH |
| Air Flow | | +/-1.0 % of scale length |
| Air Pressure | 0-1500 Pa (0-6 in. w.g.) | +/-1.0 % of scale length |
| | -25 to 25 Pa (-0.1 to 0.1 in. w.g.) | +/- 10.0 % of scale length |
| Fluid Pressure (other than air) | | +/- 1.0 % of scale length |

1.9. SUBMITTALS

- 1.9.1. Product Data and Shop Drawings:

- 1.9.1.1. Within 30 days of award of contract, before start of construction, submit completely engineered and coordinated shop drawing package.
- 1.9.1.2. Before start of construction, submit completely engineered and coordinated shop drawing package including graphics samples
- 1.9.1.3. Submittals in printed format and as amended below.
- 1.9.1.4. Provide drawing files through Electronic Fire Transfer.
- 1.9.1.5. Riser Diagrams: Indicate: communication wire paths and connections to network devices; power wire and ground wire connections to Operator Interfaces and network devices; wire types and port types with manufacturer's model numbers; communication protocol and communication speed for network segments; power panel and breaker designations; wire terminal designations; addresses for network devices; room designations.
- 1.9.1.6. Provide required number of IP addresses, required number and location of Ethernet ports and subnets; identification of Internet socket port number requirements for external communication through Owner firewall.
- 1.9.1.7. Submit floor plan drawing indicating the coverage of CO and NO2 sensors. Show the coverage of each sensor on the floorplan as well.
- 1.9.1.8. Specifications and Instructions: Indicate: dimensions, capacities, electrical characteristics, mechanical characteristics, environmental characteristics, performance characteristics, finishes. Circle model number for Products provided or furnished. General catalogue sheets are not acceptable. Provide installation instructions.
- 1.9.1.9. System Flow Diagrams: Indicate: control devices, control device designation, control device range, control device fail-safe position, point object type, point object name, point object address. Indicate flow directions for gases and liquids relevant to the controlled process. Indicate hardwired interlocks between control devices and equipment. Indicate the location of field control devices.
- 1.9.1.10. Products Schedule: Indicate: Product designation, Product name, Product manufacturer, Product model number, Product data sheet reference number, quantities. Provide quantities required under the Work.
- 1.9.1.11. Valve Schedule: Indicate: system designation, service, medium, quantity, reference drawing, valve type, pipe configuration, fail position, pipe size, valve body size, valve design flow, valve design pressure drop, actual valve pressure drop, design Cv, valve Cv, design close-off, valve close-off, control type, control signal, connection type, valve model number.
- 1.9.1.12. Damper Schedule: Indicate: system designation, control device designation, duct dimensions, blade width, blade type, damper model number, calculated torque, actuator torque, actuator model number, actuator quantity, actuator fail-safe position, provisions for edge and blade seals and actuator mounting configuration.
- 1.9.1.13. Room Schedule: Indicate: controller object name, controller address, controller model number, application designation, room designation, VAV air volume set points, and sensor model numbers.
- 1.9.1.14. Cabinet Layouts: Interior: Indicate: orientation of contents including controllers, transformers, cable trays, terminal strips, relays, control devices, labels. Exterior: Indicate: orientation of gauges, displays, switches, labels.
- 1.9.1.15. Wire Details: Indicate: connections between control devices, controllers and equipment; connections to sources of power and grounds; control device designations, control device terminal designations, control device location; equipment terminal designations; cabinet terminal strip designations; wire designations. For control devices shown on multiple Drawings, indicate the control device with the same designation on all Drawings. Differentiate between manufacturer installed wire and field installed wire.

- 1.9.1.16. Sequence of Operation: Provide a complete description of operation to Section 23 09 23 - SEQUENCE OF OPERATION FOR BAS. Provide description of operation for interlocks that directly connect to the Work. Indicate references to the system flow diagram by control device designation or point object name.
- 1.9.1.17. Custom Application Programs (Algorithms): Provide in printed format to Section 23 09 23 - SEQUENCE OF OPERATION FOR BAS. Provide comments that describe the details of program functions.
- 1.9.1.18. Flow Diagrams for Custom Application Programs (Algorithms): Provide in printed format to Section 23 09 23 - SEQUENCE OF OPERATION FOR BAS.
- 1.9.1.19. Points Schedule: Indicate: input points, output points and virtual points for each controller. Indicate: point object address, point object name, point object description, point object alarm limits. List points in ascending order based on point object address.
- 1.9.1.20. Submit floor plan drawing indicating the coverage of Thermostats sensors where applicable or a spreadsheet to convey the same information.
- 1.9.2. Samples:
 - 1.9.2.1. Provide with submittal under Part 1: Product Data and Shop Drawings for approval by the Owner and/or Consultant:
 - 1.9.2.1.1. Graphic Representations: Conceptual layouts in printed format of images and point objects for systems under Part 3: Execution, Operator Interface. Indicate or explain which other graphic representations are directly accessed.
 - 1.9.2.1.1.1. Typical terminal unit floor plan graphic that shows conditions on occupied floor.
 - 1.9.2.1.1.2. Typical equipment room floor graphic.
 - 1.9.2.1.1.3. Typical graphic for each system and terminal unit.
 - 1.9.2.1.1.4. Typical navigation menu.
 - 1.9.2.1.2. Products: As specified under Part 3: Execution, Control Devices.
 - 1.9.3. Work Schedule:
 - 1.9.3.1. Provide a schedule of the Work within four weeks of contract award. Indicate: intended sequence of tasks, start dates, task durations, and delivery dates for material and equipment requiring long lead times, restraints on Work by other trades or situations.
 - 1.9.3.2. Provide monthly updated Work Schedule indicating percentage complete and revisions to expected delivery dates.
 - 1.9.4. Values Schedule:
 - 1.9.4.1. Provide a schedule of separate system prices that comprises the price of the Work of this Section within four weeks of contract award. In addition to the system price, indicate material and labour prices separately for the system. Indicate each mechanical and electrical system as a separate price. Indicate terminal unit systems of the same type on a floor as a separate system price for the respective floor. Include the price for communication networks and power networks allocated proportionately to the separate system prices. Indicate the Operator Interfaces as a separate system price. Include all costs associated with the Work of the system in the separate system price.
 - 1.9.4.2. The Values Schedule provides the basis for progress payments.
- 1.9.5. Project as-built documents:
 - 1.9.5.1. Operation and Maintenance Manuals:

- 1.9.5.1.1. Provide 1 copy of corrected manuals in printed format and three copies on Electronic File Transfer within three weeks following completion of Acceptance Test under Part 3: Execution. Provide manuals in hard cover three-ring binders with index page and indexing tab per section.
- 1.9.5.1.2. Sections:
 - 1.9.5.1.2.1. Contact Information: Provide names, addresses, 24-hour telephone numbers of service representatives and installing Subcontractors.
 - 1.9.5.1.2.2. Operation: Provide Owner operating manuals for Operator Interfaces, Controller Resident Software, DDC Controllers, Advanced Application Controllers, Specific Application Controllers, control devices, compressed air system. For Custom Application Programs (Algorithms) Editor, provide a reference manual for the language syntax that describes each function.
 - 1.9.5.1.2.3. Engineering, Installation and Maintenance: Provide manuals for design and installation of point objects, controllers, and control devices. Provide instructions for calibrating, troubleshooting and replacing controllers and control devices.
 - 1.9.5.1.2.4. Software: Provide complete original issue media and release notes for Operator Interfaces.
 - 1.9.5.1.2.5. Preventive Maintenance Procedures: Provide for Operator Interfaces, controllers, control devices. Provide a schedule of tasks; indicate dates for inspection, maintenance and calibration; indicate the pages in the engineering, installation and maintenance manuals that list the procedures.
 - 1.9.5.1.2.6. Replacement Parts List: Indicate: manufacturer name, manufacturer model number, Supplier name, Supplier address, Supplier telephone number.
 - 1.9.5.1.2.7. Certificates: Provide original issue certificates for installation, maintenance and calibration.
 - 1.9.5.1.2.8. Test Forms: Provide copies of test forms completed under Part 3: Execution, Testing and Commissioning.
 - 1.9.5.1.2.9. Provide licenses, guarantees and warranty documents for Products and systems.
- 1.9.5.2. As-built Product data and Shop Drawings:
 - 1.9.5.2.1. Provide drawing files through Electronic File Transfer
 - 1.9.5.2.2. Provide three copies in printed format for approval by the Consultant within three weeks following the successful completion of Acceptance Test under Part 3: Execution.
 - 1.9.5.2.3. Provide three copies in printed format and three copies in CD for approval by the Consultant within three weeks following the successful completion of Demonstration under Part 3: Execution.
 - 1.9.5.2.4. Provide 1 copy on Electronic File Transfer.
 - 1.9.5.2.5. Points Schedule: For points schedule generated under Part 1: Submittals, Product Data and Shop Drawings, indicate operating conditions for point object data; list point objects by system designation and alphabetically by point object name.
 - 1.9.5.2.6. Time-of-Day (TOD) Schedules: Indicate: objects assigned to the TOD Schedule, Occupied Mode times.
- 1.9.5.3. As-built Floor Plans:
 - 1.9.5.3.1. Maintain on the Project site as-built conditions on one full-size set of Contract Drawings, referred to as marked-up drawings; indicate on these drawings as-built locations for: control devices, cabinets, network devices with network address, communication networks by type and address, connection points to communication networks for Operator Interfaces, power networks, conduit paths, junction boxes, Operator Interfaces.
 - 1.9.5.3.2. Submit three copies of marked-up drawings to Consultant for review within three weeks following successful completion of Acceptance Test under Part 3: Execution. Revise Contract Drawings to match the approved marked-up drawings; revise using AUTOCAD Release 12 or higher format and submit three copies as full-size in printed format and two copies electronically in a means discussed in as-built product data and Shop Drawings.

- 1.9.5.4. Software Backup:
 - 1.9.5.4.1. Provide with as-built Product data and Shop Drawings.
 - 1.9.5.4.2. Provide three copies of complete BAS databases on Electronic File Transfer.
- 1.9.5.5. Training Manuals:
 - 1.9.5.5.1. Provide a course outline, and one copy in printed format of training manuals provided under Part 3: Execution, Instruction and Training at least six weeks prior to the first class. Modify the course outline and training materials to suit Owner's requirements and as requested by the Consultant.

1.10. WARRANTY

- 1.10.1. Warrant the Work free from defects for a period of 12 months and in accordance with the General Conditions and as amended below.
- 1.10.2. Warranty start date will be the date the Work is accepted under Part 3: Execution, Acceptance Test.
- 1.10.3. Warranty start date will be the date the Work is accepted under Part 3: Execution, Demonstration.
- 1.10.4. Provide a single warranty start date even when the Owner has received beneficial use prior to acceptance of the Work. For Work split into multiple contracts or for a multi-phase contract, provide a separate warranty start date and period for each contract or phase.
- 1.10.5. Adjust, repair or replace defects and failures in the Work at no additional cost during the warranty period and without reduction in service to the Owner. Provide warranty service during normal business hours and within 24 hours of the Owner's request for service.
- 1.10.6. Provide warranty service by factory trained service representatives of the Supplier.
- 1.10.7. Replace Operator Interface software, Controller Resident Software, controller firmware and database files with revisions that correct deficiencies or defects during the warranty period at no charge to the Owner. Notify the Owner of changes and schedule the installation. Update Operation and Maintenance Manuals with firmware release notes.
- 1.10.8. Prior to testing date under Part 3: Execution, Acceptance Test, update firmware in controllers to latest revisions at no additional cost to the Owner; update Operation and Maintenance Manuals with firmware release notes.
- 1.10.9. During the warranty period check the tuning of each control loop once during heating season and once during cooling season; notify the Owner when this Work is to occur. Forward to the Consultant documentation indicating observations and adjustments made.
- 1.10.10. Warrant Products that are reconditioned under the Work to the same requirements as new Products.

1.11. OWNERSHIP OF PROPRIETARY MATERIAL

- 1.11.1. Software and documentation supplied and generated under the Work or required for ongoing system operation, maintenance and modification becomes the property of the Owner, including and not limited to graphic files, database files, Custom Application Programs, Project as-built documents and training manuals.
- 1.11.2. Owner shall receive all Administrator level login and passwords for engineering toolset at first session. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.
- 1.11.3. Vendor to provide unlimited number of Licensing and user profile accounts for the BAS without additional fees.
- 1.11.4. As of last day of the warranty period, all software to be upgraded to most current recommended version of manufacturer's release.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Existing Products: To Part 3: Execution, Existing Products.
- 2.1.2. New Products: Non-beta versions currently under manufacture and have been applied in similar installations for a minimum period of one year.
- 2.1.3. Revisions: Latest available revision for Operator Software, Controller Resident Software and controller firmware at start of Warranty.
- 2.1.4. Revisions: Latest available revision for Controller Resident Software and controller firmware at start of Warranty.
- 2.1.5. Replacement Parts: Readily available and not scheduled for discontinuation at time of Total Project Completion.
- 2.1.6. Expansion: Expandable through additional inputs and outputs and to card access, security, fire alarm, lighting control systems and other building systems.

2.2. NETWORK

2.3. BAS

- 2.3.1. The BAS consists of at least two tiers of communication networks.
- 2.3.2. The Tier 1 network shall have the following minimum capabilities:
 - 2.3.2.1. The communication protocols utilized for peer-to-peer communications in Tier 1 will be BACnet IP. Use of a proprietary communication protocol for peer-to-peer communications in any Tier is not allowed.
 - 2.3.2.2. High speed data transfer for alarm reporting, point log reporting and uploading/downloading of programs.
 - 2.3.2.3. Single or multiple node failure reporting.
 - 2.3.2.4. Rapid Spanning Tree Protocol (RTSP)
 - 2.3.2.5. Message and alarm buffering to prevent data loss.
 - 2.3.2.6. Error detection, correction and re-transmission to ensure data integrity.
 - 2.3.2.7. Synchronization of the real time clocks in the Building Controllers and Advanced Application Controllers.
 - 2.3.2.8. Employ a device count capacity license model that supports expansion capabilities.
 - 2.3.2.9. Shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:
 - 2.3.2.9.1. BACnet,MODBUS
 - 2.3.2.10. Provide a network that exceed the following capabilities:
 - 2.3.2.10.1. Data transfer rate of at least 10 Mbit/s for alarm reporting, point log reporting and uploading/downloading of programs.
 - 2.3.2.10.2. Single or multiple node failure reporting.
 - 2.3.2.10.3. Error detection, correction and re-transmission to ensure data integrity.
 - 2.3.2.10.4. Synchronization of the real time clocks in the Building Controllers and Advanced Application Controllers.
- 2.3.3. Message and alarm buffering to prevent data loss shall be provided within the IP controllers.

- 2.3.4. Coordinate with base building local area network provider to ensure connectivity of all BAS devices and allocation of network ports.
- 2.3.5. A failure of any component or controller on the base building local area network shall not interrupt the execution of communication on this network.
- 2.3.6. Provide full communication capability across all systems including the base building local area network so that all BAS specified downloading, uploading, data transmission, control commanding, alarm handling and programming is achieved smoothly and transparently.
- 2.3.7. Review location and quantity of communication hub ports required for connection of lower tier networks to the Tier 1 network. Coordinate and arrange use of ports with Base Building Local Area Network Contractor.
- 2.3.8. BAS Network shall have an extra 25% capacity for future expansion on all tiers.
- 2.3.9. Remote Network Access: For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.
- 2.3.10. Remote Network Access: For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet.
- 2.3.11. Fiber Optic Cable System: Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.
- 2.3.12. Fiber Optic Cable System: Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

2.4. CENTRAL SERVER

- 2.4.1. Provide industry standard hardware that meets or exceeds DDC System manufacturer recommended specifications and that can achieve response times required by Specification Section 1.11 BAS PERFORMANCE.
- 2.4.2. Provide industry standard hardware that meets or exceeds DDC System manufacturer recommended specifications
- 2.4.3. Hard Disk to be capable of storing system software, one year of archive trend data at 15minute intervals and system database that is not less than twice the size of the database required when system is accepted. Provide additional external storage space if required.
- 2.4.4. Server shall be on UPS, 15 minutes, minimum 500W and emergency power.
- 2.4.5. Minimum server configuration to be the equivalent of current DELL or IBM small business server class computers.
- 2.4.6. Support Multi-Tasking and multi-user, TCP/IP network, Graphic Display Building Editor, Application software.
- 2.4.7. Operating system shall be Windows 10 LTSC using version 2019 or the latest compatible version.
- 2.4.8. Server shall include dual redundant power supplies. Server shall include data redundant hard disks (RAID).

2.4.9. All servers will be a 19-inch rack mountable.

2.5. OPERATOR INTERFACE

2.5.1. Operator Work Station minimum requirements: Current market Dell, IBM/Lenovo or HP workstation with 22-24" monitor. Include keyboard and mouse.

2.5.2. Alarm and Event Printers: Paper sheet fed printer, latest HP (or equivalent) Colour Laser printer.

2.5.3. Portable Operator Terminals (POT):

2.5.3.1. This device may be connected to any point on system network or may be connected directly to any controller for programming, setup and troubleshooting.

2.5.3.2. Provide software to allow remote access to BAS for monitoring and control functions including full graphical displays.

2.5.3.3. If a laptop, minimum laptop configuration to be the equivalent of current DELL or IBM small business performance class laptops.

2.5.3.4. If other hand held devices such as tablet, provide the latest Samsung model. Provide all necessary cables to connect with the applicable BAS controllers.

2.5.4. Operator Software:

2.5.4.1. BAS should be enabled for Web Browser Navigation. If not required at the time of installation, it should have the capacity to be brought online at a later date without any additional software upgrades.

2.5.4.2. User Interface: Completely web based without the need for interface/translation devices or need to load software individually on each computer.

2.5.4.3. All points of user interface to be on standard personal computers. The primary point of interface on these personal computers to be a standard Web Browser such as Microsoft Internet Explorer.

2.5.4.4. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this Specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.

2.5.4.5. The operator interface is to provide complete tool sets, operational features, multi-screen displays and other necessary features to comply to this Specification.

2.5.4.6. System and software to permit multiple user remote access via the internet.

2.5.4.7. Security:

2.5.4.8. Access Level: Defines operator's ability to view, command and modify objects, and execute applications and system functions.

.1 Definition: Multiple operators are assigned access levels, and independent user login names and passwords are configurable.

.2 Processing: Automatically log off operator after an adjustable period of mouse or keyboard inactivity. Log operator activity.

.3 Storage: Store operator data, login names and passwords in encrypted format.

2.5.4.9. On-line Help: Context-sensitive for operation and configuration tasks.

2.5.4.10. System and software to permit multiple user remote access

2.5.4.10.1. via the internet.

- 2.5.4.11. Database Configuration:
 - 2.5.4.11.1. Each workstation and server to store a copy of current system database.
 - 2.5.4.11.2. This database to be updated whenever change is made to system configuration.
 - 2.5.4.11.3. Storage of this database to be automatic and not require operator intervention.
- 2.5.4.12. Objects and Properties:
 - 2.5.4.12.1. Create and delete objects. View and modify object properties.
 - 2.5.4.12.2. Backup and Restore:
 - 2.5.4.12.2.1. Automatically backup objects and operator overrides to local hard drive of the Operator Workstation and Server when a change is made in the controller.
 - 2.5.4.12.2.2. Automatically restore objects to a controller with an empty objects database.
- 2.5.4.13. System Diagnostics: Display diagnostic messages at Operator Workstations. Store diagnostic messages to local hard drive of Operator Workstation and Server.
- 2.5.4.14. Alarms and Events:
 - 2.5.4.14.1. Definition: Alarm limits, alarm limit differentials, states and reactions shall be adjustable.
 - 2.5.4.14.2. Processing: Alarm and event messages are independently configured to route to network devices. Enable and disable alarms and events manually by the operator and automatically through Custom Application Programs. Message displays at Operator Workstations to indicate source, location and nature without using acronyms.
 - 2.5.4.14.3. Storage: Store alarm and event messages to local hard drive of the Operator Workstation and Server.
- 2.5.4.15. Trends:
 - 2.5.4.15.1. Definition: Create, delete and modify trends. Title blocks, legends sampling interval and start and stop time shall be configurable.
 - 2.5.4.15.2. Storage: Store trend data in Owner's server. Maintain twelve consecutive months of trend data on the Server for benchmark data. Store Analog data at 15 minute intervals and digital data when there is a change of value.
- 2.5.4.16. Reports:
 - 2.5.4.16.1. Definition: Create, delete and modify reports. Report data shall include date and time stamps. Title blocks and legends shall be configurable.
 - 2.5.4.16.2. Storage: Reports are printed and stored to local hard drive of the Operator Workstation and Server automatically and by operator command. Report data shall be available for use in spreadsheets and database programs.
- 2.5.4.17. Time-of-Day (TOD) Schedules:
 - 2.5.4.17.1. Definition: Create, delete and modify TOD Schedules. Assign objects to TOD Schedules based on function and location.
- 2.5.4.18. Custom Application Programs (Algorithms):
 - 2.5.4.18.1. Definition: Create, delete and modify programs and program statements.
 - 2.5.4.18.2. Syntax: Support the syntax under Part 2: Products, Controller Resident Software, Custom Application Programs.
- 2.5.4.19. Graphics:
 - 2.5.4.19.1. Definition: Create, delete and modify graphic representations of the controlled systems. Import and convert images from other programs, including but not limited to: Micrografx Designer, Microsoft Visio, AutoCAD.

- 2.5.4.19.2. Graphics shall be HTML or JavaScript based and shall require no plug-ins or shall use plug-ins that are widely available to end users such as Active-X or Macromedia Flash.
- 2.5.4.19.3. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
- 2.5.4.19.4. Graphics shall be 2 dimensional representations of controlled systems, equipment and devices.
- 2.5.4.19.5. Provide a color graphic system flow diagram display for each system with all points as indicated on the control diagrams.
- 2.5.4.19.6. Graphics to be provided as follows:
 - 2.5.4.19.6.1. Facility Site Graphic
 - 2.5.4.19.6.2. BAS Network Schematics
 - 2.5.4.19.6.3. Terminal Unit Floor Plan
 - 2.5.4.19.6.4. Primary Equipment Room Floor Plan
 - 2.5.4.19.6.5. Individual Graphics for each System and Terminal Unit
- 2.5.4.19.7. Navigation between systems shall be point and click.
- 2.5.4.19.8. Dynamic Values: Add point object data to graphic representations.
- 2.5.4.19.9. Library: Provide library of image files; include standard images for chillers, boilers, air handlers and terminal units and standard symbols for fans, pumps, coils, control devices, pipes, dampers and ducts.
- 2.5.4.20. Clock Synchronization: Real-time clocks in control panels and workstations to use open system synchronization services. Clocks to be synchronized daily. System to change between daylight saving and standard time automatically.

2.6. 3RD PARTY MANUFACTURER INTERFACE.

- 2.6.1. 3rd party manufacturer controllers included but not limited to chillers, boilers, variable frequency drives, power monitoring, medical gasses to be based on the open system communication (BACnet) for seamless integration with BAS. Include network connection from BAS to 3rd party manufacturer controllers.
- 2.6.2. If 3rd party manufacturer controllers are based on different open system standard than BAS, it is the responsibility of BAS Contractor to provide the appropriate interface for integration of that 3rd party manufacturer controller to BAS.
- 2.6.3. If open system controllers are not available, include all appropriate hardware equipment and software to allow bi-directional data communication between the BAS and 3rd party manufacturers' control panels.

2.7. CONTROLLER RESIDENT SOFTWARE

- 2.7.1. The software resides in Building Controllers and Advanced Application Controllers and is edited by means of the Operator Interface.
- 2.7.2. Security:
 - 2.7.2.1. Definition: Multiple operators are assigned access levels, and independent user login names and passwords are configurable.
 - 2.7.2.2. Processing: Automatically log off operator after an adjustable period of inactivity.
- 2.7.3. Alarms and Events:
 - 2.7.3.1. Definition: Alarm limits, alarm limit differentials, states and reactions shall be adjustable.

- 2.7.3.2. Processing: Alarm and event messages are independently configured to route to network devices. Enable and disable alarms and events manually by the operator and automatically through Custom Application Programs.
- 2.7.4. Trends:
 - 2.7.4.1. Definition: Create, delete and modify trends. Title blocks, legends, sampling interval and start and stop time shall be configurable.
 - 2.7.4.2. Storage: Trend data is retrieved by the Operator Interface.
 - 2.7.4.3. Create trend logs for all AI/AO/BI/BO of the BAS. Analog points to be at 15 minute intervals and Digital points to be at Change of Value.
- 2.7.5. Time-of-Day (TOD) Schedules:
 - 2.7.5.1. Definition: Create, delete and modify TOD Schedules. Assign objects to TOD Schedules based on function and location.
- 2.7.6. Custom Application Programs (Algorithms):
 - 2.7.6.1. Definition: Create, delete and modify programs and program statements.
 - 2.7.6.2. Syntax Capabilities:
 - 2.7.6.2.1. Analog and binary point objects.
 - 2.7.6.2.2. Conditional statements (IF, THEN, ELSE, ELSE IF) using compound Boolean relations (AND, OR and NOT) and comparisons (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL).
 - 2.7.6.2.3. Floating-point arithmetic using operators for addition, subtraction, division, multiplication and square root; absolute value and minimum/maximum value arithmetic functions.
 - 2.7.6.2.4. Predefined objects representing date, time of day, day of week, month of year and elapsed time.
 - 2.7.6.2.5. Create, delete and modify custom function blocks.
- 2.7.7. Maintenance Messages: Display at Operator Workstations. Indicate equipment name and maintenance required based on equipment run time, starts, and calendar date limits..
- 2.7.8. PID Control: PID (proportional-integral-derivative), PI and P algorithms for direct acting and reverse acting. Analog output is time-varying. Output control device is adjustable by the operator. Set point and gains are adjustable.
- 2.7.9. Optimal Start/Stop: Delay equipment start-up to latest possible time which will allow building space to reach target conditions by occupancy time. Advance shut-down of equipment to earliest possible time and maintain space target conditions until the end of occupancy time.
- 2.7.10. Enthalpy Economizer Control: Control outside, return and exhaust dampers based on inside and outside enthalpy comparisons.
- 2.7.11. Electrical Demand Management: Manage electrical demand by monitoring power consumption. If consumption exceeds operator adjustable level system to be capable of adjusting set-points, de-energizing low priority equipment and taking other pre-programmed actions as described in SEQUENCES OF OPERATION.
- 2.7.12. Chiller Optimization: sequence chillers and other chilled water plant equipment and reset chilled water and condenser water control set points, to provide cooling at minimum cost.
- 2.7.13. Load Reset: use the zone with the greatest load to reset the set-point of heating or cooling source.
- 2.7.14. Morning Warm-Up: compare outside and space temperatures and if outside air temperature is less than desired space temperature, run the system before occupancy with fully closed outside dampers until space temperature is satisfied.

- 2.7.15. Night Cool Down: compare outside and space temperatures and if outside air temperature is less than desired space temperature, run the system during unoccupied hours with outside dampers fully opened until space temperature is satisfied.
- 2.7.16. Equipment Sequencing: Sequence equipment with lead - leg, duty - standby and priority assignment based upon runtime or operator command as described in SEQUENCES OF OPERATION.
- 2.7.17. Staged Starts: Operator selectable time delays between starts for equipment on power restoration or scheduled start.
- 2.7.18. Anti-Short Cycling: Minimum on and minimum off times for equipment.
- 2.7.19. Dead-band Switch: Cycle a binary point object based on controlled point object and set point for direct acting and reverse acting. Differentials are adjustable.
- 2.7.20. Equipment Run Time Totalization: Accumulated run time expressed in unit hours and operator adjustable high runtime alarms.

2.8. DDC CONTROLLERS

- 2.8.1. General
 - 2.8.1.1. Input/Output Interface
 - 2.8.1.1.1. Minimum Spare I/O Capacity: Controllers to have minimum 20% spare capacity or at least one of each type of I/O available on the controller. This does not apply to Application Specific Controllers
 - 2.8.1.1.2. For tenant Projects: delete this requirement if not available with base building controllers
Controllers to be swappable without disconnecting the wiring
 - 2.8.1.1.3. Controllers to continue to provide control functions in event of network communications failure.

2.9. DDC CONTROLLERS

- 2.9.1. General
 - 2.9.1.1. Input/Output Interface:
 - 2.9.1.1.1. Analog Inputs:
 - 2.9.1.1.1.1. Signal: 4 to 20 mA, 0 to 10 VDC, thermistor, RTD.
 - 2.9.1.1.2. Binary Inputs:
 - 2.9.1.1.2.1. Detect dry contact closure.
 - 2.9.1.1.2.2. Wetting Current: Supplied by the controller.
 - 2.9.1.1.3. Pulsed Inputs:
 - 2.9.1.1.3.1. Detect pulse of dry contact closure.
 - 2.9.1.1.3.2. Pulse Frequency: Compatible with input device.
 - 2.9.1.1.3.3. Wetting Current: Supplied by the controller.
 - 2.9.1.1.4. Analog Outputs:
 - 2.9.1.1.4.1. Signal: 4 to 20 mA, 0 to 10 VDC. Provide range and zero adjustment.
 - 2.9.1.1.4.2. Accuracy Rating: +/- 1% of scale length.
 - 2.9.1.1.5. Binary Outputs:
 - 2.9.1.1.5.1. Triac: Rated for 0.5 A at 24 VAC
 - 2.9.1.1.5.2. Relay: NO or NC configuration, rated for 3 A at 24 VAC
 - 2.9.1.1.5.3. Provide secondary relay for higher loads.

- 2.9.1.1.6. Minimum Spare I/O Capacity: Controllers to have minimum 20% spare capacity or at least one of each type of I/O available on the controller. This does not apply to Application Specific Controllers.
- 2.9.1.2. Controllers that perform scheduling operations to have on board real-time clock.
- 2.9.1.3. Controllers to continue to provide control functions in event of network communication failure.
- 2.9.1.4. Controllers to be swappable without disconnecting the wiring.
- 2.9.1.5. Immunity to Power: Rated for 90% to 110% of nominal voltage.
- 2.9.2. Building Controllers (BC):
 - 2.9.2.1. Independent, networked, microprocessor-based for all internetwork control strategies.
 - 2.9.2.2. Reside on Ethernet Tier 1 BAS network.
 - 2.9.2.3. Manage connected input and output control devices; transmit real and virtual point object data to distributed controllers and Operator Interfaces and provide global strategy and direction.
 - 2.9.2.4. Continuous monitoring of processor, memory and communication circuits; assume a predetermined failure mode for abnormal conditions; assume a failsafe operating mode for failed communication with objects.
 - 2.9.2.5. Communicates to card access, security, fire alarm, lighting control systems.
 - 2.9.2.6. Service communication port for communication with Portable Operator Terminals.
 - 2.9.2.7. Memory: Non-volatile EEPROM for firmware. Seventy-two hours battery backed memory for object database and custom application programs.
 - 2.9.2.8. Each BC to support firmware upgrades without need to replace hardware.
 - 2.9.2.9. Environment: Suitable for anticipated ambient conditions.
 - 2.9.2.10. Serviceability: LEDs for power, communication and processor status.
- 2.9.3. Advanced Application Controllers (AAC):
 - 2.9.3.1. Independent, networked, microprocessor-based.
 - 2.9.3.2. Reside on lower tier BAS network (BACNet or LON).
 - 2.9.3.3. Manage connected input and output control devices; transmit real and virtual point object data to distributed controllers and Operator Interfaces.
 - 2.9.3.4. Continuous monitoring of processor, memory and communication circuits; assume a predetermined failure mode for abnormal conditions; assume a failsafe operating mode for failed communication with objects.
 - 2.9.3.5. Service communication port for communication with Portable Operator Terminals.
 - 2.9.3.6. Memory: Non-volatile EEPROM for firmware. Seventy-two hours of battery backed memory for object database and custom application programs.
 - 2.9.3.7. Each AAC to support firmware upgrades without need to replace hardware.
 - 2.9.3.8. Environment: Suitable for anticipated ambient conditions.
 - 2.9.3.9. Serviceability: LEDs for power, communication and processor status.
- 2.9.4. Application Specific Controllers (ASC):
 - 2.9.4.1. Microprocessor-based networked. Non-adjustable programs with operator adjustable settings for customized operation within equipment design limits.
 - 2.9.4.2. Reside on lower tier BAS network (BACNet or LON).
 - 2.9.4.3. Service communication port for communication with Portable Operator Terminals.

2.9.4.4. Memory: Non-volatile EEPROM memory for firmware and program data.

2.9.4.5. Environment: Suitable for anticipated ambient conditions.

2.9.4.6. Serviceability: LEDs for power, communication and processor status.

2.10. POWER SUPPLIES AND LINE FILTERING

2.10.1. Provide a separate power supply for every Building Controller, Advanced Application Controller and Application Specific Controller for terminal units.

2.10.2. Power Supply Voltage: 24 V, unless indicated otherwise on Drawings.

2.10.3. Power Supplies:

2.10.3.1. Type: Enclosed; Class 2 current-limiting, or over-current protection in primary and secondary circuits for Class 2 service to the National Electrical Code.

2.10.3.2. Applied Loads: To 80% of rated capacity.

2.10.3.3. DC Power Supplies: Regulated output.

2.10.3.4. Built in over voltage and over current protection.

2.10.3.5. Able to withstand 150% current overload for at least 3 seconds without trip or failure.

2.10.3.6. Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations and controllers.

2.11. CONTROL DEVICES

2.11.1. Motorized Control Dampers:

2.11.1.1. Sizing:

2.11.1.1.1. Dimensions: As indicated. Maximum damper section size: 1200 mm x 1500 mm (48 in. x 60 in.). For dampers larger than the section maximum, use an assembly of multiple, equally sized sections.

2.11.1.1.2. Two-position: Parallel blade.

2.11.1.1.3. Modulating: Opposed blade. Parallel blade dampers may be used for return air and bypass applications.

2.11.1.2. Frame: 125 mm x 25 mm x 3 mm (5 in. x 1 in. x 0.125 in.) 6063T5 extruded aluminum with mounting flanges on both sides.

2.11.1.3. Blades: Airfoil shape, 6063T5 extruded aluminum, maximum 150 mm (6 in.) depth.

2.11.1.4. Seals:

2.11.1.4.1. Blade Edge: Extruded thermoplastic rubber (TPR) suitable for -58 deg. C to 135 deg. C (-72 deg. F to 275 deg. F), mechanically locked in place and easily replaceable in the field.

2.11.1.4.2. Blade Jamb: Spring-loaded stainless steel.

2.11.1.5. Bearings: Molded synthetic.

2.11.1.6. Linkage: Corrosion resistant steel and concealed in the frame.

2.11.1.7. Drive Shaft: Corrosion resistant steel of square or hexagon shape.

2.11.1.8. Axle: Corrosion resistant steel.

2.11.1.9. Leakage: Maximum 40.6 L/s/sq m (8 CFM/sq ft) at 1.0 kPa (4 in. w.g.) of differential pressure across fully closed damper when tested to AMCA Standard 511.

2.11.1.10. Make and Model: Ruskin CD-50 or equivalent.

2.11.2. Actuators For Dampers, Electronic:

- 2.11.2.1. Actuator Type: Modulating, except as indicated below for VAVs.
- 2.11.2.2. Control Signal: Compatible with BC, AAC and ASC.
- 2.11.2.3. Floating control signal is acceptable only for VAV damper application.
- 2.11.2.4. Operating Time: Maximum 120 seconds throughout the full rotation or fast acting 75 seconds for critical systems with 2 position control.
- 2.11.2.5. Angle of Rotation: Adjustable between 0° to 90°.
- 2.11.2.6. Stall protection: Mechanical or electronic.
- 2.11.2.7. Actuators shall have electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation.
- 2.11.2.8. Failsafe: Fail in place for VAV terminals; spring return for other applications. Spring return to normal position within 15 seconds or less than 10 seconds for critical systems with 2 position control.
- 2.11.2.9. Manual Override: Crank type. External gear release for fail in place actuators.
- 2.11.2.10. Position Indicator: Reversible for clockwise or counter-clockwise rotation; set the 0 degrees mark to the failsafe position.
- 2.11.2.11. Torque: To damper manufacturer's requirements to provide complete compression of seals between frame and blades and for smooth control.
- 2.11.2.12. Provide 2 SPDT auxiliary switches for critical systems dampers to prove open-closed.
- 2.11.3. Control Valves:
 - 2.11.3.1. Characteristics, materials and pressure ratings suitable for the application; refer to schedules.
 - 2.11.3.2. Flow Characteristic:
 - 2.11.3.2.1. Water:
 - 2.11.3.2.1.1. Two-way: Equal percentage.
 - 2.11.3.2.1.2. Three-way: A Port: Equal percentage. B Port: Linear or modified linear.
 - 2.11.3.2.2. Steam: Linear.
 - 2.11.3.3. Sizing Water Valves:
 - 2.11.3.3.1. Two-position: Line size with full ports.
 - 2.11.3.3.2. Two-way Modulating: Non Radiation: Pressure drop equal to the pressure drop through the coil or 27 kPa (4 psi), whichever is greater. Radiation: Pressure drop equal to 7 kPa (1 psi).
 - 2.11.3.3.3. Three-way Modulating: Non Radiation: Pressure drop equal to the pressure drop through the coil or 27 kPa (4 psi), whichever is greater. Radiation: Pressure drop equal to 7 kPa (1 psi).
 - 2.11.3.4. Butterfly Valves:
 - 2.11.3.4.1. Type: High-performance (HPBV).
 - 2.11.3.4.2. Make and Model: Dezurik BHP or equivalent.
 - 2.11.3.4.3. Tee-fitting: Provide for three-way application; with motor mounting bracket and linkage hardware.
 - 2.11.3.5. Valves 12 mm (1/2 in.) through 50 mm (2 in.):
 - 2.11.3.5.1. Screwed ANSI Class 250 bronze body.
 - 2.11.3.6. Valves 62 mm (2-1/2 in.) and Larger:
 - 2.11.3.6.1. Water temperature less than 121 deg. C (250 deg. F) at 1035 kPa (150 psi) or less than 93.2 deg. C (200 deg. F) at 1139 kPa (165 psi): Flanged ANSI Class 125 cast iron body.

- 2.11.3.3.6.2. Water temperature greater than 121 deg. C (250 deg. F) at 1035 kPa (150 psi) or greater than 93.9 deg. C (200 deg. F) at 1138 kPa (165 psi): Flanged ANSI Class 250 cast iron body or ANSI Class 300 cast steel body.
- 2.11.4. Actuators for Control Valves, Electronic:
 - 2.11.4.1. Control Signal: Compatible with BC, AAC and ASC.
 - 2.11.4.2. Floating control signal is not acceptable.
 - 2.11.4.3. Operating Time: Maximum 120 seconds throughout the full rotation.
 - 2.11.4.4. Mounting: Corrosion resistant hardware.
 - 2.11.4.5. Stall Protection: Electronic overload or digital rotation sensing.
 - 2.11.4.6. Failsafe: Fail in place for terminal reheat coils; fail open for all other heating valves; fail open for critical cooling valves (e.g. server or IT rooms), fail closed for all other cooling valves. Spring return to fail position within 15 seconds. Battery or capacitor return are not acceptable. Refer to Sequence Of Operation for alternate fail positions as may be required.
 - 2.11.4.7. Manual Override: Crank type. External gear release for fail in place actuators.
 - 2.11.4.8. Position Indicator: Provide. Indicate valve open and closed positions.
- 2.11.5. Digital Thermostat:
 - 2.11.5.1. Digital thermostats shall be 7-day programmable digital type suited for the application.
 - 2.11.5.2. Standalone terminal units shall utilize a digital thermostat where shown on Drawings.
 - 2.11.5.3. Digital thermostat shall have user selectable engineering units (F or C) and set point adjustment.
 - 2.11.5.4. Digital thermostat shall support automatic daylight savings time switchover.
 - 2.11.5.5. Digital thermostat shall support automatic and manual heat/cool changeover when applicable.
 - 2.11.5.6. Digital thermostat shall support temporary set point adjustment with automatic return to normal operation.
- 2.11.6. Refrigerant Gas Detection System:
 - 2.11.6.1. Gas Detection Controller /Expansion Module - Inside Mechanical Room
 - 2.11.6.1.1. Use: Centralized Stand Alone refrigerant gas detection monitoring main controller with real-time gas reading, selective alarm activation
 - 2.11.6.1.2. Power Requirement: 22-27 Vac, 29-38 Vdc, 2A max @ 29Vdc
 - 2.11.6.1.3. Up to 20 gas transmitters, Digital Communication Modbus RS-485 Line, Up to 61 m (200 ft.) from the controller.
 - 2.11.6.1.4. Alarm Levels: 3 fully programmable alarm levels
 - 2.11.6.1.5. Outputs: 4 DPDT form C relays (alarms and/or fault) at 5 A, 30 Vdc or 250 Vac (resistive load); 65dBA buzzer, 3 Outputs at 24 Vdc @ 250 mA each
 - 2.11.6.1.6. Integral Strobe/Horn: STAS flashing LED/105dBA, 4-28V, 2800Hz (RFSA)
 - 2.11.6.1.7. Display: 122 x 32 dot matrix backlit LCD display
 - 2.11.6.1.8. Visual Indicators: - Green LED - Normal Operation
 - 2.11.6.1.9. Red LED Gas Alarm A, B, and C
 - 2.11.6.1.10. Yellow LED: Fault/Service
 - 2.11.6.1.11. The Controller/expansion module must provide all the functionalities necessary to comply with current ASHRAE 15 guidelines and CSA B-52 Mechanical Codes.

- 2.11.6.1.12. Manual Fan Start/Stop operation
- 2.11.6.1.13. Audible Alarm with a silence key to acknowledge
- 2.11.6.1.14. Visible Alarm
- 2.11.6.1.15. Operating Humidity Range: 0-95% RH, non-condensing
- 2.11.6.1.16. Operating Temperature Range: 0°C to 40°C (32°F to 100°F)
- 2.11.6.1.17. Enclosure rating: NEMA 4X, ABS - Polycarbonate - indoor
- 2.11.6.1.18. Certifications: CAN/CSA C22.2 No 61010-1
- 2.11.6.1.19. Conforms to: ANSI/UL 61010-1; IEC 61010-1 Including Amendments A1:1992 + A2:1995 and National Deviations (Canada, US)
- 2.11.6.1.20. Make and Model: Honeywell 301EM RFSA or equivalent Gas Detection Remote Annunciator Panel: Outside Mechanical Room
- 2.11.6.2.1. Use: Remote Annunciator / Slave display panel located outside each entrance to Mechanical room
- 2.11.6.2.2. Power Requirement: 22-27 Vac, 50 or 60 Hz, 29-38Vdc, 2.0 A max @ 24 Vdc
- 2.11.6.2.3. Up to 10 remote Annunciator panels can be connected to the main refrigerant gas detection Controller; Digital Communication Modbus RS-485 up to 304 m (1000 ft).
- 2.11.6.2.4. The remote annunciator panel must provide all the functionalities necessary to comply with Current ASHRAE 15 and CSA B-52 Mechanical Codes. This includes a key for manual "fan start" only operation, strobe/horn audible visual alarm on top of the unit
- 2.11.6.2.5. Display 122 x 32 dot matrix backlit LCD display
- 2.11.6.2.6. Visual Indicators: - Green LED - Normal Operation
- 2.11.6.2.7. Red LED Gas Alarm A, B, and C
- 2.11.6.2.8. Yellow LED: Fault/Service
- 2.11.6.2.9. The Remote annunciator panel will indicate the exact concentration of refrigerant gas as displayed on the 301EMRFSA Main Controller and the refrigerant gas detected. The LCD display screen will indicate multiple alarm levels for each sensing point.
- 2.11.6.2.10. Operating Temperature Range: 0°C to 40°C (32°F to 100°F)
- 2.11.6.2.11. Enclosure rating: NEMA 4X, ABS - Polycarbonate - indoor
- 2.11.6.2.12. Certifications: CAN/CSA C22.2 No 61010-1
- 2.11.6.2.13. Conforms to: ANSI/UL 61010-1; IEC 61010-1 Including Amendments A1:1992 + A2:1995 and National Deviations (Canada, US)
- 2.11.6.2.14. Make and Model: Honeywell 301EM RP RFSA or equivalent
- 2.11.6.3. Wired Refrigerant Gas Transmitter:
- 2.11.6.3.1. Use: Wall mounted, wired refrigerant gas detector transmitter used in conjunction with 301EMRFSA controller, Diffusion Type with no internal sample pump or filter maintenance required
- 2.11.6.3.2. Power Requirement: 8.5 - 12.5 Vdc, 1A@10 Vdc Maximum
- 2.11.6.3.3. Network: Modbus RS-485
- 2.11.6.3.4. Sensing Technology: NDIR (Non Dispersive Infrared)
- 2.11.6.3.5. Accuracy: ±10ppm @ 50 ppm / ±40ppm @ 500 ppm
- 2.11.6.3.6. Detection Range: Refrigerants 0-1000 ppm

- 2.11.6.3.7. R11, R12, R13B1, R22, R114, R123, R125, R134a, R227, R245A, R404A, R407C, R410A, R507, R508b
- 2.11.6.3.8. Resolution: 1 ppm
- 2.11.6.3.9. Response Time (T90) 60 seconds
- 2.11.6.3.10. Operating Temperature Range: 0°C to 40°C (32°F to 100°F)
- 2.11.6.3.11. 0 to 95% RH (non-condensing)
- 2.11.6.3.12. Enclosure NEMA 4X ABS/Polycarbonate - Indoor
- 2.11.6.3.13. Certified to: CAN/CSA C22.2 No. 61010-1
- 2.11.6.3.14. Conforms to: ANSI/UL 61010-1
- 2.11.6.3.15. Make and Model: Honeywell 301IRFS sensors or equivalent.

2.12. WIRE AND CONDUIT

- 2.12.1. Conduit: Electrical metallic tubing EMT with compression type fittings in dry locations; cold rolled steel zinc coated or zinc coated rigid steel with threaded fittings in wet locations or where exposed to weather.
- 2.12.2. Outlet boxes: Dry locations: sheradized or galvanized drawn steel 100 mm (4 in.) square or octagon with suitable raised cover; Exposed to Weather: threaded hub cast aluminum boxes with gasket plate.
- 2.12.3. Junction boxes: Sized according to number, size and position of entering raceway; type: suitable for the environment.
- 2.12.4. Wire:
 - 2.12.4.1. Network:
 - 2.12.4.1.1. Per controls manufacturer recommendations
 - 2.12.4.1.2. Per base building network requirements, coordinate with Owner/network manager
 - 2.12.4.1.3. Refer to Division 27
 - 2.12.4.2. Analog Input, Output: Stranded 18 gauge copper twisted shielded.
 - 2.12.4.3. Binary Input, Output: 18 gauge, minimum insulation rating of 600 volts.
 - 2.12.4.4. Class 2: FT-6 without conduit in ceiling plenums; FT-4 in conduit for all other cases.
 - 2.12.4.5. Plenum rated wiring to be used.

PART 3 EXECUTION

3.1. GENERAL WORKPERSONSHIP

- 3.1.1. Install all controllers, cabinets, control devices and power supplies in readily accessible locations providing adequate ambient conditions for its specified application and to the Canadian Electrical Code.
- 3.1.2. Install Products to manufacturer's installation instructions.
- 3.1.3. Install parallel to building walls and floors unless indicated or specified or required by manufacturer's installation instructions.
- 3.1.4. Mechanical Contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

3.2. COORDINATION

- 3.2.1. Submittals: To Part 1: General, Submittals.

- 3.2.2. Integrate and coordinate Work under this section to controls and control devices provided or installed by others.
- 3.2.3. Each Supplier of control Product to configure, program, start-up and commission that product to satisfy requirements of Sequence of Operation regardless of where within Contract Documents product is described or specified.
- 3.2.4. Resolve compatibility issues between control Product provided under this section and those provided under other sections or divisions of this Specification.

3.3. EXISTING PRODUCTS

- 3.3.1. This scope only applies to the Products that have become redundant as a result of this scope.
- 3.3.2. Performance: During construction check and verify reused existing Products are operational. For existing Product that is not operational submit a proposal to replace existing Product for approval by the Consultant. Generally, Products which will potentially become redundant as a result of this scope of Work will only be reused if it meets the standards of this Specification.
- 3.3.3. Existing Products: Resue existing products.
- 3.3.4. Existing Wiring: Neatly coil, cap, identify and contain unused within cabinet(s).
- 3.3.5. Existing Cabinets: Keep cabinet but remove unused products within esiting cabinets from site and discard.
- 3.3.6. Existing Sensor Wells: Abandon.
- 3.3.7. Existing Electric Thermostats: Reuse.
- 3.3.8. Existing Sensors and Transmitters: Reuse.
- 3.3.9. Existing DDC Controllers: Reuse.
- 3.3.10. Existing Dampers, Electric Damper Actuators and Linkages: Remove from site and discard.
- 3.3.11. Existing Control Valves and Electric Valve Actuators: Remove from site and discard.

3.4. WIRING AND CONDUIT

- 3.4.1. Wire shall be neatly tie wrapped to conduit mounted to the building structure but must be installed at right angles or parallel to the building. Loose wiring shall only be allowed over a distance of 1500 mm (5 ft.) but must not pass over lighting fixtures.
- 3.4.2. Wiring in Equipment Room, between floors, or between concrete walls shall be installed in conduit. Exposed wiring will not be accepted. Conduit shall be installed at right angles or parallel to the building walls.
- 3.4.3. Should it become necessary to splice field wiring it shall be soldered. If soldering is not possible, approved B type crimp connectors are an acceptable alternative. Wire nuts and Marr connections are not acceptable. Provide a 500 mm (20 in.) loop length at all splices.
- 3.4.4. Conceal conduit within finished shafts, ceilings, and walls as required. Install exposed conduit parallel with or at right angles to the building walls.
- 3.4.5. Plug or cap unused conduit openings and stubs with compatible fittings.
- 3.4.6. Route all conduit to clear beams, plates, footings and structural members except through column footings and grade beams.
- 3.4.7. Provide watertight seals at penetrations through outside foundation walls.
- 3.4.8. Support conduit 25 mm (1 in.) and smaller to the building with one-hole non-perforated malleable iron or steel pipe straps. Suspend conduits larger than 1 in. on pipe racks with split-ring hangers and rods.
- 3.4.9. Maintain caps on conduit openings throughout construction.

- 3.4.10. Where conduit is attached to vibrating or rotating equipment, install and anchor flexible metal conduit with a minimum length of 450 mm (18 in.) and a maximum length of 900 mm (36 in.) in such a manner that vibration and equipment noise will not be transmitted to the rigid conduit.
- 3.4.11. Where exposed to weather or in damp or wet locations, provide waterproof flexible conduit.
- 3.4.12. Fill conduit to maximum of 60 % of its capacity. Provide a pull rope within the conduit when the installation is complete. Bend conduit to a radius of greater than 3 times the conduit diameter to a maximum of three 1/4 bends permitted between pull boxes.
- 3.4.13. Wire within cabinets shall be installed in a plastic tray with a cover. Terminate wires to field-removable, modular terminal strips.
- 3.4.14. All field sensors shall be provided with a flexible conduit connection minimum length of 450 mm (18 in.) and an enclosure for the electrical connections.

1.2. POWER WIRING

- 3.4.15. Power for Section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS) shall be provided under Electrical Division 26 at 120 VAC 60 Hz single phase and shall terminate in junction boxes installed where shown on electrical and/or Mechanical Drawings. Wiring and conduit from these boxes to control devices being electrically powered to be provided by Section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS).
- 3.4.16. Where power for equipment is fed from MCC, 120 VAC power for Section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS) shall also be fed from the MCC from the 120 VAC section. Wiring and conduit from the MCC to control devices being electrically powered to be provided by section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS).

3.5. COMMUNICATION WIRING

- 3.5.1. Install communication wiring per controls manufacturer recommendations as to type of wire used and segment lengths.
- 3.5.2. Install communication wiring in conduit and raceways separated from other wiring.
- 3.5.3. Verify entire network's integrity following cable installation using appropriate tests for each cable.
- 3.5.4. Each run of communication wiring to be continuous length without splices.
- 3.5.5. Provide data cables in conduit back to the closest data/telecom closet/room to allow all BAS head end equipment to connect to the network and all BAS controllers in the building as applicable to the project.
- 3.5.6. Ensure data cables are coordinated with requirements of BAS equipment based on submitted Shop Drawings.

3.6. OPERATOR INTERFACE

- 3.6.1. Operator Software:
 - 3.6.1.1. Security: Set up operators with independent user login name and password and assign access levels to Owner's requirements.
 - 3.6.1.2. Reports: Configure the following reports:
 - 3.6.1.3. List of objects and point object data that are in alarm state sorted by priority in descending order then by point object name in ascending order.
 - 3.6.1.4. List of disabled point objects sorted by point object name in ascending order.
 - 3.6.1.5. List of TOD Schedules: Indicate: objects assigned to the TOD Schedule, Occupied Mode times.
- 3.6.2. Graphics: Generate graphic representations for systems under Section 23 09 23 - SEQUENCE OF OPERATION FOR BAS and as follows:

- 3.6.2.1. Building elevation in three dimensions; indicate: floors and mechanical rooms.
- 3.6.2.2. Floor plans: Indicate: Equipment rooms; point object data for temperature, humidity and pressure. Directly access graphic representation for terminal systems.
- 3.6.2.3. Equipment Rooms: Indicate locations for systems.
- 3.6.2.4. Systems: Indicate: Equipment, service connections, point object data, set points, reset schedules. Highlight point objects under operator command.
- 3.6.2.5. Graphic representations link to and display graphic representations for associated systems.

3.7. CONTROL DEVICES

- 3.7.1. Provide or furnish control devices as indicated on the Drawings and to the requirements of this Section and to execute sequence of operation under Section 23 09 23 - SEQUENCE OF OPERATION FOR BAS.
- 3.7.2. Provide or furnish control devices as indicated on the Drawings and to the requirements of this Section and to execute sequence of operations.
- 3.7.3. Motor Operated Dampers (Uninsulated):
 - 3.7.3.1. Furnish motor operated dampers for installation under Section 23 31 13 - DUCTWORK AND SPECIALTIES. Provide supervision on site during installation.
 - 3.7.3.2. Install in areas maintained above freezing.
 - 3.7.3.3. Install insulated motor operated dampers on all systems that connect with (or transfer air to/from) the exterior ambient environment and operate intermittently (i.e. time of day schedule, temperature sensor controlled, etc.).
- 3.7.4. Actuators for Dampers, Electronic:
- 3.7.5. Control Valves:
 - 3.7.5.1. Furnish control valves for installation under Section 22 11 13 - PIPE, VALVES AND FITTINGS (EXCEPT PLUMBING). Provide supervision on site during installation.
- 3.7.6. Actuators for Control Valves, Electronic:
 - 3.7.6.1. Factory install or field install actuator to valve body.
 - 3.7.6.2. Install hardwire interlocked to supply fan starter for respective system.
 - 3.7.6.3. Provide according to Section 23 09 23 - SEQUENCE OF OPERATION FOR BAS.
 - 3.7.6.4. Shut down the fan when duct temperature is equal to or less than 1.67 deg. C (35 deg. F).
 - 3.7.6.5. Install to adequately cover potential areas of low level stratification. Provide one low-limit thermostat for each 2.8 sq. m. (25 sq. ft.) of duct cross section. Mount sensing element on plastic clips.
- 3.7.7. Refrigerant Gas Detection System:
 - 3.7.7.1. Provide complete and operational system in accordance with CSA B52 "Mechanical Refrigeration Code."
 - 3.7.7.2. Provide refrigerant vapour detector(s) in areas where refrigerant from a leak is most likely to concentrate and have detectors activate at a value no greater than the corresponding threshold limit value (TLV) / time-weighted average (TWA) limits or ammonia limits described in CSA B52.
 - 3.7.7.3. Provide multiple detectors where leaks are likely to concentrate in multiple locations including but not limited to:
 - 3.7.7.3.1. High and Low elevations where multiple refrigerants may stratify to different heights.
 - 3.7.7.3.2. At each ventilation exhaust inlet where airflow patterns direct leaks to multiple locations.

3.7.7.4. Provide remote annunciator panels outside of each entrance to the Mechanical Room.

3.8. IDENTIFICATION

3.8.1. All wires shall be tagged at both ends. The tagging shall identify the device it is connected to. Use of the point object name is acceptable.

3.8.2. All wires passing through a junction box shall be tagged with the device identity or its termination point.

3.8.3. The junction boxes shall be tagged "BAS" with a sequential number suffix.

3.8.4. Label wires, control devices, controllers.

3.9. TESTING AND COMMISSIONING

3.9.1. Test and commission the BAS prior to the Demonstration and Acceptance Test.

3.9.2. Test and commission the BAS prior to the Demonstration.

3.9.3. Prepare test forms which shall identify each test. The forms shall be sub-divided into:

3.9.3.1. points, controllers

3.9.3.2. programs, loops, networks and graphics.

3.9.4. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these Specifications.

3.9.5. Device tests shall identify and confirm successful completion of the following:

3.9.5.1. Device installation.

3.9.5.2. Device identification.

3.9.5.3. Device calibration.

3.9.5.4. Device operation.

3.9.5.5. Wiring to device, connection details and wire type.

3.9.5.6. Validation of the device signal at the controller.

3.9.6. Controller tests shall identify and confirm successful completion of the following:

3.9.6.1. Controller installation.

3.9.6.2. Power source and grounding.

3.9.6.3. Make, model and serial number, software revisions.

3.9.7. Software tests shall identify and confirm successful completion of the following:

3.9.7.1. Custom application programs.

3.9.7.2. Alarm reporting.

3.9.7.3. Trending and reports.

3.9.7.4. Energy management programs.

3.9.8. Loop tuning tests shall identify and confirm successful completion of the following:

3.9.8.1. Loop input signal.

3.9.8.2. Loop output signal.

3.9.8.3. Set point adjustment.

- 3.9.8.4. Device response.
- 3.9.8.5. Control response.
- 3.9.9. Network communication tests shall identify and confirm successful completion of the following:
 - 3.9.9.1. Primary network communication function.
 - 3.9.9.2. Secondary network communication function.
 - 3.9.9.3. Alarm reporting function.
 - 3.9.9.4. Operator communication.
- 3.9.10. Dynamic graphics tests shall identify and confirm successful completion of the following
 - 3.9.10.1. All graphics.
 - 3.9.10.2. All point objects per graphic.
 - 3.9.10.3. All set-points per graphic.

3.10. DEMONSTRATION

- 3.10.1. When all tests have been completed and the documentation completed, request a meeting with the Consultant and Owner. Provide at this meeting a demonstration that all systems on the BAS are operating. At the successful conclusion of this demonstration the Consultant will allow the Acceptance Test to begin.
- 3.10.2. When all tests have been completed and the documentation completed, request a meeting with the Consultant and Owner. Provide at this meeting a demonstration that all systems on the controls are operating.
- 3.10.3. At the discretion of the Consultant and Owner, demonstrate up to 10% of the tests described in Part 3: Execution, Testing and Commissioning and witnessed by the Consultant and Owner. Should any test fail then the BAS Contractor shall retest the failed components or functionality.

3.11. ACCEPTANCE TEST

- 3.11.1. When Testing and Commissioning and the Demonstration have been completed satisfactorily the Consultant will give approval for commencement of the Acceptance Test.
- 3.11.2. Notify the Owner in writing 2 weeks prior to the testing date.
- 3.11.3. Furnish a new operator's log book to building operators.
- 3.11.4. The Acceptance Test period shall be 21 days. Visit the site each morning, Monday to Friday, to review the BAS operation and the building operators log book which contains records of all problems experienced by the building operators, the point object name and value and time and date of failure, and time of return to service. During the first 14 days of the acceptance test, any operational failures due to malfunction of wiring, controllers or Operator Interfaces, shall designate a restart to testing for 21 days. Any failure of control devices shall be corrected and the acceptance test shall continue from the date the failure has been corrected. During the last 7 days of testing, no failures of any kind will be accepted, or the last 7 days shall be repeated.
- 3.11.5. The BAS shall not be accepted or considered Substantially Complete until the Acceptance Test is successfully completed.
- 3.11.6. At the successful completion of the Acceptance Test, provide a certificate of completion.

3.12. INSTRUCTION AND TRAINING

- 3.12.1. Provide three days of instruction during the BAS installation. This instruction shall include: identification of devices, power sources, conduit and wire installation, the operation of controlled devices and how they interface with the mechanical systems.

- 3.12.2. Provide one day of instruction that shall cover the operation and maintenance of the control systems.
- 3.12.3. Provide an additional five days of instruction that shall cover the operation and maintenance of the BAS systems. The instruction shall be conducted in the building and video taped by the Owner. Submit training course outline for review by the Consultant before completion of the BAS and before instruction period commences. Instruction shall include:
 - 3.12.3.1. Operation and maintenance of Operator Interfaces.
 - 3.12.3.2. Operation and maintenance of controllers.
 - 3.12.3.3. Custom Application Programming software.
 - 3.12.3.4. Point objects addressing and commanding.
 - 3.12.3.5. Custom reporting.
 - 3.12.3.6. Creating and modifying graphics.
 - 3.12.3.7. Data base modification, deletion and back-up and restore operations.
 - 3.12.3.8. System malfunction diagnostics and maintenance.
 - 3.12.3.9. Control devices, operation and maintenance.
- 3.12.4. One day shall be 7.5 working hours excluding one hour lunch break.
- 3.12.5. Since the Owner may require to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer's standard pricing such as transportation, meals, etc.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS and Section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS).
- 1.1.2. The locations of all sensors shall be discussed with and approved by the Owner and/or Engineer's Representative, before installation. Locations shown are approximate only, and are given to assist the Contractor in pricing only, and shall not be construed as being the final approved location.
- 1.1.3. The control sequence descriptions are complementary. Provide detailed sequences of operation and all points required to implement the sequences.
- 1.1.4. All settings and set points listed in this Section shall be variable and Operator adjustable without the need to create or modify Custom Application Programs.
- 1.1.5. All set points and reset schedules shall be visual on the associated dynamic graphic.
- 1.1.6. Where the project includes an existing BAS, ensure that any upgrades to the existing BAS for this project scope does not negatively impact existing BAS infrastructure. Maintain the functionality of existing controls not revised by this scope of work.

PART 2 PRODUCTS

2.1. GENERAL APPLICATION PROGRAMS

- 2.1.1. Provide a specific set of programs to achieve automated, operator independent control of facility sub-systems.
- 2.1.2. Refer to Section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS) for software programs.

PART 3 EXECUTION

3.1. RECIRCULATION PUMP

- 3.1.1. Applicable Systems: P-DHWR-B.1 (associated with existing domestic hot water tank in Mechanical Room B008)
- 3.1.2. Normal Operation:
 - 3.1.2.1. The BAS shall monitor existing domestic hot water tank temperature.
 - 3.1.2.2. The controls provided with existing domestic hot water tank shall maintain existing tank temperature set-point.
 - 3.1.2.3. The BAS shall modulate existing domestic water mixing valve to maintain the domestic hot water supply temperature.
 - 3.1.2.4. During occupied hours, domestic hot water recirculation pump shall run continuously.
 - 3.1.2.5. The BAS shall monitor the DHW supply temperature at the outlet of the tank and at a remote location downstream in the domestic water system as indicated on site by the Consultant.
 - 3.1.2.6. During unoccupied hours, the BAS shall start the domestic hot water recirculation pump when the remote supply temperature falls below the minimum supply water set-point (initially set at 37.8 deg. C. (100 deg. F.)).
 - 3.1.2.7. The BAS shall stop the domestic hot water circulator when the remote temperature is maintained at a minimum of 51.7 deg. C. (125 deg. F.) for 10 minutes.
- 3.1.3. Alarms:

3.1.3.1. Domestic Water Recirculation Pump (DWRPST) from current sensor.

3.2. VAV WITH REHEAT COIL

3.2.1. Applicable Systems:

3.2.2. System Start:

3.2.2.1. The VAV box shall be enabled when the associated VAV air handling unit is started. Heating coil valve and duct heater shall be enabled.

3.2.3. Normal Operation:

3.2.3.1. Provide static independent control. Provide set-points for minimum and maximum air flows.

3.2.3.2. In occupied mode, mode VAV box Damper (VAVD) and the Reheat Valves (RHV) shall modulate in sequence to maintain Space Temperature (SPCT) at set-point (adjustable). The damper shall be modulated between its minimum and maximum air flow settings and shall be at minimum setting before the reheat are enabled.

3.2.3.3. In unoccupied mode, heating coil valve and duct heater shall modulate to maintain the night set-back space temperature set-point.

3.2.4. System Stop:

3.2.4.1. The VAV box shall be disabled when the associated VAV air handling unit is stopped.

3.2.5. Schedule:

3.2.5.1. To be determined by the Owner.

3.2.6. Alarms:

3.2.6.1. Space Temperature (SPCT) out of range.

3.3. VAV WITH REHEAT COIL AND RADIANT HEAT

3.3.1. Applicable Systems:

3.3.2. System Start:

3.3.2.1. The VAV box shall be enabled when the associated VAV air handling unit is started. Heating coil valve and radiant heat valve shall be enabled.

3.3.3. Normal Operation:

3.3.3.1. Provide static independent control. Provide set-points for minimum and maximum air flows.

3.3.3.2. In occupied mode VAV box Damper (VAVD) and the Reheat and Radiation Valves (RHV, RADV) shall modulate in sequence to maintain Space Temperature (SPCT) at set-point (adjustable). The damper shall be modulated between its minimum and maximum air flow settings and shall be at minimum setting before the reheat and radiation valve open.

3.3.3.3. In unoccupied mode, heating coil valve and radiant heat valve shall modulate to maintain the night set-back space temperature set-point.

3.3.4. System Stop:

3.3.4.1. The VAV box shall be disabled when the associated VAV air handling unit is stopped. Heating coil valve and radiant heat valve shall remain enabled.

3.3.5. Schedule:

3.3.5.1. To be determined by the owner.

3.3.6. Alarms:

3.3.6.1. Space Temperature (SPCT) out of range.

3.4. VAV WITH RADIANT HEAT

3.4.1. Applicable Systems:

3.4.2. System Start:

3.4.2.1. The VAV box shall be enabled when the associated VAV air handling unit is started. Radiant heat valve shall be enabled.

3.4.3. Normal Operation:

3.4.3.1. Provide static independent control. Provide set-points for minimum and maximum air flows.

3.4.3.2. In occupied mode VAV box Damper (VAVD) and the Radiation Valves (RADV) shall modulate in sequence to maintain Space Temperature (SPCT) at set-point (adjustable). The damper shall be modulated between its minimum and maximum air flow settings and shall be at minimum setting before the radiation valve opens.

3.4.3.3. In unoccupied mode, radiant heat valve shall modulate to maintain the night set-back space temperature set-point.

3.4.4. System Stop:

3.4.4.1. The VAV box shall be disabled when the associated VAV air handling unit is stopped. Radiant heat valve shall remain enabled.

3.4.5. Schedule:

3.4.5.1. To be determined by the owner.

3.4.6. Alarms:

3.4.6.1. Space Temperature (SPCT) out of range.

3.5. VAV BOX

3.5.1. Applicable Systems:

3.5.2. System Start:

3.5.2.1. The VAV box shall be enabled when the associated VAV air handling unit is started. The VAV box shall be enabled when the associated VAV air handling unit is started.

3.5.3. Normal Operation:

3.5.3.1. Provide static independent control. Provide set-points for minimum and maximum air flows.

3.5.3.2. In occupied mode, VAV box Damper (VAVD) shall modulate in sequence to maintain Space Temperature at set-point (adjustable). The damper shall modulated between its minimum and maximum air flow settings.

3.5.3.3. In unoccupied mode, VAV shall modulate to maintain the night set-back space temperature set-point.

3.5.4. System Stop:

3.5.4.1. The VAV box shall be disabled when the associated VAV air handling unit is stopped.

3.5.5. Schedule:

3.5.5.1. To be determined by the Owner.

3.5.6. Alarms:

3.5.6.1. Space Temperature (SPCT) out of range.

3.6. KITCHEN ECOLOGY UNIT

3.6.1. Applicable Systems: KEU-1.1

- 3.6.2. General:
 - 3.6.2.1. The kitchen ecology unit and all kitchen hood are controlled by a Halton system provided by the kitchen hood supplier.
- 3.6.3. System Start:
 - 3.6.3.1. System start is initiated by the Halton Controller via the BAS, or directly through user command schedule at the BAS. Upon signal to start the unit by the Halton Marvel Controller, the BAS shall open the Exhaust Air Damper. When the damper end switch is met, the respective fan shall start.
- 3.6.4. Normal Operation:
 - 3.6.4.1. Exhaust fan shall run on demand.
 - 3.6.4.2. The KEU system is enabled/disabled via the MARVEL system.
- 3.6.5. System Stop:
 - 3.6.5.1. System stop is initiated by the Halton Controller via the BAS or directly through user command schedule. Upon signal to stop the system, the fan shall stop and the Exhaust Air Damper shall close. The unit's internal controls shall be disabled.
- 3.6.6. Schedule:
 - 3.6.6.1. To be determined by the owner.
- 3.6.7. Alarms:
 - 3.6.7.1. Exhaust Fan Status (EFST) from current sensor.
 - 3.6.7.2. Upon signal from Fire alarm, the exhaust fan shall run continuously until the Fire alarm has been disabled then the unit will follow the sequence outlined above.
 - 3.6.7.3. Safeties and Limits
 - 3.6.7.4. Fan speed modulation is disabled until fan run status is received.
- 3.7. SANITARY EXHAUST FANS**
 - 3.7.1. Applicable Systems:
 - 3.7.2. System Start:
 - 3.7.2.1. System start shall be initiated through time schedule where fan is to run countinuously at low speed.
 - 3.7.3. Normal Operation:
 - 3.7.3.1. Exhaust fan shall run continuously at low speed during occupied hours.
 - 3.7.3.2. Exhaust fan shall run continuously at high speed for one hour when activated
 - 3.7.4. System Stop:
 - 3.7.4.1. System stop is initiated through time schedule. Upon signal to stop the system, the exhaust fan shall stop.
 - 3.7.5. Schedule:
 - 3.7.5.1. To be determined by the owner.
 - 3.7.6. Alarms:
 - 3.7.6.1. Exhaust Fan Status (EFST) from current sensor.
- 3.8. SUPPLEMENTARY AC UNITS (A/C-1.1, A/C-2.1, A/C-2.2, C/U-R.1, C/U-R.2, C/U-R.3)**
 - 3.8.1. Applicable Systems:

3.8.2. System Start:

3.8.2.1. System start shall be initiated by space temperature demand. Upon signal to start the system, the unit's internal controls shall be enabled.

3.8.3. Normal Operation:

3.8.3.1. In occupied mode, the unit's internal controls shall stage fan speed and DX variable compressor in sequence to maintain Space Temperature (SPCT) at set-point (adjustable). The Space Temperature (SPCT) set-point shall be adjustable at the thermostat or override centrally through the BAS.

3.8.4. System Stop:

3.8.4.1. System stop is initiated when space temperature is satisfied. A minimum operating time of 20 minutes (adjustable) shall be provided to prevent cycling. Upon signal to stop the system the supply fan shall stop. DX cooling is disabled.

3.8.5. Monitor:

3.8.5.1. The BAS shall monitor all control points available from the unit's internal controls.

3.8.5.2. Condensing Unit Status from current sensor.

3.8.5.3. Evaporator Unit Status from current sensor.

3.8.5.4. Space Temperature (SPCT) out of range.

3.8.6. Schedule:

3.8.6.1. To be determined by each respective room's temperature.

3.8.7. Alarms:

3.8.7.1. Condensing Unit Status from current sensor.

3.8.7.2. Evaporator Unit Status from current sensor.

3.8.7.3. Space Temperature (SPCT) out of range.

3.9. ELECTRIC SNOW MELT

3.9.1. Monitor/Control points to tie into BAS: override on/off, supply, heat, snow, alert

3.9.2. Refer to Electrical Drawing E600 for snow melt system controller location.

END OF SECTION

PART 1 GENERAL**1.1. WORK INCLUDED**

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. All gate, globe and check valve shall be approved under Canadian Interprovincial Regulations for the Construction and Inspection of Boilers, Tanks, and Appurtenances.
- 1.1.3. Provide Shop Drawings in accordance with Section 20 05 03 - SHOP DRAWINGS for all valves, appurtenances, and grooved components.
- 1.1.4. All steel pipe and fittings shall be manufactured in North America. Off-shore pipe shall not be accepted on site. Pipe shall be clearly marked as being manufactured in North America or it shall be removed from site.

PART 2 PRODUCTS**2.1. MATERIALS**

- 2.1.1. Use pipes, fittings and valves as shown below unless specifically shown or specified otherwise.

2.2. CLEAN STEAM STAINLESS STEEL PIPING HUMIDIFIERS 105 KPA (15 PSI)

- 2.2.1. 65 mm (2-1/2 in) and larger
 - 2.2.1.1. Pipe: 304L ASTM A312 "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes" seamless welded stainless steel pipe, Schedule 40.
 - 2.2.1.2. Fittings: 304L stainless steel ASTM A403 "Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings," Schedule 40 butt-welding. Follow applicable codes for stainless steel pipe joints.
 - 2.2.1.3. Flanges: Forged 304L stainless steel, ASTM A182M "Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service," 1035 kPa (150 psi) WSP.
- 2.2.2. 50 mm (2 in) and less
 - 2.2.2.1. Pipe: 304L ASTM A312 "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes" seamless welded stainless steel pipe, schedule 40.
 - 2.2.2.2. Fittings: welding 304L stainless steel ASTM A182M "Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service," schedule 40 threaded, ANSI/ASME B16.3 "Malleable Iron Threaded Fittings: Classes 150 and 300."
 - 2.2.2.3. Joints: Threaded
 - 2.2.2.4. Flanges: Forged 304L stainless steel, ASTM A182M "Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service," 1035 kPa (150 psi) WSP.
- 2.2.3. Strainers:
 - 2.2.3.1. 65 mm (2-1/2 in) and larger: Cast stainless steel, class 150, flanged connections, bolted flanged cover.
 - 2.2.3.2. Mueller Steam Specialties Model 781-SS 50 mm (2 in) and less: Cast stainless steel, class 600, screwed connections.
 - 2.2.3.4. Mueller Steam Specialties Model 581-SS
- 2.2.4. Valves:

- 2.2.4.1. Gate Valves: Class 150 316 stainless steel, flanged gate valve.
- 2.2.4.1.1. Kitz 150UMAM
- 2.2.4.2. Ball Valves: 50 mm (2 in) and smaller. Screwed, 316 stainless steel full port ball valve. 6895 kPa (1000 psi) WOG, 689 kPa (100 psi) @ 232 °C (450 °F), two piece body, blowout-proof stem, adjustable packing nut, locking lever handle, and floating ball.
- 2.2.4.2.1. M.A. Stewart model G2-E
- 2.2.4.3. Check Valves:
- 2.2.4.3.1. 65 mm (2-1/2 in) and larger: 316 Stainless Steel swing check valve, flanged connections, bolted cover: Kitz 150UOAM 50 mm (2 in) and smaller: 316 Stainless Steel swing check valve, 1379 kPa (200 psi) WOG screwed connections, threaded cap: Kitz AKUOM

2.3. LOW TEMPERATURE AND/OR PRESSURE WATER

- 2.3.1. Heating water less than 121 deg. C. (250 deg. F.) at 1035 kPa (150 psi), or heating water less than 93.2 deg. C. (200 deg. F.) at 1139 kPa (165 psi).
- 2.3.2. Pipes 65 mm (2-1/2 in.) and larger ASTM A53/A53M or ASTM A106, Schedule 40. Fittings: Welded, Pressed, Grooved. Joints: Welded, Pressed (Viega, Apollo or approved equivalent), Grooved (Victaulic, Shurjoint or approved equivalent).
- 2.3.3. Pipes 50 mm (2 in.) and smaller, black steel ASTM A53/A53M or ASTM A106, Schedule 40. Fittings: Schedule 40. Joints: Threaded, pressed (Viega, Apollo or approved equivalent).
- 2.3.4. Pipe runouts to all induction and fan coil units and similar equipment soft temper copper ASTM B88, Type L, plain ends, size as shown, but minimum size of runouts 19 mm (3/4 in.). All joints made with 95-5 tin-antimony or tin-silver solder.
- 2.3.5. Fittings 300 mm (12 in.) and larger, black steel ASTM A234, 9.5 mm (0.375 in.) wall, butt-welding ends, ANSI B16.9.
- 2.3.6. Fittings 65 mm (2-1/2 in.) to 250 mm (10 in.) black steel ASTM A234, Schedule 40, butt-welding ends, ANSI B16.9.
- 2.3.7. Fittings 50 mm (2 in.) and smaller, malleable iron ASTM A197, 860 kPa (125 psi) WSP threaded, ASNI ANSI B16.3.
- 2.3.8. Flanges 65 mm (2-1/2 in.) and larger, forged steel ASTM A181, 1035 kPa (150 psi) WSP, ANSI B16.1. Use only weld neck flanges with butterfly valves.
- 2.3.9. Fittings alternative for entire system for heating water: wrought copper or cast bronze, solder, joint, ANSI B16.22.
- 2.3.10. Unions 50 mm (2 in.) and smaller malleable iron ASTM A197, 1035 kPa (150 psi) WSP, with bronze to iron ground joint, ANSI B16.3.
- 2.3.11. Flange accessories for heating water:
- 2.3.11.1. Gasket, 1.5 mm (1/16 in.) Synthetic fibres with rubber binder suitable for 205 deg. C. (400 deg. F.) continuous maximum temperature at 3440 kPa (500 psi), equal to Garlock Multi-Swell 3760.
- 2.3.11.2. Bolts, hexagonal head machine with hexagonal nut, steel ASTM A307, ANSI B18.2.
- 2.3.12. Flange accessories for chilled water, gasket, cloth inserted rubber ring, bolts, hexagonal head machine with hexagonal nut, steel ASTM A307, ANSI B18.2.
- 2.3.13. Strainers 65 mm (2-1/2 in.) and larger, cast iron 860 kPa (125 psi) WSP, flanged.
- 2.3.14. Strainers 50 mm (2 in.) and smaller, cast iron 1720 kPa (250 psi) WSP, threaded.
- 2.3.15. Strainers 50 mm (2 in.) and smaller, for copper pipes bronze 860 kPa (125 psi) WSP, threaded. Mueller #351M.

- 2.3.16. Gate valves 65 mm (2-1/2 in.) and larger, cast iron 860 kPa (125 psi) WSP, bronze mounted, O.S. and Y ANSI B16.1 Flanges, shall be Crane #465 1/2, Jenkins #454J, Toyo 421, NCI #GTVA-FCI-1333HW or Kitz 72.
- 2.3.17. Gate valves 50 mm (2 in.) and smaller, bronze 1035 kPa (150 psi) WSP rising stem, threaded shall be Crane #431, Jenkins #2810J, Toyo 298, NCI #GTVA-TBZ2333 or Kitz 42.
- 2.3.18. Globe valves 65 mm (2-1/2 in.) and larger, cast iron 860 kPa (125 psi) WSP, bronze mounted, renewable composition disc, ANSI B16.1 Flanges shall be Crane #351, Jenkins #2342, Toyo 400A, NCI #GLBA-FCI-1333HW or Kitz 76.
- 2.3.19. Globe valves 50 mm (2 in.) and smaller, bronze 1035 kPa (150 psi) WSP, renewable composition disc, threaded shall be Crane #7TF, Jenkins #106-B, Toyo 221, NCI #GLBA-TBZ2360 or Kitz 9.
- 2.3.20. Butterfly valves maybe used as an alternative to gate valves only and shall be iron body, one-piece alloy steel shaft, top and bottom bearings, bronze disc or iron disc with stainless steel trim, resilient elastomer replaceable seat with integral reinforcing ring or keyed to body. Body with threaded lugs. Bubble-tight shut-off to 1035 kPa (150 psi) pressure in either direction when the piping and connecting flange is removed from one side of the valve.
- 2.3.20.1. Valves 100 mm (4 in.) and smaller with lever operator with lock.
- 2.3.20.2. Valves 150 mm (6 in.) and larger with worm gear manual operator with indication of valve opening.
- 2.3.20.3. Butterfly valves shall be shall be DeZurik Model BGS, Keystone Model 222-784, Bray Series 31, Challenger Model 20-CN4E, Apollo 143, Kitz 6122EL/G, Centerline 200, or Crane 44.
- 2.3.21. Eccentric plug valves may be used as an alternative to Globe valves and shall be cast iron body, split alloy steel shaft, top and bottom bearings, resilient elastomer plug. Body with flanged ends. SEVERAL MANUFACTURERS DO NOT MEET THE BUBBLE-TIGHT SHUT-OFF REQUIREMENTS. BE CAREFUL BEFORE APPROVING ANY MANUFACTURER NOT NAMED. Bubble-tight shut-off to 1035 kPa (150 psi) pressure in either direction when the piping and connecting flange is removed from one side of the valve.
- 2.3.22. Valves 100 mm (4 in.) and smaller with lever operator with lock. Valves 150 mm (6 in.) and larger with worm gear manual operator with indication of valve opening.
- 2.3.23. Check valves 50 mm (2 in.) and smaller bronze 860 kPa (125 psi) WSP, swing check, screwed cover, screwed shall be Crane #37, Jenkins #4092, Toyo 236, NCI CKVA-TBZ2331 or Kitz 22.
- 2.3.24. Check valves 65 mm (2-1/2 in.) and larger ANSI Class 150, 1030 kPa (150 psi) WSP, dual flapper retainerless design with carbon steel body and stainless steel check, renewable disc and seat for flanged installation, shall be Velan-Proquip model BDD10-1B or DUO CHEK II H15SMF-201, NCI/SSI #150WTCT, or Mueller 72-DHH-3-H.
- 2.3.25. Drain valves for blow-off of sediment from strainers and tank drainage shall be 19 mm (3/4 in.) size 4140 kPa (600 psi) WOG ball valve with bronze or forged brass body, solid ball, virgin Teflon seat and packing, male threaded garden hose end, brass cap and chain shall be Watts B6000, Toyo 5046, Kitz 58CC or Apollo 78-100.
- 2.3.26. Float type eliminators, designed for a minimum of 1035 kPa (150 psi) water pressure with steel or cast iron body having removable flanged top, stainless steel or copper float and stainless steel valve and level mechanism.
- 2.3.27. As an alternative on vertical in-line pumps suction elbow may be combination elbow and strainer. Strainer perforations shall be as specified for Y strainers. Blow-off valves shall be provide in all sizes. Sizes of elbow strainer shall suit the pump suction size. Elbow shall be cast iron. Elbow shall be sized to suit pipe.
- 2.3.28. Radiation and fan coil shut off valves shall be Dahl Model 11042FXUN radiator valve suitable for 1720 kPa (250 psi) at 121 deg. C. (250 deg. F.). Lockshield balance valves shall be Dahl Model 13.013M.

- 2.3.29. Ball valves for heating water 50 mm (2 in.) and smaller shall be bronze body 4140 kPa (600 psi) WOG, virgin Teflon seat, solid ball, TFE stem packing and thrust washer, 1/4 turn open-closed operation. All components to be replaceable in-line. Solder end valves are not acceptable. All ball valves shall be complete with stem extensions. Ball valves shall be Watts No. B-6800, Toyo 5050, Kitz 62, or Apollo 82-100-04.
- 2.3.30. Ball valves for heating water 50 mm (2 in.) and smaller shall be bronze or forged brass 4140 kPa (600 psi) WOG, virgin Teflon seat, solid ball, TFE system packing and thrust washer, 1/4 turn open-close operation. All ball valves shall be complete with stem extensions. Ball valves shall be Watts B6000, Toyo 5044A, Kitz 58/59, NCI 600FP-T/600FP-S or Apollo 70-100/200-04.
- 2.3.31. Flow balancing valves shall have meter connection for attaching to a portable meter. Each connection shall have positive shut-off valves. Each valve shall be capable of precise flow measurement, accurate flow balancing and positive shut-off. Adjustment shall be by multiple turns of the handle for Vernier type setting and shall have a hidden memory feature for tamper-proof setting.
- 2.3.31.1. For all valves 65 mm (2-1/2 in.) and larger, provide flanged or grooved as follows: Flanged: Victaulic / TA Hydronics Series 788 flanged, Nexus UltraMB MBF, or IMI Hydronic Engineering STAF; Grooved: Victaulic / TA Hydronics Series 789 grooved, Nexus UltraMB MBG, or IMI Hydronic Engineering STAG.
- 2.3.31.2. For valves 50 mm (2 in.) and smaller, provide screwed as follows: Victaulic / TA Hydronics Series 787, Nexus UltraMB, or IMI Hydronic Engineering STAD.
- 2.3.31.3. Provide a portable flow measuring meter, complete with hoses and carrying case to suit each size of valve provided. Meter shall be computerized, differential pressure type for direct reading of flow rate in either GPM or L/s.
- 2.3.32. As an alternative to Standard Details (MSD-765.02) for reheat coil installation provide preassembled coil pipe and fitting assembly with flow balancing valve, unions, air vent, temperature and pressure port, and serviceable strainer with isolation valves. Victaulic Series 799 Koil-Kit complete with 78K-STADK flow balancing valve, 78-UP union plus air vent and PT port, and 78Y with 20 mesh Y-strainer/ball valve/drain & coil hoses or Red & White complete with 9517/9519 flow balancing valve, 92STC Combination ball valve, Y-strainer, drain & test port, 92UTFM brass union, air vent and PT port, SSB stainless steel flexible hoses. Automatic air vent piped to drain shall be used if branch take-off is above the main. Stainless steel hose sizes to be determined by Contractor. Coordinate control valve with Controls Contractor.

2.4. GROOVED PIPE AND FITTINGS

- 2.4.1. For systems less than 120 deg. C. (248 deg. F.) at 2068 kPa (300 psi) or as specified.
- 2.4.2. Grooved pipe and fittings may be used for hot water, chilled water, hot or chilled glycol, and condenser water systems.
- 2.4.3. Pipes 50 mm (2 in.) to 250 mm (10 in.) black steel ASTM A53, Schedule 40 cut or roll grooved.
- 2.4.4. Pipes 300 mm (12 in.) and larger black steel ASTM A53, 9.5 mm (0.375 in.) wall, cut or grooved.
- 2.4.5. Couplings shall consist of two ASTM A536 grade 65-45-12 ductile iron housing segments, ASTM D2000 pressure responsive elastomer gasket, and ASTM A449 zinc-electroplated steel bolts and nuts.
- 2.4.5.1. Sizes 300 mm (12 in.) and smaller:
- 2.4.5.1.1. Rigid Type: Housings shall be cast with torque-absorber and shift-limiting slant bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9 and to prevent mis-assembly due to overshift.
- 2.4.5.1.1.1. 50 mm (2 in.) through 300 mm (12 in.): Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to 121 deg C. (250 deg. F). Victaulic Style 107V.

- 2.4.5.1.1.2. As an alternative provide Victaulic Zero-Flex Style 07.
- 2.4.5.1.2. Flexible Type: For use in locations where vibration attenuation and stress relief are required or in a Victaulic riser design. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Style 177N or 77.
- 2.4.5.2. Size 350 mm (14 in.) and larger: Victaulic AGS Series with lead-in chamfer on housing key and wide width flush seal gasket.
- 2.4.5.2.1. Rigid Type: Housing key shall fill the wedged shape AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
- 2.4.5.2.2. Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular deflection. Victaulic W77.
- 2.4.6. Fittings 50 mm (2 in.) to 250 mm (10 in.) cast ductile iron ASTM A536 grade 65-45-12.
- 2.4.7. Fittings 300 mm (12 in.) and larger full flow cast fitting. Factory fabricated steel fittings to ASTM Grade B may only be used with the approval of Engineer's Representative.
- 2.4.7.1. 350 mm (14 in.) and larger shall be complete with Victaulic 'AGS' grooved ends.
- 2.4.8. Branch connections: ductile iron ASTM A535; Victaulic Style 920, 920N, or 72.
- 2.4.9. Flanges; ductile iron ASTM A536 for sizes 50 mm (2 in.) to 600 mm (24 in.); Victaulic Style 741/W741.
- 2.4.10. Gaskets: EPDM conforming to ASTM D-2000, temperature range -34 deg. C. to 110 deg. C. (-30 deg. F. to 230 deg. F.).
- 2.4.10.1. EHP conforming to ASTM D-2000, temperature range -34 deg. C to 121 deg. C. (-30 deg. F. to 250 deg. F.).
- 2.4.11. Valves 50 mm (2 in.) to 300 mm (12 in.): ductile iron Body to ASTM A536, EPDM pressure-responsive seat, electroless-nickel coated ductile iron disc, with stem offset from the disc centerline to provide complete 360-degree circumferential seating for temperatures up to +110 deg. C. (+230 deg. F.), for bubble-tight service to 2065 kPa (300 psi). Victaulic Vic-300 MasterSeal.
- 2.4.11.1. Butterfly Valves 350 mm (14 in.) to 600 mm (24 in.): Ductile iron body to ASTM A536, EPDM disc mounted seal, PPS (polyphenylene sulphide) coated ductile iron disc, and stainless steel stem. (Stem shall be offset from the disc centerline to provide full 360- degree circumferential seating). Rated for temperatures up to + 110 deg. C. (+230 deg. F.), for bubbletight service to 2065 kPa (300 psi). Victaulic AGS Vic-300.
- 2.4.12. Check valves 65 mm (2-1/2 in.) to 300 mm (12 in.): ductile iron ASTM A536 EPDM coated disc spring loaded design for non-slam operation. Victaulic Series 716.
- 2.4.12.1. Check valves 350 mm (14 in.) to 600 mm (24 in.): Ductile iron body to ASTM A395, dual stainless steel disc(s), with stainless steel spring and shaft, rated for temperatures up to +110 deg. C. (+230 deg. F.), for service to 1575 kPa (230 psi) Victaulic Series W715.
- 2.4.13. Strainers 50 mm (2 in.) to 600 mm (24 in.): ductile iron ASTM A536 with type 304 stainless steel screen. Victaulic Style 730/732 and W730/W732.
- 2.4.14. As an alternative on vertical in-line pumps, suction elbow may be suction diffusers. Victaulic 731-D.
- 2.4.15. As an alternative to Standard Details for pumps, piping may be manufactured vibration isolation pump drop assemblies 50 mm (2 in.) to 300 mm (12 in.). Includes flow control, vibration-isolation flexible couplings, access ports for gauges and thermowells, isolation and check valves, strainer or suction guide and an integral flanged pump connection. Victaulic Series 380, 381, 382 or 383.
- 2.4.16. All grooved Products, including couplings, fittings, valves and specialty items shall be Victaulic.

2.4.17. For other system components refer to Low Temperature and/or Pressure Water Article.

2.7. PLAIN END PIPE COUPLINGS AND FITTINGS

2.7.1. For systems 120 deg. C. (248 deg. F.) at 2068 kPa (300 psi).

2.7.2. Plain end couplings fittings may be used for hot water, chilled water, hot or chilled glycol, and condenser water systems.

2.7.3. Pipes 12 mm (1/2 in.) to 50 mm (2 in.) black steel ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," Schedule 40.

2.7.4. Couplings and fittings shall be ASTM A536 "Standard Specification for Ductile Iron Castings" grade 65-45-12 ductile iron housing segments, ASTM D2000 "Standard Classification System for Rubber Products in Automotive Applications" pressure responsive elastomer gasket, and ASTM A449 "Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use" zinc-electroplated steel bolts and nuts.

2.7.5. Gaskets: EPDM conforming to ASTM D2000 "Standard Classification System for Rubber Products in Automotive Applications," temperature range -34 deg. C. to 120 deg. C. (-29 deg. F. to 248 deg. F.).

2.8. CONDENSATE SYSTEM

2.8.1. Pipes 65 mm (2-1/2 in.) and larger, black steel ASTM A53, Schedule 80, plain ends, ANSI B36.10.

2.8.2. Pipes 50 mm (2 in.) and smaller, black steel ASTM A53, Schedule 80, threaded ANSI B36.10.

2.8.3. Fittings 65 mm (2-1/2 in.) and larger, black steel ASTM A234, Schedule 80, butt welding ends, ANSI B16.9.

2.8.4. Fittings 50 mm (2 in.) and smaller, cast iron ASTM A126, 1720 kPa (250 psi) WSP, threaded ANSI B16.4.

2.8.5. Flanges, unions, strainers, gate valves, globe valves and check valves as specified for steam under 860 kPa (125psig).

2.8.6. Flange accessories for condensate system:

2.8.6.1. Gasket, 1.5 mm (1/16 in.) Asbestos free, Aramid fibres with nitrile binder suitable for 205 deg. C. (400 deg. F.) continuous maximum temperature at 6880 kPa (1000 psi), equal to Garlock Blue-Gard 3000.

2.8.6.2. Bolts, alloy steel ASTM A193, ANSI B16.5, nuts, hexagonal, steel ASTM A307.

2.9. WELDING

2.9.1. Pipe welding shall be in accordance with:

2.9.1.1. ANSI/ASME B31.1

2.9.1.2. ANSI/ASME Boiler and Pressure Vessel Code, Section IX.

2.9.1.3. TSSA

2.9.1.4. Authorities Having Jurisdiction

2.9.1.5. CSA B51 - Boiler, Pressure Vessel and Pressure Piping Code

2.9.2. Ensure complete penetration of deposited metal with base metal. Manufacturer shall provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. All welded pipe joints shall be made by the fusion welding process employing a shielded metallic arc process (SMAW). The use of a gas metal arc welding process (GMAW/ MIG) for pipe welding is not permitted. Inside of pipe shall be free of excessive reinforcement. The use of backing plates is not acceptable. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during the welding operation.

- 2.9.3. In no cases shall Schedule 40 or standard weight pipe be welded with less than three passes including one stringer/ root, one filler and one lacer. Schedule 80 pipe shall be welded with not less than four passes including one stringer/ root, two filler and one lacer/ cap.
- 2.9.4. Each weld shall be uniform in width and size throughout its full length. In addition, the cover pass (final weld layer) shall be free of coarse ripples, grooves, overlaps, abrupt ridges and valleys/ under cut. The surface smoothness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
- 2.9.5. Each weld layer or pass shall be visually free of slag, inclusions, cracks, porosity and lack of fusion. Grinding to meet this criteria and elimination of defects and surface preparation of welds shall be done in a manner as not to gouge, groove or reduce the adjacent base material thickness below the minimum required.
- 2.9.6. All butt welds shall be full penetration with uniform crown, with reinforcement blending smoothly into the base material. Concavity on the root side of a single welded circumferential butt weld is permitted with the resulting thickness of the weld at least equal to the thickness of the thinner member of the sections being joined.
- 2.9.7. Socket welds shall have a gap of approximately 1.5 mm (1/16 in.) minimum to 3 mm (1/8 in.) maximum between the bottom of the socket and the end of the pipe prior to welding.
- 2.9.8. Visually inspect all welds for compliance with this section. Welds found to be lacking penetration, or containing excessive porosity or cracks must be removed and replaced with an original quality weld as specified herein.

2.10. PIPE COATINGS

- 2.10.1. For carbon steel piping: primer coated with an epoxy coating, 5 mil thickness or manufacturer's recommended thickness, whichever is more stringent.
- 2.10.2. For stainless steel piping: coated with an epoxy primer, 5 mil thickness or manufacturer's recommended thickness, whichever is more stringent, and an epoxy finish coat, 5 mil thickness or manufacturer's recommended thickness, whichever is more stringent.

2.11. GENERAL REQUIREMENTS FOR PIPE SYSTEMS

- 2.11.1. Where a branch at least two pipe sizes smaller connects into a main, welding fittings of Bonney Forge, full flow fittings or other approved manufacturer may be used.
- 2.11.2. For chilled, condenser and low temperature heating water, where a branch at least two pipe sizes smaller connects into a main, branch may be mitred and welded to main.
- 2.11.3. Use Y pattern strainers with screens of type 304 stainless steel or Monel with approximately 1 mm (1/32 in.) perforations for sizes 100 mm (4 in.) and smaller, and approximately 3 mm (1/8 in.) perforations for larger sizes. Provide a valved blow-off connection in all caps 65 mm (2-1/2 in.) and larger. Maximum pressure drop with clean screen shall not exceed 7 kPa (1 psi) with water velocity through inlet pie of 1.5 m/s (5 ft./s). For 50 mm (2 in.) and larger pipe size all heads retaining the basket shall be bolted. For 38 mm (1-1/2 in.) and smaller pipe heads shall be gasketed with straight threads.
- 2.11.4. Solder end globe, angle and gate valves, sizes 50 mm (2 in.) and smaller, are acceptable if it can be shown that they are similar in design and construction to the valves specified.
- 2.11.5. Except where special features are required or unless otherwise approved, all globe, gate and check valves shall be of one manufacturer, with the manufacturer's name and the pressure rating clearly marked on the outside of the valve body.
- 2.11.6. Strainers shall be Colton Industries or Mueller.
- 2.11.7. Air vents shall be Bell and Gosset, Taco, Sarco, Watts, Zurn, or Maid-O-Mist.

- 2.11.8. Manufacture air separators in an ISO recognized facility. Factory test each unit per Hydraulic Institute standards at the factory of origin. Provide tangential type air separator with flanged or grooved inlet and outlet connections. Provide the vessel shell diameter as three times the nominal inlet/outlet pipe diameter. Provide inlet and outlet connections of the same size. Design, construct, and stamp the unit for the system design pressure class in accordance with ASME Boiler and Pressure Vessel Code. Supply the separator with automatic air vent, and connect the vent connection into the bottom of the compression tank for air control systems.
- 2.11.9. Manufacture air and dirt separators in an ISO recognized facility. Factory test each unit per Hydraulic Institute standards at the factory of origin. Provide air and dirt separator with flanged or grooved inlet and outlet connections. Provide the vessel shell diameter as three times the nominal inlet/outlet pipe diameter and provide the separator complete with coalescing media. Provide air and dirt separator that allows access for removal and cleaning of coalescing media. Provide bottom of air and dirt separator with dirt chamber and ball valve for dirt purge. Provide separator with inlet and outlet connections of the same size. Design, construct and stamp the separator for the system design pressure class in accordance with ASME Boiler and Pressure Vessel Code. Supply the separator with automatic air vent and connect the vent connection into the bottom of the compression tank for air control systems. Provide air and dirt separator from one of the following manufacturers: Spirotherm Spirovent, Xylem Bell & Gossett, Taco, or Armstrong.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. For pipe 65 mm (2-1/2 in.) and larger, use flanges, and for smaller pipe, use unions at all valves and equipment.
- 3.1.2. Flare connections may be used on soft copper tubing where one end of the flare connection is an integral part of the equipment or valve.
- 3.1.3. Provide pipe coatings in accordance with the requirements of this section, where carbon steel piping or stainless steel piping is installed exterior to the building.
- 3.1.4. Provide automatic air vents at all high points on piping mains for hot and chilled water systems. Where venting a horizontal pipe, grade pipe up in direction of flow with vent at high point. Provide gate valve at the float inlet. Pipe outlets to drain using copper pipe. Drain pipe shall be run such that its route is visible.
- 3.1.5. Provide manual air vents on all hot water heating units where air may be trapped. Use screw-driver operated vents of chrome plated brass. Vents shall be accessible without removing cover of heating unit.
- 3.1.6. Provide air separators and air and dirt separators where shown on the Drawings.
- 3.1.7. Provide vacuum breakers on all equipment having modulating steam control valves and locate between valve and equipment, unless directed otherwise by equipment manufacturer.
- 3.1.8. Pipe vacuum breakers to condensate lines on high pressure systems. Where not piped to condensate lines, install with a pigtail to prevent leakage of steam flashed from the condensate.
- 3.1.9. Make reduction in steam main size with eccentric reducing coupling.
- 3.1.10. Arrange all runs of piping to prevent interference and to achieve a satisfactory and workpersonlike installation of neat appearance. Run all piping parallel to walls. All valves, controls, equipment, expansion compensators, flexible connections and, as far as possible, all piping shall be easily accessible for inspection, maintenance and operation.
- 3.1.11. Pitch all lines 25 mm in 12 m (1 in. in 40 ft.-0 in.) unless shown otherwise.
- 3.1.12. Install drain valves at all low points for draining and locate where easily accessible. In order to achieve this, install remote from system where necessary, clearly marked. Typical marking similar to the following:

- 3.1.12.1. Heating system
- 3.1.12.2. Danger, authorized personnel only
- 3.1.13. Carefully ream threaded joints and join with compound on the male thread only. Re-tighten flanged connections after the installation has been brought up to its service. Following testing, apply insulation. Take care not to overstress the material during construction.
- 3.1.14. Pipe welding operations shall be performed by welders Provincial Certification for the class of piping to be welded. Ensure the internal opening of pipes and fittings are not restricted by superfluous material.
- 3.1.15. When welding or cutting with a torch, take precautions to prevent fire by maintaining fully charged 4.5 kg (10 lbs.) carbon dioxide extinguisher immediately adjacent to the operation. Protect wooden structure with fire retardant blankets.
- 3.1.16. Arrange piping to permit ease of equipment removal. Provide flanges or unions on all pipe connections to each piece of equipment.
- 3.1.17. Connect all multi-row water coils in counter flow.
- 3.1.18. Drains from packaged air handling unit drain pans shall be of same size as connection on unit. Provide traps on all drains and deep seal traps on both sides of the fan and coil sections.
- 3.1.19. Connect bases of all pumps with packed glands to drain with 12 mm (1/2 in.) OD copper tubing.
- 3.1.20. Provide on the discharge line of each spray pump, a 12 mm (1/2 in.) valved bleed-off. Connect to discharge line above sump water level and run to drain.
- 3.1.21. Provide strainers upstream of each pump suction, steam control valve and steam trap not preceded by a control valve, and where shown.
- 3.1.22. Provide butterfly valves where shown; these are permitted in lieu of gate valves in sizes 65 mm (2-1/2 in.) and larger.
- 3.1.23. Install all valves in Equipment Rooms in accessible locations from the floor. Where valves are not accessible from the floor, equip with chain operators at the discretion of the Engineer's Representative.
- 3.1.24. Provide gate, globe and check valves in all piping systems as shown and as required for satisfactory operation and control of equipment. Provide shut-off valves wherever piping is connected to all equipment. Provide one flow balancing valve and one shut-off valve on water coils.
- 3.1.25. Provide for the expansion and contraction of all pipes. Install with sufficient flexibility to prevent end-thrust and movements caused by thermal expansion or Contraction causing detrimental distortion or damage of connection equipment. Provide offsets between mains and equipment of sufficient length to safely absorb the expansion of the main.
- 3.1.26. Install all control devices, valves and any other appurtenances as directed by the controls and/or BAS trades.
- 3.1.27. Make connections between copper and steel with brass or bronze fittings.
- 3.1.28. Ball valves may be used in low temperature and/or pressure systems only in lieu of gate valves in 50 mm (2 in.) and smaller. Provide union downstream of ball valves for servicing if ball valve is not a three piece design.
- 3.1.29. For grooved piping ensure ends are clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove for proper gasket sealing.

- 3.1.30. Grooved pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All couplings shall meet the manufacturer's standards for visual inspection. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Install in accordance with manufacturer's latest recommendations. A manufacturer's factory trained representative shall periodically visit the site and review the installation for best practices. The Contractor shall correct any identified deficiencies. Grooved Product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by the manufacturer prior to the completion of the Work. Install flow balancing valves in sections of straight pipe as recommended by the manufacturer, but in no case with less than 10 pipe diameters upstream of the valve.
- 3.1.31. Install flow balancing valves in the following locations:
- 3.1.31.1. Each heating water coils including unit heaters, fan coils and force flow heaters
- 3.1.31.2. Each wall fin, radiant ceiling or similar heating device
- 3.1.31.3. And where shown
- 3.1.32. Provide copper pipe and fittings with bronze valves and pipe components to and from all medical equipment requiring chilled, heating, or condenser water extended from the main services outside of the space served. Where systems are separated from the primary chilled, heating, or condenser water distribution systems by heat exchanger(s), provide copper pipe and fittings with bronze valves and pipe components for the entire secondary system. Provide system to meet the maximum pressure rating required by the medical equipment.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Submit Product data sheets for all Products required, except for pipe and fittings.
- 1.2.2. Submit a schematic piping diagram for each refrigerant piping system indicating pipe sizes, slopes, valves, traps, and piping specialties sealed by a Professional Engineer in the Province of the installation.
- 1.2.3. Submit confirmation of registration of the Project with the Authority Having Jurisdiction.

1.3. REGULATORY COMPLIANCE AND QUALITY ASSURANCE

- 1.3.1. The installing Contractor shall be certified and shall register all Projects in accordance with the requirements of the Authority Having Jurisdiction.
- 1.3.3. All components of a refrigeration piping system shall have a Canadian Registration Number or CSA certification acceptable to Authority Having Jurisdiction.
- 1.3.4. All systems shall display appropriate Ozone Depletion Prevention (ODP) tags prior to commissioning. Manufacturer shall not commission any system not displaying proper ODP tags.

1.4. SPECIAL CONSIDERATIONS FOR VARIABLE REFRIGERANT FLOW (VRF) PIPING SYSTEMS

- 1.4.1. VRF refrigeration piping systems shall be installed as per the balance of this Specification with the following considerations and/or exceptions:
- 1.4.2. Refrigerant Contractors shall be certified by the VRF Equipment Supplier. Proof of training certification shall be made available upon request.
- 1.4.3. There shall be minimal use of refrigeration specialties (filter driers, accumulators, receivers, check valves, etc.) in the VRF pipe system. Install in accordance with VRF manufacturer's recommendations.
- 1.4.4. Pressure relief valves shall be 4482 kPa (650 PSI) rated and installed in pairs (two valves per circuit).
- 1.4.5. Y style piping joints and headers shall be provided by the manufacturer to ensure proper refrigerant balance and flow for optimum system capacity and performance.
- 1.4.6. T style joints, field fabricated joints, or Y joints that are not provided by the manufacturer shall not be permitted.
- 1.4.7. Approved flaring block, and approved torque wrenches, both available from VRF manufacturer, shall be used for all flare connections.
- 1.4.8. Pipe clamps shall fasten around the piping insulation. Pipe clamps that compress the copper directly shall be installed a minimum of 900 mm (36 in) away from joints, and shall be loosely tightened to allow for copper expansion.
- 1.4.9. Provide VRF manufacturer with actual pipe lengths installed for calculation of refrigerant charge. Supply and charge VRF system with required quantity of refrigerant prior to VRF manufacturer commissioning. Refrigerant charging shall be done in the liquid state.

PART 2 PRODUCTS

2.1. PIPE, FITTINGS AND JOINTS

- 2.1.1. Copper piping shall be air conditioning / refrigerant grade ASTM B280, annealed or hard drawn as required. Soft annealed copper tubing shall not be used in sizes larger than 22 mm (7/8 in).
- 2.1.1.1. Braze all joints except as noted.
- 2.1.1.2. Joints 22 mm (7/8 in) and smaller may be flared.
- 2.1.1.3. Fittings shall be cast copper alloy for flared copper tube, or wrought copper and bronze solder-joint pressure fittings.
- 2.1.1.4. Joints and fittings for brazed joint shall be wrought-copper or forged-brass sweat fittings.
- 2.1.1.5. Cast sweat-type joints and fittings shall not be permitted for brazed joints.
- 2.1.1.6. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of equipment.

2.2. BRAZING FILLER METAL

- 2.2.1. Filler metal shall be type BAg-5 with AWS Type 3 flux except as noted.
- 2.2.2. Copper to copper joint filler metal shall be BCuP-5 or BCuP-6.
- 2.2.3. Brazing rods for all joints shall be 15 % Lucas Milhaupt "sil-Fos".

2.3. VALVES

- 2.3.1. Valves shall be designed, manufactured, and tested specifically for refrigerant service. Valve bodies shall be of brass, bronze, steel, or ductile iron construction. Valves 25 mm (1 in) and smaller shall have brazed or socket welded connections. Valves larger than 25 mm (1 in) shall have butt welded end connections. Threaded end connections shall not be used, except in pilot pressure or gauge lines where maintenance disassembly is required and welded flanges cannot be used. Internal parts shall be removable for inspection or replacement without applying heat or breaking pipe connections. Valve stems exposed to the atmosphere shall be stainless steel or corrosion resistant metal plated carbon steel. Direction of flow shall be legibly and permanently indicated on the valve body. Purge, charge and receiver valves shall be of manufacturer's standard configuration.
- 2.3.2. Refrigerant access valves and hose connections shall be in accordance with AHRI 720.
- 2.3.3. Isolation valves shall be installed where shown on the schematics. Isolation valves shall be bi-flow self-seating with operating pressures up to 4482 kPa (650 PSI). Valves shall be complete with brass Schrader connections located on the valve body only.
- 2.3.4. Check Valves shall be Mueller Industries Inc. "Checkmaster" straight through type for valves 6.4 mm to 16 mm (1/4 in to 5/8 in) diameter, globe type for valves 22 mm (7/8 in) diameter and larger, each complete with extended tubing for brazing connections, and as follows:
 - 2.3.4.1. Straight through type check valves are to be complete with a machined brass gasketed body, phosphor bronze spring, and neoprene seat.
 - 2.3.4.2. Globe type check valves are to be complete with a cast bronze body, forged brass cap, phosphor bronze spring, PTFE seat disc, and neoprene O-ring seal.
- 2.3.5. Liquid Solenoid Valves
 - 2.3.5.1. Ball type valves as specified above, each in accordance with AHRI 760 and be suitable for continuous duty with applied voltages 15 % under and 5 % over nominal rated voltage at maximum and minimum encountered pressure and temperature service conditions, direct-acting or pilot-operating type, moisture-proof, ULC approved, totally encapsulated or encapsulated and

metal jacketed as required. Valves shall have an operating pressure differential suitable for the refrigerant used.

2.3.6. Expansion Valves

2.3.6.1. Valve shall be the diaphragm and spring-loaded type with external equalizers, and bulb and capillary tubing. Valve shall be equipped with an external superheat adjustment along with a seal cap. Internal equalizers may be utilized where flowing refrigerant pressure drop between outlet of the valve and inlet to the evaporator coil is negligible and pressure drop across the evaporator is less than the pressure difference corresponding to 1 Deg. C. (2 Deg. F.) of saturated suction temperature at evaporator conditions. Pilot-operated valves shall have a characterized plug to provide required modulating control.

2.3.6.2. Electronic expansion valves shall be brass body, needle valve with floating needle and machined seat, stepper motor drive.

2.3.7. Safety Relief Valves

2.3.7.1. Suction lines shall be rated at 2413 kPa (350 PSI) and liquid at 4482 kPa (650 PSI) or liquid and discharge lines at 4482 kPa (650 PSI) respectively.

2.3.7.2. Purpose built Y-fitting shall be Superior Products model 3155W.

2.3.8. Evaporator Pressure Regulators, Direct-Acting

2.3.8.1. Valve shall include a diaphragm/spring assembly, external pressure adjustment with seal cap, and pressure gauge port. Valve shall maintain a constant inlet pressure by balancing inlet pressure on diaphragm against an adjustable spring load. Pressure drop at system design load shall not exceed the pressure difference corresponding to a 1 Deg. C. (2 Deg. F.) change in saturated refrigerant temperature at evaporator operating suction temperature. Spring shall be selected for indicated maximum allowable suction pressure range.

2.4. PIPING ACCESSORIES

2.4.1. Filter Driers

2.4.1.1. Sizes 15 mm (5/8 in) and larger shall be the full flow, replaceable core type. Sizes 15 mm (1/2 in) and smaller shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down, and shall remove water, acid, and foreign material from the refrigerant. Filter driers shall be constructed so that none of the desiccant will pass into the refrigerant lines. Minimum bursting pressure shall be 10.3 MPa (1500 PSI).

2.4.2. Discharge Line Oil Separator

2.4.2.1. Discharge line oil separator shall be provided in the discharge line from each compressor. Oil return line shall be connected to the compressor as recommended by the compressor manufacturer.

2.4.3. Accumulator

2.4.3.1. Accumulators shall be provided in the suction line to protect the compressor from liquid refrigerant damage. Accumulator shall be cUL listed under the required operating pressures and must be installed as close to the compressor as possible.

2.4.4. Refrigerant Moisture and Liquid Indicators

2.4.4.1. Indicators shall be single or double port, ULC listed. Body shall be copper or brass with flared or soldered ends. Sight glass shall have color coded paper moisture indicator with removable element cartridge and plastic cap. Maximum working pressure shall be 3447 kPa (500 PSIG). Maximum working temperature shall be 93.3 Deg. C. (200 Deg. F.).

2.4.5. Pressure and Vacuum Gauges

2.4.5.1. Gauges shall conform to ASME B40.100 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 85 mm (3-1/2 in) in

diameter with a range from 0 kPa (0 PSIG) to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

2.4.6. Insulation

- 2.4.6.1. Liquid, suction and hot gas lines shall be individually insulated in accordance with Section 20 07 00 – INSULATION.

PART 3 EXECUTION

3.1. GENERAL

- 3.1.1. Consider the piping shown on the Drawings as diagrammatic, indicating the general runs and connections only, and parts may not be shown in the true position. Be responsible for the proper erection of the systems of piping in every respect suitable for the work intended.
- 3.1.2. Install all piping in the best workpersonlike manner and in accordance with the best practices of the trade. Piping shall be pitched 13 mm (1/2 in) for every 3000 mm (10 ft) of length in the direction of flow to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt, or other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and as shown.
- 3.1.3. Pipe supports shall be a maximum of 1800 mm (6 ft) apart. Pipe clamps shall fasten around the piping.
- 3.1.4. Piping supports and guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.
- 3.1.5. Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal.
- 3.1.6. Install in accordance with CSA B52 and ASME B31.5 Mechanical Refrigeration Code.
- 3.1.7. Safety pressure relief valves shall be installed in the piping as per CSA B52. All pressure relief valves and brazed joints shall be suitably sized.
- 3.1.8. Install two pressure relief valves per refrigeration circuit using a purpose built "Y" fitting complete with integral ball valves.
- 3.1.9. Install on the liquid and suction line or liquid and discharge line as per Drawing details. Pressure relief valves shall be individually isolated to allow for maintenance and replacement.
- 3.1.10. Nitrogen purging / sweeping shall be used when brazing and welding to minimize oxidization.
- 3.1.11. Isolation valves shall be installed where shown on the schematics or as required.
- 3.1.12. Prevent the release of refrigerants into the atmosphere during installation and testing.
- 3.1.13. Pipe shall be cut accurately to measurements established at the jobsite, and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Pipe or tubing shall be cut square reamed to remove burrs, and shall permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

- 3.1.14. Install pipe, valves, and fittings to facilitate easy maintenance. Do not locate valves, couplings, or flanged/union connections directly above electrical panels, motor starters or MCC's.
- 3.1.15. A liquid line filter dryer shall be installed in each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer. Dryers shall be sized in accordance with the manufacturer's recommendations for the system in which it is installed.
- 3.1.16. A moisture indicating sight glass shall be installed in all refrigerant circuits down stream of all filter dryers and where indicated. Site glasses shall be full line size.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Shop Drawings: Submit Shop Drawings of all chemicals used in the system in accordance with Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Water piping cleaning solution for closed loop systems shall be equal to GE W&P Technologies FERROQUEST FQ7103 or Solenis CSW 600. Refer to manufacturer's written instructions for chemical concentrations.
- 2.1.2. Boiler system cleaning formulation shall be equal to GE W&P Technologies OPTISPERSE ADJ0346 or Solenis LAC PN 0057-40-7. Refer to manufacturer's written instructions for chemical concentrations.
- 2.1.3. Glycol system solution shall be 50% by volume of factory, pre-mixed solution of inhibited ethylene glycol. Ethylene glycol shall be Dow Chemical Co. "Dowtherm SR-1", Interstat Chemical Co. "Intercool NFE", or Recochem Inc. "Recotherm IG".
- 2.1.4. Glycol system solution shall be 50% by volume of factory, pre-mixed solution of inhibited propylene glycol. Propylene glycol shall be Dow Chemical Co "Dowfrost", Interstat Chemical Co. P-323" or Recochem Inc. "Recofreeze PG."
- 2.1.5. Alcohol Anti-freeze solution shall be 40% by volume of Anchem Sales "Ancool-100."
- 2.1.6. Glycol make-up packages shall be provided for glycol water make-up. Each glycol make up package shall be equal to Solenis Chemical E5800; PN 9243-01-5, Expanflex model GMP-2-50, GE W&P Technologies AGS-2045, or Armstrong GLA-STD-LP-1 for 1.8 gpm make-up at 50 psig with a 120 V (1/3 hp) motor and 50 gallon polyethylene storage tank complete with hinged cover. Unit shall be complete with cut-off and (audible and visual) alarm in case of high pressure or low solution level. The pumping assembly shall be mounted in a sturdy steel frame, complete with legs to keep it off the floor. The package shall include a motor, a pump, a magnetic starter, a pressure tank, a priming valve, a PRV, a shut-off valve and a pressure gauge

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. All systems shall have been hydrostatically tested prior to cleaning.
- 3.1.2. Thoroughly flush all systems with raw water to remove loose mill scale and debris. Remove and clean all strainers and flush low points before chemical cleaner is added.
- 3.1.3. Disconnect all coils and by-pass flow.
- 3.1.4. A temporary pump shall be installed in the system and shall be capable of pumping adequate discharge at adequate head.
- 3.1.5. A temporary heater shall be installed in the system and shall be capable of maintaining the circulating water temperature as required for chemical treatment.
- 3.1.6. Systems shall be filled with city water and approved chemical cleaner introduced by a small temporary chemical injector pump at the temporary circulating pump section. Cleaner shall be introduced to maintain concentrations as per the manufacturer's recommendations.

- 3.1.7. All systems shall be cleaned in accordance with manufacturer's written instructions and under the supervision of the Chemical Supplier's representative. Minimum cleaning procedures shall be to fill all water piping cleaning solution, circulate at 1.5 times specified system flow rate and maintain at highest possible temperature for 72 hours. During this period heavy blowdown of all low points shall be carried out every 6 hours. Strainers shall be cleaned as necessary to permit maximum flow possible and, in any event, at least every 6 hours. Drain the solution, all strainers, and flush entire system with clean water for a minimum of 24 hours. Repeat fill and flush procedure as often as required, adding inhibitor with each fill, to achieve acceptable contaminant levels. Systems shall then be refilled, ready for use. Temperature of system for cleaning shall be to suit Chemical Supplier's requirements.
- 3.1.8. Take samples of system from a series of representative drains as directed by the Engineer's Representative. If system is still dirty, repeat cleaning procedure specified above until acceptable. Acceptable samples shall indicate that alkalinity and pH have returned to potable water levels. Copies of all test reports shall be submitted by the Water Treatment Supplier to the Engineer's Representative for verification prior to final filling.
- 3.1.9. Add fluid and chemical treatment immediately after cleaning has been completed and accepted. Acceptable control parameters shall be as follows:
- 3.1.9.1. Nitrite: 1000 - 1500 ppm
- 3.1.9.2. pH: 8.5 – 10 or as required by equipment manufacturer
- 3.1.9.3. Iron: Less than 2.0 ppm
- 3.1.9.4. Copper: Less than 0.3 ppm
- 3.1.9.5. Molybdate: 100 - 150 ppm
- 3.1.9.6. Hardness (CACO3): Less than 50 ppm or as required by equipment manufacturer (soften water as required)
- 3.1.10. Steam boiler manufacturer shall supervise alkaline boil out of the boilers on site in the presence of Engineer's Representative and before thermal efficiency test. Isolate boilers, meter cleaning chemicals into treated water, and fire the boiler according to standard procedures provided by the boiler manufacturer. Blow down through intermittent valves at least one half of the gauge glass every eight hours through the bottom blowdown line. Add make-up as required after each blow down. Boil out for 24 hours, drain and wash thoroughly. Do not allow boiler to cool below 93.33 deg. C. (200 deg. F.) Flush with hot water for two hours, drain and inspect. If oil or grease is present, repeat boil out procedure.
- 3.1.11. For glycol systems install glycol make-up system as per manufacturer's written instructions and in accordance with Section 23 77 13 - EXPANSION TANKS. Fill system with specified glycol product to achieve the required glycol concentration. Glycol systems shall be provided with a Freezing Point Glycol Test Kit equal to Solenis PN 7729-01-7.
- 3.1.12. For ground source closed loop heat pump systems after cleaning and draining, fill the system with alcohol or propylene glycol anti-freeze solution as specified or shown in equipment schedules.
- 3.1.13. For tenant Work the Base Building Contractor shall drain and fill the base building system. Arrange and pay for this Work.
- 3.1.14. The Mechanical Contractor shall supply the Engineer's Representative with certified documentation from the Water Treatment Supplier that the systems have been properly equipped, chemically cleaned and that they are maintaining sufficient levels of scale/corrosion inhibitor. The Contractor shall request such documentation from the Water Treatment Supplier within one week of presentation to the Engineer's Representative.
- 3.1.15. A label or tag identifying any chemical additives, their concentration, and their maintenance requirements shall be permanently and prominently displayed on the heat source.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Shop Drawings

1.2.1.1. Submit Shop Drawings of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.

1.2.1.2. Submit Shop Drawings of each supporting structural assembly required in the ductwork systems, designed by an engineer licensed to practice in the Place of the Work in the appropriate discipline. Same design engineer stamps each and every Shop Drawing.

1.2.2. Samples: Submit samples as required.

1.2.3. Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.

1.3. QUALIFICATIONS

1.3.1. Acceptable sheet metal trade specialists are limited to following:

1.3.1.1. Engie

1.3.1.2. Modern Niagara (DMC Mechanical Ltd.)

1.3.1.3. Smith & Long (Giffin Sheetmetal Ltd.)

1.3.1.4. J.C. Rogers

1.3.1.5. Black & MacDonald

1.3.1.6. Tam-Kal

1.3.1.7. David C. Little Contracting Inc.

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Fabricate all ductwork unless specifically noted otherwise, of galvanized sheet steel with Z180 coating to A653/A653M.

2.1.2. Sealing compound: Minnesota Mining and Manufacturing or other approved manufacturer. Duct tape shall be Duro-Dyne or other approved manufacturer.

2.1.3. Flexible ducting:

2.1.3.1. Flexible fabric ducting shall be Flexmaster Fabriflex FAB-4. ULC listing S110.

2.1.3.2. Flexible metal ducting shall be Flexmaster Triple-Lock Aluminum Flexible ducting T/L. ULC listing S110.

2.1.3.3. Acoustic flexible metal ducting shall be Flexmaster Triple-Lock Acoustic Flexible ducting T/L-A-T/L consisting of perforated aluminum inner core, 38 mm (1-1/2 inch) insulation, and aluminum outer covering. ULC listing S110.

2.1.3.4. Thermal flexible metal ducting shall be Flexmaster Triple-Lock Thermal Flexible T/L-M ducting ULC listing S110.

- 2.1.3.5. Acoustic flexible metal duct for clinical applications shall be Flexmaster Triple Lock T/L-AMG consisting of a perforated aluminum inner core, seamless polyester liner, 38mm (1-1/2 in.) insulation with foil mylar finish to UL 181, Class 1.
- 2.1.3.6. Multiunit residential flexible duct within residential suites: Thermaflex M-KE Acoustic Flexible Duct R-4.2.
- 2.1.4. Access Ports shall be Lawson-Taylor or other approved manufacture of 32 mm (1-1/4 in.) dia. ports.
- 2.1.5. Flexible Connections:
 - 2.1.5.1. Ventfabrics, Duro Dyne or Dyne-Air.
 - 2.1.5.2. For fans less than 0.5 kPa (2 in. wg.) connections shall be minimum 680 gm/sq.m. (20 oz./sq.yd.) fire retardant polyvinyl-chloride polyester fabric equal to Vinyl-Flex.
 - 2.1.5.3. For fans in excess of 0.5 kPa (2 in. wg.) connections shall be minimum 1,080 gm/sq.m. (32 oz/sq.yd.) non-toxic neoprene coated fibreglass fabric equal to Neoprene N.T.
 - 2.1.5.4. For all flexible connections located outside the building (e.g. roof top units) flexible connections shall be fire retardant Hypalon coated fibreglass fabric and shall be a minimum 9915 gm/sq.m. (27 oz./sq.yd.) equal to Hypalon.
 - 2.1.5.5. For all systems where the temperature may exceed 112 deg. C. (235 deg. F.) silicone rubber coated fibreglass shall be used, and shall be equal to Silicone H1-T. Submit flexible connections for review before installation.
- 2.1.6. Dampers:
 - 2.1.6.1. Dampers for rectangular ducts shall be Nailor Industries, model #1820 (Opposed Blades) and model #1890 (Butterfly Damper) for round ducts.
 - 2.1.6.2. Dampers: For right angle branch duct take-off from vertical riser; Air vector Vectrol or other approved manufacturer.
 - 2.1.6.3. Construct fire dampers, smoke dampers and combination smoke and fire dampers of stainless steel where dampers are installed in aluminum or stainless steel ductwork.
 - 2.1.6.4. Fire Dampers: Underwriters' Laboratories Classified to ANSI/UL 555 Standard for Fire Dampers and CAN/ULC S112 Standard Method of Fire Test of Fire Damper Assemblies or ANSI/UL 555C Standard for Ceiling Dampers as applicable.
 - 2.1.6.4.1. Fire dampers shall be curtain type, rated as "Dynamic," and shall have the blades clear of the air stream. Fire dampers shall be Type B or Type C as required to suit system air velocity and pressure. Type A fire dampers are not acceptable. Dampers shall be multi-sectional as required to suit size and UL/ULC Listing requirements. Where the specified curtain fire dampers are limited by the UL/ULC Listing for maximum size, they shall be substituted with multi-blade type complete with power actuation and/or fusible link as required to satisfy the fire rating of the partition. Where a fire damper is required to be installed behind a wall grille, Slimline type dampers may be used to provide a flush to wall grille installation.
 - 2.1.6.4.2. Fire-stop flaps or ceiling mounted fire dampers shall be as shown in the Underwriters' Laboratories Listing for the specific ceiling assembly used.
 - 2.1.6.4.3. Thermally insulated motorized control dampers: in accordance with the requirements contained within Section 23 09 00 – BUILDING AUTOMATION SYSTEM (BAS).
 - 2.1.6.5. Combination balancing/fire damper: Price VCS4
 - 2.1.6.6. Combination Smoke and Fire Dampers: Multi-blade type complete with operating shaft, stainless steel side seals and fire resistant insulating blade seals. Dampers shall bear label corresponding to fire rating shown on the Architectural Drawings and shall be of the same manufacturer as noted for fire dampers. Damper shall be opened/closed by electric damper actuator and fully closed on activation of electric temperature sensing device. Limit switches shall be provided to show

position of damper blades. Leakage through dampers shall not exceed 40.6 L/s/ sq.m. (8 cfm/sq.ft.) of damper area at 1.0 kPa (4.0 in. wg.) of differential pressure when determined in accordance with CAN/ULC S112.1 "Leakage Rated Dampers for Use in Smoke Control Systems." Submit test data with Shop Drawings.

- 2.1.6.7. Smoke Dampers: Similar to dampers described above but without electric temperature sensing device.
- 2.1.6.8. Provide integral smoke detector as part of combination smoke and fire dampers, and smoke dampers required above. Provide integral smoke detector that is rated for zero flow.
- 2.1.6.9. Actuators For Combination Smoke and Fire Dampers and Smoke Dampers, Electronic:
 - 2.1.6.9.1. Actuator Type: Modulating.
 - 2.1.6.9.2. Control Signal: Compatible with fire alarm system and BAS.
 - 2.1.6.9.3. Power: Where a 120 V circuit is provided by the Electrical Contractor, provide a 120:24 V transformer, where required based on the actuator in question.
 - 2.1.6.9.4. Operating Time: Maximum 75 seconds throughout the full rotation.
 - 2.1.6.9.5. Angle of Rotation: Adjustable between 0° to 90°.
 - 2.1.6.9.6. Stall protection: Mechanical or electronic.
 - 2.1.6.9.7. Provide actuators with electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation.
 - 2.1.6.9.8. Failsafe: Spring return. Spring return to normal position within 10 seconds.
 - 2.1.6.9.9. Manual Override: Crank type.
 - 2.1.6.9.10. Position Indicator: Reversible for clockwise or counter-clockwise rotation; set the 0 degrees mark to the failsafe position.
 - 2.1.6.9.11. Torque: To damper manufacturer's requirements to provide complete compression of seals between frame and blades and for smooth control.
 - 2.1.6.9.12. Provide 2 SPDT auxiliary switches to prove open-closed.
 - 2.1.6.9.13. Provide electric temperature sensing device with damper actuators for all combination smoke and fire dampers. Temperature sensing device shall be ULC listed and suitable for UL 555S "Smoke Dampers" smoke and fire damper application.
 - 2.1.6.9.14. Provide UL 555S "Smoke Dampers" listed damper actuators for all dampers used in smoke control. All actuators shall be factory installed on dampers.
 - 2.1.6.9.15. Listed to UL 2043 "Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces."
- 2.1.6.10. Positive Seal Shut-off Dampers:
 - 2.1.6.10.1. Isolation type, positive seal, bubble tight damper at a differential pressure of 2.5 kPa (10 in. wg.). Damper shall be constructed with 1.9837 mm (0.0781 in - 14 USS gauge) thick, Type 304 stainless steel dish shaped disc with a knife-edge that seals against a T-304 stainless steel frame. The frame shall have a closed-cell neoprene rubber gasket that creates a gasket-to-knife edge seal. The damper shall have a ¼ turn worm-gear actuator with handwheel. The actuator shall have an aluminum base and cover. The rated torque shall be 225 Joules (2,000 in. lbs.) with a gear ratio of 30:1. The actuator shall be fully lubricated and self-locking.
 - 2.1.6.10.2. The damper shall be all weld design, all pressure retaining weld joints and seams shall be continuously welded. Weld joints and seams requiring only intermittent welds by design shall not be continuously welded interior weld joints, where possible, shall be continuously welded to provide a smooth interior design, as a minimum, all welds shall be wire brushed and/or buffed to remove heat discolouration, burrs and sharp edges. All welding procedures, welders, and welder

operators shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX. All production welds shall be visually inspected in accordance with standard procedure incorporating the workpersonship acceptance criteria in Section 5 and 6 of ANSI/ANWS D9.1-1990 Specification of Welding of Sheet Metal.

- 2.1.6.11. Fabricate manual duct dampers as shown on Standard Details from galvanized steel 1.26 mm thick (0.048 in - 18 GSG gauge) or heavier. Dampers for ducts up to 300 mm (12 in.) deep shall be one blade carried on a 9 mm (3/8 in.) square steel rod mounted inside the duct. Dampers for ducts of greater depth than 300 mm (12 in.) shall be multi-blade, opposed-acting type, and shall have blades mounted in 38 mm (1-1/2 in.) steel channel frame, and interconnected for operation from one locking type hand quadrant. Dampers for right angle take-off of branch from vertical riser shall have operator extended to an accessible location. For externally insulated ducts, mount quadrant on a bracket, designed to clear the insulation. All dampers shall have indicator to show position of damper blade.
- 2.1.6.12. Fabricate splitter dampers as shown on Standard Details from at least the same thickness of galvanized steel as the duct in which it is installed, down to a minimum of 0.95 mm thick (0.0374 in - 20 GSG gauge). Fabricate of double thickness so that the entering edge presents a round nose to the air flow, and mount securely on hinges at the air leaving edge. Length of splitter shall be at least 1-1/2 times the width of the smaller branch duct, but in no case less than 300 mm (12 in.) long. Attach splitter hinge near the air entering edge with support passing through a clamp on the side of the duct, located where it is most accessible for external adjustment and locking of the damper.
- 2.1.6.13. Counterbalanced backdraft dampers shall be multi-blade louvre type, constructed of extruded aluminum in extruded aluminum frames with adjustable coated counterbalance weights. Blades shall be joined with a tie bar and have rust-proof shafts rotating in bronze bushings.
- 2.1.6.14. Motorized dampers for Control Operation: In accordance with applicable requirements control systems (pneumatic) or central energy management systems section.
- 2.1.7. Interior Duct Protective Coating: Chlorinated rubber base paint or Eisenheiss Black.
- 2.1.8. Hardware and Accessories:
 - 2.1.8.1. Spin-in connections shall be specifically built for that purpose. Dampers shall be a minimum 1 gauge heavier than the ductwork in which it is installed and shall have a full length shaft pivoted at two diametrically opposed points. An indicator shall be attached to the shaft to indicate the damper position.
 - 2.1.8.2. Hardware for balancing or splitter dampers shall be rattle-free and leak resistant. Bearing rods shall be sized to suit the damper size. Neoprene seals shall be used to minimize leaks. Hardware shall be Dyn-Air or equal.
 - 2.1.8.3. Provide single thickness turning vanes built to and supported at intervals dictated by SMACNA HVAC Duct Construction Standards Metal and Flexible. Provide rails securely set in the elbow so that they cannot loosen.
- 2.1.9. Provide following duct penetrations with barred duct inserts to restrict passage for minimum and maximum security applications:
 - 2.1.9.1. Barred ductwork insert shall be 5 mm (3/16 in.) welded steel on all four sides with 19 mm (3/4 in.) solid round security bars on 150 mm (6 in.) centres with 65 mm x 5 mm (2-1/2 in. x 3/8 in.) security bars on sizes exceeding 300 mm (12 in.). Angle frame shall be 5 mm (3/16 in.) steel angle (one welded to unit and one shipped loose for field welding). Install per manufacturer's current installation instructions.
- 2.2. FABRICATION** Fabricate ductwork in accordance with applicable duct construction requirements of SMACNA.
 - 2.2.2. Provide dishwasher and kitchen exhaust ducts in accordance with Section 23 31 16.29 – SPECIAL DUCTWORK.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.
- 3.1.2. Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.
- 3.1.3. Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.
- 3.1.4. Hang all ductwork securely and in a rigid manner. Provide hangers in accordance with SMACNA Standard "HVAC Duct Construction Standards Metal and Flexible."
- 3.1.5. Where pre-engineered support systems are provided, provide systems that have been evaluated and certified by SMACNA as well as a 3rd party evaluation service. Ensure application of pre-engineered support systems comply with the limitations noted in the SMACNA and 3rd party certification documents for the specific product in question (e.g. maximum duct width, single tier trapeze only, etc.). Install pre-engineered support systems in strict conformance to the manufacturer's written installation instructions and the conditions of the SMACNA and 3rd party evaluation documents.
- 3.1.6. Support all vertical ducts at each floor, on all sides, with angle riveted to the ducts.
- 3.1.7. The following low pressure, medium pressure and high pressure duct construction is based on an ASHRAE method of construction, and gives a minimum standard of construction. Alternative ASHRAE or SMACNA duct construction is acceptable, provided it meets the minimum standards as outlined by these Specifications. Submit proposed alternatives for review prior to fabrication.
- 3.1.8. Low pressure ductwork 0.5 kPa (2 in. wg) static pressure and less as follows:
 - 3.1.8.1. Rectangular/round duct location:
 - 3.1.8.1.1. Ductwork serving fans with an external static pressure of 0.5 kPa (2 in. wg) or less.
 - 3.1.8.1.2. Downstream of terminal heating and cooling devices.
 - 3.1.8.2. Seal ducts to Seal Class C in accordance with SMACNA "HVAC Duct Construction Standards Metal and Flexible" and "HVAC Air Duct Leakage Test Manual."
 - 3.1.8.3. SMACNA leakage class:
 - 3.1.8.3.1. Rectangular ductwork: 16
 - 3.1.8.3.2. Round ductwork: 8
 - 3.1.8.4. Refer to tables for low pressure rectangular duct construction and round duct construction below for further duct construction requirements.
- 3.1.9. Medium pressure ductwork greater than 0.5 kPa (2 in. wg) and less than 1.5 kPa (6 in. wg) static pressure as follows:
 - 3.1.9.1. Rectangular/round duct location:
 - 3.1.9.1.1. Ductwork serving fans with an external static pressure greater than 0.5 kPa (2 in. wg) and less than 1.5 kPa (6 in. wg).
 - 3.1.9.1.2. Smoke exhaust systems.
 - 3.1.9.1.3. Life safety pressurization systems.
 - 3.1.9.1.4. Ductwork downstream of Ecology unit.

- 3.1.9.1.5. Refer to Section 23 31 16.29 – SPECIAL DUCTWORK for additional requirements.
- 3.1.9.2. Seal ducts 1 kPa (4 in. wg) and greater static pressure to Seal Class A and 0.75 kPa (3 in. wg) static pressure to Seal Class B in accordance with SMACNA “HVAC Duct Construction Standards Metal and Flexible” and “HVAC Air Duct Leakage Test Manual.”
- 3.1.9.3. SMACNA leakage class:
 - 3.1.9.3.1. Rectangular ductwork:
 - 3.1.9.3.1.1. 1 kPa (4 in. wg) and greater static pressure: 4
 - 3.1.9.3.1.2. 0.75 kPa (3 in. wg) static pressure: 8
 - 3.1.9.3.2. Round ductwork:
 - 3.1.9.3.2.1. 1 kPa (4 in. wg) and greater static pressure: 2
 - 3.1.9.3.2.2. 0.75 kPa (3 in. wg) static pressure: 4
- 3.1.9.4. Refer to tables for medium pressure rectangular duct construction and round duct construction below for further duct construction requirements.
- 3.1.10. High pressure ductwork 1.5 kPa (6 in. wg) static pressure and greater as follows:
 - 3.1.10.1. Rectangular/round duct location:
 - 3.1.10.1.1. Ductwork serving fans with an external static pressure of 1.5 kPa (6 in. wg) and greater.
 - 3.1.10.1.2. Laboratory exhaust systems.
 - 3.1.10.1.3. Dust collector systems.
 - 3.1.10.1.4. Welding exhaust systems.
 - 3.1.10.1.5. Refer to Section 23 31 16.29 – SPECIAL DUCTWORK for additional requirements.
- 3.1.10.2. Seal ducts to Seal Class A in accordance with SMACNA “HVAC Duct Construction Standards Metal and Flexible” and “HVAC Air Duct Leakage Test Manual.”
- 3.1.10.3. SMACNA leakage class:
 - 3.1.10.3.1. Rectangular ductwork: 4
 - 3.1.10.3.2. Round ductwork: 2
- 3.1.10.4. Refer to tables for high pressure rectangular duct construction and round duct construction below for further duct construction requirements.

3.1.11. Comply with the tables below in conjunction with the clauses above.

TABLE 1: LOW PRESSURE RECTANGULAR DUCT CONSTRUCTION

| MAX. DUCT DIMENSION | SHEET METAL US GAUGE | TRANSVERSE JOINT CONNECTION AND BRACING |
|---|----------------------|---|
| Up to 300 mm (12 in.) | 26 | Flat drive or flat 'S' no bracing |
| 325 mm to 425 mm (13 in. to 18 in.) | 24 | Flat drive or flat 'S' no bracing |
| 475 mm to 750 mm (19 in. to 30 in.) | 24 | 25 mm (1 in.) standing 'T' bracing 25 mm x 25 mm x 3 mm (1 in. x 1 in. x 1/8 in.) at maximum 1500 mm (60 in.) centres. |
| 775 mm to 1050 mm (31 in. to 42 in.) | 22 | 25 mm (1 in.) standing 'T' bracing 25 mm x 25 mm x 3 mm (1 in. x 1 in. x 1/8 in.) at maximum 1500 mm (60 in.) centres. |
| 1075 mm to 1200 mm (43 in. to 48 in.) | 22 | 38 mm (1-1/2 in.) standing 'T'; bracing 38 mm x 38 mm x 3 mm (1-1/2 in. x 1-1/2 in. x 1/8 in.) at maximum 1500 mm (60 in.) centres. |
| 1225 mm to 1350 mm (49 in. to 54 in.) | 22 | 38 mm (1-1/2 in.) standing 'T'; bracing 38 mm x 38 mm x 3 mm (1-1/2 in. x 1-1/2 in. x 1/8 in.) at maximum 1200 mm (48 in.) centres. |
| 1375 mm to 1500 mm (55 in. to 60 in.) | 20 | 38 mm (1-1/2 in.) standing 'T'; bracing 38 mm x 38 mm x 3 mm (1-1/2 in. x 1-1/2 in. x 1/8 in.) at maximum 1200 mm (48 in.) centres. |
| 1525 mm to 2100 mm (61 in. to 84 in.) | 20 | 38 mm (1-1/2 in.) standing 'T'; bracing 38 mm x 38 mm x 3 mm (1-1/2 in. x 1-1/2 in. x 1/8 in.) at maximum 1200 mm (48 in.) centres. |
| 2125 mm to 2400 mm (85 in. to 96 in.) | 18 | 50 mm (2 in.) standing 'T' bracing 38 mm x 38 mm x 5 mm (1-1/2 in. x 1-1/2 in. x 3/16 in.) at maximum 600 mm (24 in.) centres. |
| 2425 mm to 3000 mm (97 in. to 120 in.) | 18 | 50 mm (2 in.) standing 'T' bracing 50 mm x 50 mm x 6 mm (2 in. x 2 in. x 1/4 in.) at maximum 600 mm (24 in.) centres. |
| 3025 mm and over (121 in. and over) | 18 | As above with addition of tie rods at 300 mm (120 in.) centres for joint bracing. |
| <p>Bracing spacing shown is maximum spacing between two bracings or between bracing and joint.</p> <p>Locate bracings mid-way between joints.</p> <p>Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.</p> | | |

TABLE 2: MEDIUM PRESSURE RECTANGULAR DUCT CONSTRUCTION

| MAX. DUCT DIMENSION | SHEET METAL US GAUGE | TRANSVERSE JOINT CONNECTION & BRACING |
|---|----------------------|---|
| Up to 300 mm (12 in.) | 24 | 25 mm (1 in.) standing seam, 16 mm (5/8 in.) welded flange 25 mm (1 in.) pocket lock, no bracing. |
| 325 mm to 425 mm (13 in. to 18 in.) | 24 | 25 mm (1 in.) standing seam, 22 mm (7/8 in.) welded flange, 25 mm (1 in.) pocket lock, bracing 25 mm x 25 mm x 16 gauge (1 in. x 1 in. x 16 UG gauge) at 1200 mm (48 in.) centres. |
| 475 mm to 600 mm (19 in. to 24 in.) | 22 | 32 mm (1-1/4 in.) standing seam, 35 mm (1-3/8 in.) welded flange, 30 mm (1-1/8 in.) pocket lock, bracing 25 mm x 25 mm x 3 mm (1 in. x 1 in. x 1/8 in.) at maximum 120 mm (48 in.) centres. |
| 625 mm to 900 mm (25 in. to 36 in.) | 22 | 38 mm (1-1/2 in.) standing seam, 38 mm (1/2 in.) pocket lock, bracing 25 mm x 25 mm x 3 mm (1 in. x 1 in. x 1/8 in.) at maximum 120 mm (48 in.) centres. |
| 925 mm to 1200 mm (37 in. to 48 in.) | 22 | 50 mm (2 in.) standing seam or 50 mm (2 in.) flanged joint, bracing 38 mm x 38 mm x 3 mm (1-1/2 in. x 1-1/2 in. x 1/8 in.) at maximum 750 mm (30 in.) centres. |
| 1125 mm to 1500 mm (49 in. to 60 in.) | 20 | 38 mm (1-1/2 in.) standing seam or 38 mm (1-1/2 in.) flanged joint with tie rod in centre, bracing 50 mm x 50 mm x 3 mm (2 in. x 2 in. x 1/8 in.) at maximum 600 mm (24 in.) centres. |
| 1525 mm to 1800 mm (61 in. to 72 in.) | 20 | 38 mm (1-1/2 in.) standing seam or 38 mm (1-1/2 in.) flanged joint with tie rod in centre, bracing 50 mm x 50 mm x 3 mm (2 in. x 2 in. x 1/8 in.) at maximum 600 mm (24 in.) centres. |
| 1825 mm to 2100 mm (73 in. to 84 in.) | 18 | 50 mm (2 in.) standing seam or 38 mm (1-1/2 in.) flanged joint with tie rod in centre, bracing 65 mm x 65 mm x 5 mm (2-1/2 in. x 2-1/2 in. x 3/16 in.) at maximum 600 mm (24 in.) centres. |
| 2425 mm and over (96 in. and over) | 18 | 50 mm (2 in.) standing seam or 38 mm (1-1/2 in.) flanged joint with tie rod in centre, bracing 65 mm x 65 mm x 5 mm (2-1/2 in. x 2-1/2 in. x 3/16 in.) at maximum 600 mm (24 in.) centres. |
| <p>Bracing spacing shown above is maximum spacing between two bracings or between bracing and joint. Locate bracing mid-way between joints.</p> <p>Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.</p> | | |

TABLE 3: HIGH PRESSURE RECTANGULAR DUCT CONSTRUCTION

| MAX. DUCT DIMENSION | SHEET METAL US GAUGE | CONSTRUCTION |
|--|----------------------|--|
| Up to 300 mm (12 in.) | 22 | Flanged angle gasketed joint or butt welded joint with 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) angle. |
| 325 mm to 450 mm (13 in. to 18 in.) | 22 | Flanged angle gasketed joint or butt welded joint with flanged angle 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) and reinforcing angle 25 mm x 25 mm x 16 US gauge (1 in. x 1 in. x 16 US gauge) at maximum 1200 mm (48 in.) centres. |
| 475 mm to 600 mm | 22 | Flanged angle gasketed joint or butt welded joint with flanged angle 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) and reinforcing angle 25 mm x 25 mm x 3 mm (1 in. x 1 in. x 1/8 in.) at maximum 1200 mm (48 in.) centres. |
| 625 mm to 900 mm (25 in. to 36 in.) | 22 | Flanged angle gasketed joint or butt welded joint with flanged angle 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) and reinforcing angle 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) at maximum 800 mm (32 in.) centres. |
| 925 mm to 1200 mm (37 in. to 48 in.) | 22 | Flanged angle gasketed joint or butt welded joint with flanged angle 38 mm x 38 mm x 3 mm (1-1/2 in. x 1-1/2 in. x 1/8 in.) and reinforcing angle 65 mm x 65 mm x 3 mm (2 in. x 2 in. x 1/8 in.) at maximum 750 mm (30 in.) centres. |
| 1225 mm to 1500 mm (49 in. to 60 in.) | 20 | Flanged angle gasketed joint or butt welded joint with flanged angle 50 mm x 50 mm x 5 mm (2 in. x 2 in. x 3/16 in.) and reinforcing angle 50 mm x 50 mm x 3 mm (2 in. x 2 in. x 3/16 in.) at maximum 600 mm (24 in.) centres. |
| Over 1500 mm (60 in.) and all sizes between fan and round duct | 20 | Flanged angle gasketed joint or butt welded joint with flanged angle 50 mm x 50 mm x 5 mm (2 in. x 2 in. x 3/16 in.) and reinforcing angle 50 mm x 50 mm x 3 mm (2 in. x 2 in. x 3/16 in.) at maximum 600 mm (24 in.) centres. |

TABLE 4: ROUND DUCT CONSTRUCTION

| 1. Round ducts up to 750 mm (30 in.) diameter factory fabricated, helically wound galvanized iron strips with spiral lock seam. | | | |
|---|-------------------------|----------------|--------------------------|
| DIAMETER | STRIP METAL US GAUGE | STRIP JOINT | GIRTH JOINT |
| Up to 200 mm (8 in.) | 26 | 100 mm (4 in.) | 50 mm (2 in.) long slip |
| 225 mm to 550 mm (9 in. to 22 in.) | 24 | 100 mm (4 in.) | 50 mm (2 in.) long slip |
| 575 mm to 750 mm (23 in. to 30 in.) | 22 | 150 mm (6 in.) | 100 mm (4 in.) long slip |

Join with galvanized iron coupling sleeves or conduit fittings of welded construction.

Construct larger ductwork as follows with longitudinal lock or butt welded seams:

| DIAMETER | SHEET METAL US GAUGE | REINFORCING | GIRTH JOINT |
|---|----------------------------|--|--|
| 775 mm to 900 mm (31 in. to 36 in.) | 20 | None | 100 mm (4 in.) long slip |
| 925 mm to 1500 mm (37 in. to 60 in.) | 18 | 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) angle on max 1800 mm (72 in.) centres | 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in. angle flanged. |

- 3.1.12. Seal all joints of all ducts. Brush joints with the compound before and again after assembly. Seal any leaks causing noise.
- 3.1.13. Seal the bottom and side joints of outside air ducts or plenums water-tight.
- 3.1.14. Flexible duct shall be connected to sheet metal duct and diffusers using duct sealer, minimum of two screws separated by 180 degrees and metal draw bands. Duct tape is not acceptable.
- 3.1.15. Flexible ductwork may be used under the following conditions:
 - 3.1.15.1. Where shown on Drawings to allow easy location of diffusers.
 - 3.1.15.2. Except where indicated otherwise in clauses below, minimum length of flexible duct on supply air system: 300 mm (12 in.).
 - 3.1.15.3. Except where indicated otherwise in clauses below, maximum length of flexible duct on supply air system: 1,800 mm (72 in.).
 - 3.1.15.4. Do not pass flexible ductwork through floors or fire walls.
 - 3.1.15.5. Install flexible ductwork as a single section of duct (no joints). In the event that building construction requires connection between lengths of flexible duct, use a rigid section of duct as the joint. Secure flexible duct to the rigid section using ties and sealant.
 - 3.1.15.6. Support flexible duct lengths at the midpoint with strap hangers.
 - 3.1.15.7. Within residential suites, flexible ductwork may be used under the following conditions:
 - 3.1.15.8. Exhaust ductwork connected to wall box using a maximum of 914 mm (36 in.) of flexible ductwork. Flex duct not permitted on outside air ductwork.

- 3.1.16. Where ductwork passes through a wall or floor, other than when a fire damper is required, pack around the duct using a fire resistant material to ensure a sound and airtight joint.
- 3.1.17. If changes of size of ducts are necessary because of building construction, maintain the same circular equivalent for the new size. Ratio of the longest side of the duct to the least shall not exceed 4 to 1 unless specifically authorized by the Engineer's Representative.
- 3.1.18. Select the gauge of metal and method of construction for the new size. Notify the Engineer's Representative of any change before such changes are incorporated into the Work.
- 3.1.19. If changes of location of duct are required because of building construction, review with the Engineer's Representative before the locations indicated are changed in any way.
- 3.1.20. Make changes of direction of horizontal ducts with elbows having an inside radius not less than 3/4 the width of the duct. Make change of direction from horizontal to vertical duct with elbows having an inside radius equal to the depth of the duct. Where this is not possible due to the building construction, use turning vanes.
- 3.1.21. Provide access ports at convenient locations in all main ducts and main branch take-offs with airtight covers and extension sleeves through insulation to allow air meter readings. Access ports shall be approved by the Engineer's Representative and the testing company before installation.
- 3.1.22. Provide flexible connections at each air handling unit (where not provided internally) and fan duct connections before and after any required transitions on the fan inlet and outlet respectively (i.e. on the largest duct perimeter and not directly installed on the fan inlet and outlet to reduce noise and air turbulence).
- 3.1.23. Install manual duct dampers as shown on Standard Details. Ensure dampers for right angle take-off of branch from vertical riser have operator extended to an accessible location. Adjust quadrants to clear duct insulation.
- 3.1.24. Provide splitter dampers as shown on Standard Details.
- 3.1.25. Incorporate counterbalanced backdraft dampers where shown. Adjust counterweights to the minimum pressure required to relieve the system pressure. Incorporate gravity backdraft dampers where shown.
- 3.1.26. Install motorized dampers where directed.
- 3.1.27. Install fire dampers where shown and at all penetrations through all fire rated assemblies. Provide firestop flap type fire dampers where fire dampers are shown in grilles or diffusers at ceiling level. Provide the appropriate fire damper model to suit the installation condition and provide all necessary flanges, frames, fittings, and accessories to ensure a flush installation. Obtain local authorities' approvals for all damper locations and keep one set of marked-up prints on site. Approvals shall be obtained before installation of fire dampers.
- 3.1.28. Where a fire damper is required to be installed behind a wall mounted grille, provide damper, angles, and retaining devices as required to provide a smooth, flat to wall installation.
- 3.1.29. Where fire dampers for ducts shown on Drawings require a change of type and/or powered actuation due to dimension limitations to satisfy the cUL Classification requirements, provide transitions as required to adjust duct dimensions while maintaining the equivalent circular duct diameter to avoid exceeding any specific listed maximum dimension. Where transitions are not possible or dimensions cannot be adjusted to avoid powered actuation, provide power from the closest available emergency power source as required. Review all conditions with the Engineer's Representative in advance of fabrication.
- 3.1.30. Install combination smoke and fire dampers and smoke dampers where shown. Ensure operators are accessible for maintenance. Coordinate installation of required fire alarm connections with Electrical Contractor and provide wiring connections to BAS where required by damper sequence of operations. Coordinate connections to damper actuators in accordance with sequence of operations and damper locations.

- 3.1.31. Receive automatic dampers from separate Section on site, and set in place under the supervision of the control manufacturer.
- 3.1.32. Provide access panels at all fire dampers, gravity dampers, motorized dampers, coils, heaters, humidifiers, fan bearings or similar equipment requiring occasional maintenance or inspection. Panels shall be 600 mm x 450 mm (24 in. x 18 in.) or full width of duct if less than 450 mm (18 in.) wide. Panels shall be of double wall construction and shall be internally insulated on insulated ducts. Frame shall be of structural angle with welded corners, gasketed to receive the panel. Panel shall be held in place with 4 window sash locks.
- 3.1.33. Paint visible internal surface behind each grille or register flat black.
- 3.1.34. Where duct is acoustically lined, duct dimensions shown are net, inside of lining, free area dimensions.
- 3.1.35. Install laboratory exhaust ducts in accordance with Section 23 31 16.29 – SPECIAL DUCTWORK.
- 3.1.36. Install kitchen and dishwasher exhaust ducts in accordance with Section 23 31 16.29 – SPECIAL DUCTWORK.
- 3.1.37. Ductwork installed underground shall be round spiral sheet metal constructed in accordance with high pressure duct standards. Joints shall be sealed with high pressure duct sealant and taped. Duct shall be completely covered with a minimum of two coats of bitumastic coatings.
- 3.1.38. Slope underground duct and provide drainage in accordance with the Building Code.
- 3.1.39. Install laboratory exhaust ducts in accordance with Section 23 31 16.29 – SPECIAL DUCTWORK.
- 3.1.40. Intake and exhaust ductwork for indoor cooling towers shall be constructed the same as ductwork but the bottom section of the intake duct shall have extra reinforcing to support a mass of 100 kg (weight of 250 lbs) without deflecting. Provide a supporting steel angle frame to support the plenum from the floor.
- 3.1.41. Provide internal acoustic duct lining in accordance with Section 20 05 48 – VIBRATION AND NOISE CONTROL.
- 3.1.42. Air wells shall be 1.95 mm thick (0.0767 in - 14 GSG gauge) galvanized steel construction with all joints welded. Clean all welds so that no water traps occur. Touch-up all welds with zinc rich primer. Suitably brace the entire assembly with steel angle to prevent flexing and drumming. Coat the entire surface exposed to the outside air with 2 coats of rustproofing finish. Submit sample of rustproofing for review. Provide a structural supporting frame to support the entire unit plus an additional live loading of 4.2 kg/sq.m. (100 lbs/sq.ft.).
- 3.1.43. Spin-in connections shall only be used downstream of variable volume boxes.
- 3.1.44. Ductwork shall be run parallel to the closest wall. Coordinate with piping and structural elements.
- 3.1.45. All exposed open ends of ductwork located less than 2000 mm (79 in) above the finished floor that do not have a diffuser, grille or register shall have a protective screen mounted in a suitable frame to connect the screen securely to the duct, wall and floor as applicable. The screen shall be installed and painted matte black and shall not be capable of passage of anything larger than a 15 mm (1/2 in.) sphere through the openings.
- 3.1.46. Supply air ductwork to variable volume boxes shall be rigid duct of size shown in schedules. If the length exceeds 3000 mm (10 ft.) or if there are 2-45 deg. elbows or 1-90 deg. elbow or more increase the supply air ductwork to the variable volume box one size. If the length exceeds 6000 mm (20 ft.) increase the duct by two sizes. Under no conditions shall the supply ductwork exceed 9000 mm (30 ft.) or have more than 3-90 deg. elbows or the equivalent. Transition to variable volume box inlet sizes a minimum of 4 duct diameters upstream of the terminal unit.
- 3.1.47. Where acceptable to Engineer's Representative, and where fans shut down upon detection of fire, static fire dampers may be used in lieu of dynamic fire dampers.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Shop Drawings:

1.2.1.1. Submit Shop Drawings of all room ventilators with catalogued components to be supplied. Include manufacturer's data sheets for, performance criteria, ratings, and physical dimensions and finishes.

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Room ventilators shall be Penn Zephyr, Greenheck, Loren Cook Gemini, Soler & Palau or Twin City.

2.1.2. Centrifugal fans shall be mounted in a galvanized steel, acoustically insulated housing and shall be internally isolated. Fans shall be AMCA certified for both air and sound, UL labelled and CSA approved.

2.1.3. Arrange casing for in-line installation with access to both fan and motor through the casing.

2.1.4. Inlet and discharge shall be flanged for duct connections.

2.1.5. Discharge shall be complete with spring loaded backdraft damper.

2.1.6. Penn Zephyr models Z14 and Z15 shall be hung on vibration isolating hangers. Other units shall have vibration hangers where specifically shown or specified.

2.1.7. Models Z14 and Z15 shall be hung on vibration isolating hangers. Other units shall have vibration hangers where specifically shown or specified.

2.1.8. Motors shall be prewired to terminal box located on the unit housing.

2.1.9. Motors shall be 120 volts, 1 phase for all sizes except Model Z15, which shall be 230 V, 1 phase.

2.1.10. Model Z15 motors shall be 208 V, 3 phase.

2.1.11. Speed control shall be Lek-Trol variable speed/off, solid state controller.

2.1.12. All intake and discharge ductwork shall have 25 mm (1 in.) thick acoustic lining.

2.1.13. Room ventilator shown as EF-R.1 shall be capable of producing 120 L/s at 3 in.wg. external static pressure when driven by a 1/10 hp motor.

2.1.14. Room ventilator shown as EF-R.2 shall be capable of producing 1100 L/s at 2 in.wg. external static pressure when driven by a 1 hp motor.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Install room ventilators where shown.

3.1.2. All ventilators on vibration isolation hangers shall have flexible connections on both inlet and outlet.

3.1.3. Speed control switch to be supplied only. Electrical Division to include for wall mounting and wiring.

- 3.1.4. Where reverse acting thermostats are specified in the Drawings, thermostat to be supplied by the Mechanical Division, Electrical Division to include for wall mounted and wiring.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Actuator for damper and controller furnished under Section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS).

1.3. SUBMITTALS

- 1.3.1. Shop Drawings: Submit Shop Drawings of all components in accordance with Section 20 05 03 – SHOP DRAWINGS.
- 1.3.2. Manufacturer's Data: Submit manufacturer's certified sound power ratings with an octave band analysis when tested in accordance with ASHRAE Standard 36B-63. Where a second sound attenuator is required in the system or where attenuators with outlets are used in conjunction with rated outlets and not as straight attenuators without outlets, submit certified data for review.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. The mechanical variable volume boxes shall be E.H. Price, Titus, Nailor, Krueger, or JCI Enviro-Tec as shown and specified below.
- 2.1.2. Boxes shall be low pressure terminal boxes having unit casings fabricated of galvanized steel of sufficient thickness to prevent drumming or rattling, and lined with 25 mm (1 in.) thick thermal and sound attenuating insulation. The units shall be end outlet and shall be complete with pneumatic operator and a constant volume regulator requiring no external power source. The controller shall always modulate through its full reset span regardless of maximum and minimum air flow settings. Leakage through the unit casing shall be less than 0.3% of the design volume.
- 2.1.3. Boxes shall be low pressure terminal boxes having unit casings fabricated of galvanized steel of sufficient thickness to prevent drumming or rattling, and lined with 25 mm (1 in.) thick thermal and sound attenuating insulation. The units shall be end outlet and shall be complete with DDC actuator. Leakage through the unit casing shall be less than 0.3% of the design volume.
- 2.1.4. Provide VAV boxes and actuators selected to accommodate the airflow direction as shown on the Drawings and/or equipment schedules.
- 2.1.5. Provide all supply air VAV boxes and general exhaust air VAV boxes with silencers. Provide actuators oriented to align with airflow direction for supply and exhaust. Refer to VAV Schedule and corresponding Drawings.
- 2.1.6. Design volumes shall be factory preset and calibrated and both maximum and minimum volumes shall be independently adjustable in the field, by using a cfm scale and without changing components. The box volumes are shown on Drawings. For all boxes, the minimum volume shall be set at the minimum volume recommended by the manufacturer. Maximum volume control shall be maintained within plus 5% of volume shown for box, with inlet pressures of 0.05 to 1.5 kPa (0.2 in. to 6 in.) of water.
- 2.1.7. For LEED projects, where a VAV box is used for outdoor airflow monitoring, provide one of the following combinations and maintain within + / - 10% of minimum volume shown for box. Provide sensor and box that are factory calibrated.
- 2.1.7.1. EH Price SDV VAV box with SP300 sensor and Price Intelligent Controller (PIC). SPEC SHEET LINK:
- 2.1.7.2. TITUS DESV with TITUS AeroCross sensor and TITUS Alpha BACnet Controller.

- 2.1.7.3. Enviro-Tec model SDR VAV with Flowstar Sensor and Enviro-Tec DDC Controller.
- 2.1.8. Acoustically line ductwork downstream from boxes as shown. Lengths of 25 mm (1 in.) thick acoustic lining, shall be as designed in following Schedules:
- | BOX VOLUME | LENGTH |
|--------------------------------------|------------------|
| 755.5 to 1180 L/s (1601 to 2500 cfm) | 6100 mm (20 ft.) |
| 283.5 to 755 L/s (601 to 1600 cfm) | 4600 mm (15 ft.) |
| 95 to 283 L/s (201 to 600 cfm) | 3000 mm (10 ft.) |
| Under 94.5 L/s (200 cfm) | 1500 mm (5 ft.) |
- 2.1.9. With the scheduled lengths of lined duct and a room attenuation of 8 db, the sound power level with reference to 10 to the -12 power watts shall be such that the sound pressure level in the room receiving air and in room in which the box is located, shall not exceed noise criterion 32 at an inlet static pressure 0.37 kPa (1.5 in. wg.) with noise generated by diffusers excluded. Provide manufacturer's certified sound power ratings with an octave band analysis when tested in accordance with ASHRAE Standard 36B-63.
- 2.1.10. When the scheduled lengths of lined duct cannot be obtained and/or where specifically shown, utilize straight attenuators.
- 2.1.11. With these attenuators and a room attenuation of 8 db, the sound power level with reference to 10 to the -12 power watts shall be such that the sound pressure level in the room receiving air and in room in which the box is located, shall not exceed noise criterion 32 at an inlet static pressure 0.37 kPa (1.5 in.wg.) with noise generated by diffusers excluded. Provide manufacturer's certified sound power ratings with an octave band analysis when tested in accordance with ASHRAE Standard 36B-63.
- 2.1.12. Where one attenuator fails to provide the sound attenuation required, utilize additional attenuators or lengths of duct lining. Where attenuators with outlets are used they shall be rated with the outlets and not as straight attenuators without outlets.
- 2.1.13. Where outlets are provided, they shall be complete with manual dampers in each outlet.
- 2.1.14. The box radiated noise level shall meet the criteria for specific room noise levels as specified under Section 20 05 48 - VIBRATION AND NOISE CONTROL.
- 2.1.15. Pressure drop for L/s (cfm) ranges shown for each box size shall be 0.07 kPa (0.3 in.wg.) maximum. Boxes shall be capable of modulating down to the minimum volume shown and shall shut-off tight where zero L/s (zero cfm) is shown.
- 2.1.16. Where a manufacturer requires main control air to the box, it is the responsibility of this section to ensure that main air is provided by Section 23 09 00 - BUILDING AUTOMATION SYSTEM (BAS). Failure to do this shall be at the expense of this section and shall be corrected at no cost to the Owner.
- 2.1.17. Provide VAV boxes that fail open.
- 2.1.18. Bypass boxes shall be similar to variable air volume boxes, but shall maintain room conditions by bypassing supply air to the return air.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install VAV boxes in accordance with reviewed Shop Drawings and to manufacturer's written instructions.

- 3.1.2. Air velocity sensor, actuator for damper, controller and interconnecting tubing and cable are installed by terminal box manufacturer at its manufacturing facilities; the costs for installation labour are paid for by this Section. Make control devices readily accessible from the access panel in the suspended ceiling.
- 3.1.3. Where a VAV box does not meet specified sound ratings, field enclose with (0.80 mm thick (1 lb.) lead sheeting over a 25 mm thick (1 in.) glass fibre blanket wrap, as part of the Work.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Continuous air slot in ceiling - under Division 9 - Finishes.

1.2.2. Door grilles - under Architectural Division - Grilles.

1.3. SUBMITTALS

1.3.1. Shop Drawings: Submit detailed Shop Drawings of all components furnished under this Section. Manufacturer to indicate ceiling installation type for each type of diffuser specified.

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Diffusers, registers and grilles shall be Price, Nailor, Krueger, Titus or Carnes equal to the units specified.

2.1.2. Select all diffusers to provide uniform air coverage without overlap. Air velocity up to a height of 1800 mm (6 ft.) above the floor shall be 0.127 to 0.254 m/s (25 to 50 fpm).

2.1.3. Noise generated by diffusers shall be such that room sound pressure level does not exceed noise criteria 32 with an 8 db room attenuation, the sound power level reference to 10 to -12 power watts.

2.1.4. All volume and air pattern devices shall be fully adjustable from the face of the diffuser, register or grille.

2.1.5. In gypsum board or plaster ceiling applications, provide matching mounting frame. Finish shall be prime painted, off-white in plaster and gypsum board ceilings.

2.1.6. In T-bar ceilings, manufacturer shall coordinate diffuser compatibility with t-bar ceiling specified by the architectural division. Colour shall match colour of ceiling tile in lay-in ceilings. Diffusers to suit ceiling grid as required imperial or metric.

2.1.7. Diffusers shall meet test requirements of ASHRAE Standard 36B-63, including air pattern and noise levels for air quantities from 10 % to 110 % of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63 and NC ratings shall be determined using an 8 db room attenuation factor.

2.2. SQUARE SUPPLY DIFFUSERS

2.2.1. All diffusers shown as type "P" shall be steel square plaque diffuser 600 mm x 600 mm (24 in. x 24 in.) face size and shall be square, coned metal. Diffusers shall consist of a precision formed back cone of one piece seamless construction which shall incorporate a round (or square) inlet collar of sufficient length for connecting rigid or flexible duct as shown. An inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck. E.H. Price SPD, Nailor UNI, Krueger PLQ, Carnes SFP.

2.3. LINEAR SUPPLY AND RETURN DIFFUSERS

- 2.3.1. All diffusers shown as type "T" shall be T-bar plug-in, 1 slot diffuser modified with square ends to limit side spread, and of lengths shown. Diffuser shall be installed with manufacturer plenum to match the length of the diffuser shown. Provide diffuser with mounting clips to suit in continuous T-bar openings. Pattern controllers shall be split mid length to allow each half of diffuser shall be set for different throw patterns. Throw patterns shall be fully adjustable from vertical to horizontal and variations in between. Provide blank-off panels between diffusers. Pattern controllers and blank-off panels shall be finished matte black. Plenum shall be fabricated from coated steel. Refer to Architectural Details for installation of continuous supply air slot. Duct connection to diffuser shall be of sufficient height to allow for 175 mm (7 in.) clearance from ceiling to underside of duct. EH-Price TBD3 series, Nailor 5800, Krueger PTBA, Carnes DASC.
- 2.3.1.1. Return slots shall match supply and shall have return air sight baffles and mitred corners. Return linear grilles shall be specified as above and indicated as return on the Drawings.

2.4. WALL AND DUCT GRILLES

- 2.4.1. All supply registers shown as type "B" shall be standard double deflection type with adjustable horizontal face bars and vertical rear bars. Frame shall be gasketed. Construction shall be aluminum with prime coat. Registers larger than listed sizes shall be shop fabricated in Sections such that the Sections will appear as one integral register when installed. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The damper shall be coated or galvanized steel. E.H. Price 620D, Nailor 5100 Series, Krueger 5880 Series, Carnes RNGM.

2.5. RETURN, EXHAUST AND TRANSFER GRILLES

- 2.5.1. Return grilles shown as type "E" shall be size as shown and shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick. Grilles shall be enclosed in a channel frame for inverted T-bar mounting or with a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system. Colour shall match adjacent ceiling tiles. E.H. Price Series 80, Nailor 5100 Series, Krueger EGC5 Series, Carnes RPAH.
- 2.5.2. Return registers shown as type "K" shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return. Key operated damper shall be mounted behind. General appearance, type of material and finish shall match the type "..." supply register. E.H. Price 530, Nailor 6100 Series, Krueger S80, Carnes model RSBAH.
- 2.5.3. Transfer Grilles shown as type "J" shall be standard single deflection fixed blade type. Finish shall match wall. E.H. Price model 535/F/L/0m, Nailor 6155H/V, Krueger S85.
- 2.5.4. Door transfer grilles shown as typ "DG" unless otherwise specified shall have finely spaced blades for an attractive sight proof appearance and are designed for applications in doors or partitions with Sections as thin as 35 mm (1-3/8") with flat border and countersunk holes. E.H. Price type ATG1, Nailor 51DGD, Krueger 600, Carnes RFJAH.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Refer to the Architectural Drawings for actual locations of diffusers, grilles and registers and install to suit these Drawings. The Mechanical Drawings show intent and number of diffusers, grilles and registers required.
- 3.1.2. Provide transfer grilles in all finished spaces where air is transferred though a ceiling or partition.

- 3.1.3. For exposed ductwork installations, all connections to grilles shall be oversized and shall have in-turned flanges to meet the flange of the grilles and the duct. Out-turned or exposed flanges with screw mounting shall not be accepted.
- 3.1.4. For special mounting of diffusers, grilles and registers refer to Architectural Drawings.
- 3.1.5. Where rigid duct is connected to the diffuser, grille or register all devices used for flow pattern adjustment, flow balancing and flow equalizing shall be accessible from the face of the diffuser.
- 3.1.6. Install mounting frame tied into plaster and gypsum board ceilings to allow lay in type diffusers to rest on the frame.
- 3.1.7. Diffusers for installation in lay-in ceiling shall lay on inverted T-bars.
- 3.1.8. Diffusers for installation in lay-in ceiling shall lay on inverted T-bars spaced on ... mm (... in.) centers.
- 3.1.9. Contractor shall be responsible for mounting concealed flange linear diffusers in heated environment and following manufacturers' instructions.
- 3.1.10. Contractor shall caulk around edges of linear diffusers in installations with imperfect walls.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings in accordance with Section 20 05 03 - SHOP DRAWINGS. Ensure Shop Drawings include unit Short Circuit Current Rating (SCCR).

PART 2 PRODUCTS

2.1. MATERIALS

2.1.1. Unitary Air Conditioning Units (UACU) shall be Daikin, Mitsubishi or Carrier, equal to Mitsubishi "Mr. Slim".

2.1.2. UACU shall be split system type with minimum two speed indoor evaporator section and remote outdoor compressor/condensing unit.

2.1.3. Model arrangements shall be as shown, and specified in the Schedules.

| Unit Tag | Manufacturer | Model | Capacity | Power |
|----------|--------------|------------|-------------|----------|
| A/C-1.1 | DAIKIN | FTQ30TAVJU | 30,000 BTUH | 208/1/60 |
| A/C-2.1 | DAIKIN | FTQ30TAVJU | 30,000 BTUH | 208/1/60 |
| A/C-2.2 | DAIKIN | FTQ30TAVJU | 18,000 BTUH | 208/1/60 |

| Unit Tag | Unit served | Manufacturer | Model | Capacity | Power |
|----------|-------------|--------------|-------------|-------------|----------|
| C/U-R.1 | A/C-1.1 | DAIKIN | RZR30TAVJUA | 30,000 BTUH | 208/1/60 |
| C/U-R.2 | A/C-2.1 | DAIKIN | RZR30TAVJUA | 30,000 BTUH | 208/1/60 |
| C/U-R.3 | A/C-2.2 | DAIKIN | RZR18TAVJUA | 18,000 BTUH | 208/1/60 |

2.1.4. The combination of the evaporator and condensing sections shall be provided with the capacities designated in Schedules.

2.1.5. Compressor condensing unit shall be capable of low temperature operation down to minus 34.4 deg. C. (30 deg. F.).

2.1.6. Provide unit with room thermostat. Dampers for right angle branch duct take-off from vertical riser shall be Air Vector, Vectrol, or other approved manufacturer.

2.1.7. Unit shall be provided with filter.

2.1.8. Provide BACnet interface to the BAS system for monitoring and alarm purposes. At a minimum provide the following information to the BAS.

2.1.8.1. Room temperature and set point

2.1.8.2. System Start / Stop

2.1.8.3. Alarm conditions.

- 2.1.9. Unit shall bear a minimum Short Circuit Current Rating (SCCR) listed by a Nationally Recognized Testing Lab, acceptable to the local Authority Having Jurisdiction, and shall be 25,000 A Lower SCCR listed units implying the use of current limiting fuses ahead of them in the field, in lieu of an actual appropriate SCCR rating, are not acceptable.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install complete refrigeration and controls in accordance with the manufacturer's recommendations.
- 3.1.2. Roof mounted condensers shall be complete with feet and secured to 750 mm x 750 mm (30 in. x 30 in.) precast concrete paving slabs.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Coils: Daikin, Heatcraft, Engineered Air, Aerofin, JCI York or Greenheck, LJ Wing.
- 2.1.2. All coils shall have certified AHRI capacities.
- 2.1.3. All coils shall be of copper tube, aluminum fin construction with minimum 1.26 mm thick (0.048 in - 18 GSG gauge) galvanized sheet steel casing and galvanized steel angles for heating coils and 1.56 mm thick (0.0625 in - 16 USG gauge) Type 304L stainless steel casing and stainless steel angles for cooling coils. Header shall be copper tube or cast iron.
- 2.1.3.1. Coils for mounting in ductwork shall have holes in frame for bolting to flanged ductwork.
- 2.1.3.2. Cooling coils shall have fins spaced not closer than 3.175 mm OC (8 to the in.)
- 2.1.3.3. Steam coils shall have internal steam, distribution tubes.
- 2.1.3.4. Water coils shall have serpentine circuiting arranged for counter flow between the air and water.
- 2.1.3.5. Coils shall be suitable for 860 kPa (125 psig) water pressure for low pressure systems and suitable for 1720 kPa (250 psi) water pressure for high pressure systems.
- 2.1.3.6. Coils shall be complete with plugged drain and vent connection, readily accessible.
- 2.1.3.7. Face velocity shall not exceed 3.81 m/s (750 fpm) for heating coils and 2.54 m/s (500 fpm) for cooling coils.
- 2.1.3.8. Provide dielectric couplings to ensure galvanic action does not occur between dissimilar metals.
- 2.1.4. Refrigerant coils shall provide cooling by the direct expansion of refrigerant inside the tubes. The refrigerant shall be distributed to the various coil circuits through a venturi type distributor having a low pressure drop and arranged for down-feed having male sweat connection. A maximum of 12 refrigerant circuits shall be supplied from a single distributor.
- 2.1.4.1. Provide two distributors when more than 12 circuits are required. The refrigerant shall be distributed from the multi-outlet distributor to the coil circuits through round seamless copper tubes, 8 mm OD or 6 mm OD (5/16 in. OD or 1/4 in. OD).
- 2.1.4.2. Refrigerant coils shall be tested at 2070 kPa (300 psi) air pressure under water, cleaned, dehydrated and sealed with a dry nitrogen charge. Coil shall be suitable for working pressures up to 125 kPa (250 psi).
- 2.1.4.3. Where indicated on Drawings, refrigeration coils shall be horizontally split to match the refrigerant system.
- 2.1.5. Integral face and bypass steam heating coils shall be by Aerofin or LJ Wing.
- 2.1.5.1. Provide steam heating coil with a built-in series of finned heating elements and bypasses with interlocked dampers furnished complete with electric damper motor(s).
- 2.1.5.2. Provide clamshell style dampers with linkage between blades.
- 2.1.5.3. Maintain a constant discharge air temperature regardless of variations in entering air temperature with full steam pressure on the coil at all times.
- 2.1.5.4. Provide proportioning of the air such that the temperature at any point in a plane parallel to the face of the coil, three feet downstream from the leaving side will not vary more than 2.8 Deg. C.

(5 Deg. F.) from the average discharge temperature. Provide 900mm (36 in.) clearance between the leaving side and any downstream coils.

- 2.1.5.5. Provide 16 gauge roll formed dampers, cold rolled steel with an air dried machine enamel finish. Finned heating elements shall be fabricated of seamless return bend type copper tubes with rectangular aluminum fins spaced not closer than 10 fins per inch. Finned elements shall be factory tested at 200 psi steam and 1000 lbs hydrostatic pressure.
- 2.1.6. Provide cooling coils in accordance with the Cooling Coil Schedule. All air pressure drops shall be based on wet coils.
- 2.1.7. Provide heating coils in accordance with the Heating Coil Schedule.
- 2.1.8. Provide all coils with a maximum dry-coil pressure drop of 187 Pa (0.75 in. wg.) at 2.54 m/s (500 fpm).
- 2.1.9. Drain pans below each cooling coil shall be fabricated from minimum 0.9525 mm thick (0.0375 in - 20 USS gauge) Type 304L stainless steel sheet and formed stainless steel angles, and shall extend full length of coil, double sloped at a minimum of 2% to prevent standing water with pan projecting beyond the coil. Projections shall be 75 mm (3 in.) on the air inlet side and 300 mm (12 in.) on the air leaving side of the coil. Drain pans shall be welded construction with 50 mm (2 in.) diameter stainless steel nipple for drain connection.
- 2.1.10. Cooling coil support racks shall be Type 304L stainless steel.
- 2.1.11. Coils for installation with vertical airflow shall be suitable for this orientation. Cooling coils in the vertical airflow orientation to be A-frame and/or suitably angled to prevent condensate bypassing the drain pan.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Coils shall be pitched and installed as required in the manufacturer's installation instructions. The lowest cooling coil shall be at least 150 mm (6 in.) above the floor of the unit so that it does not sit in water.
- 3.1.2. Install blank-off panels between coils and plenums to ensure no air by-pass occurs.
- 3.1.3. Install stainless steel drain pan below each cooling coil.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

- 1.2.1. Shop Drawings: Submit Shop Drawings of convector radiators, including unit capacities, sizes, piping, connections, and construction details. Shop Drawing shall clearly show the amount of expansion on each section, and method of control.
- 1.2.2. Mock-up: Install in one 900 mm (3 ft, 0 in.) length of convector radiator unit with enclosures, piping, valves, and other incidentals completely piped up for Engineer's Representative's review.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Radiators shown as Type 'A' shall be RUNTAL model R2F-1, 263BTUH/FT.
- 2.1.2. Radiators shall have capacity shown when supplied with water entering at 71.1 deg. C. (160 deg. F.) leaving at 60 deg. C. (140deg. F.) and with air entering at 21.1 deg. C. (70 deg. F.).
- 2.1.3. Provide steel double panel radiators of the lengths and in locations as indicated, and of capacities and lengths as shown on the Drawings.
- 2.1.4. The double heating panel radiation shall be of one-piece all-welded steel construction, consisting of a pair of flattened water tube panels welded to headers at each end. Welded to the inside of each panel shall be steel corrugated fins to increase the convective output of the radiator. The fins shall start at no less than 75 mm (3 in.) from the end of the radiator, and shall have no less than 32 fins per foot. The radiators shall include an integral heavy gauge (2.28 mm = 0.09 in. minimum) all-welded perforated top grille, which will cover the top of all of the finned areas.
- 2.1.5. The headers shall include all necessary inlet, outlet and vent connections as required. Standard connection sizes are 12 mm (½ in.) NPT tapered thread for supply and return piping, and 3.175 mm (1/8 in.) for the vent connection. Internal baffling is provided where required for proper water flow.
- 2.1.6. The panel radiation shall be capable of being mounted to typical stud wall construction without additional blocking or strapping. Appropriate wall mounting brackets shall be provided with the radiation.
- 2.1.7. Pressure ratings for the radiation shall be MEDIUM working pressure of maximum 586 kPa (85 psig) and maximum test pressure of 758 kPa (110 psig).
- 2.1.8. Panel radiation expansion shall not exceed 1/64 inch per foot of radiation at 215°F. The installer shall provide adequate expansion compensation for each radiator.
- 2.1.9. Panel radiation shall be cleaned and phosphatized in preparation for the powder coat finish. The radiation is then finish painted with a gloss powder coat finish, for a total paint thickness of 2-3 mils (0.002" - 0.003"). The color shall be "Runtal White".
- 2.1.10. Ribbed pipe cover trims, finished to match the radiators shall be provided with the radiation.
- 2.1.11. Runtal-Flex connectors shall be used where appropriate to provide expansion compensation for the radiators.
- 2.1.12. Type B convector radiators shall be Dunham-Bush, Engineered Air, Sigma, Rittling, or Sterling.
- 2.1.13. Convector radiators shall be complete with:

- 2.1.13.1. Convector elements consisting of copper tubes, aluminum fins and steel or cast iron headers, suitable for 1035 kPa (150 psi) working pressure.
- 2.1.13.2. Steel supports for element.
- 2.1.13.3. Plenum case shown painted matt black complete with supply air grille steel covering convector element, valves and fittings and complete with access doors or openings to valves.
- 2.1.13.4. Keeney type manually operated air vents with 6 mm (1/4 in.) O.D. copper tubing connected to air chamber, accessible without removing enclosure and mounted on end panel or on front panel of recessed convector radiator.
- 2.1.14. Convector radiators shall be sizes shown on Drawings.
- 2.1.15. Convector radiators shall be code rated for the capacity shown when supplied with water entering at 82.2 deg. C. (180 deg. F.) leaving at 71.1 deg. C. (160 deg. F.) and with air entering at 18.3 deg. C. (65 deg. F.).

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

| EQUIPMENT NO. | | | RHC-3.1 | | RHC-3.2 | | RHC-3.3 | |
|-------------------------------|--------|-------|------------------|---------|------------------|---------|------------------|---------|
| Location | | | 3rd Floor | | 3rd Floor | | 3rd Floor | |
| Airflow Rate | cfm | L/s | 180 | 85 | 212 | 100 | 422 | 199 |
| Number of Coils | | | 1 | | 1 | | 1 | |
| Width | In | mm | 12 | 305 | 11 | 279 | 20 | 508 |
| Height | In | mm | 9 | 229 | 9 | 229 | 9 | 229 |
| Area | ft² | m² | 0.8 | 0 | 0.7 | 0 | 1.0 | 0 |
| Face velocity | fpm | m/s | 240 | 1 | 308 | 2 | 338 | 2 |
| Type | | | | | | | | |
| Minimum Rows | | | 2 | | 2 | | 2 | |
| Fins per inch | | | 13 | | 11 | | 14 | |
| Series | | | Daikin 5BS1302C | | Daikin 5BS1102C | | Daikin 5BS1402C | |
| AIR SIDE | | | | | | | | |
| Entering Air Temperature (db) | °F | °C | 55.0 | 12.8 | 55.0 | 12.8 | 55.0 | 12.8 |
| Leaving Air Temperature (db) | °F | °C | 75.3 | 24.1 | 75.5 | 24.2 | 75.1 | 23.9 |
| Air Pressure Drop | In H2O | KPa | 0.1 | 0.03 | 0.2 | 0.04 | 0.2 | 0.05 |
| FLUID SIDE | | | | | | | | |
| Fluid | | | Prop. Glycol 50% | | Prop. Glycol 50% | | Prop. Glycol 50% | |
| Fluid Flow Rate | USgpm | L/min | 1.0 | 3.8 | 1.0 | 3.8 | 2.1 | 7.9 |
| Entering Fluid Temperature | °F | °C | 100.0 | 37.8 | 100.0 | 37.8 | 100.0 | 37.8 |
| Leaving Fluid Temperature | °F | °C | 91.0 | 32.8 | 89.3 | 31.8 | 90.1 | 32.3 |
| Fluid Pressure Drop | ft H2O | kPa | 1.3 | 4 | 3.0 | 9 | 5.9 | 18 |
| MINIMUM CAPACITY | | | | | | | | |
| Total | MBH | kW | 4004.0 | 1,173.2 | 4742.0 | 1,389.4 | 9260.0 | 2,713.2 |
| Turbulators | Yes/No | | | | | | | |
| REMARKS | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

| EQUIPMENT NO. | | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 12 | |
|-----------------------|-----------|----------|--------------------------------|-----|--------------------------------|-----|--------------------------------|-----|--------------------------------|-----|--------------------------------|-----|--------------------------------|-----|--------------------------------|-----|--------------------------------|-----|
| Make | | | E.H.Price | | E.H.Price | | E.H.Price | | E.H.Price | | E.H.Price | | E.H.Price | | E.H.Price | | E.H.Price | |
| Model | | | SDVQ | | SDVQ | | SDVQ | | SDVQ | | SDVQ | | SDVQ | | SDVQ | | SDVQ | |
| Inlet Size (Diameter) | In | mm | 4 | 102 | 5 | 127 | 6 | 152 | 7 | 178 | 8 | 203 | 9 | 229 | 10 | 254 | 12 | 305 |
| Maximum Airflow | cfm | L/s | 200 | 94 | 300 | 142 | 400 | 189 | 550 | 260 | 700 | 330 | 950 | 448 | 1,150 | 543 | 1,700 | 802 |
| Minimum Airflow | cfm | L/s | 26 | 12 | 42 | 20 | 62 | 29 | 85 | 40 | 110 | 52 | 140 | 66 | 180 | 85 | 270 | 127 |
| Fan Airflow | cfm | L/s | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- |
| Fan Motor | hp | kW | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- |
| Air Pressure Drop | In H2O | Pa | 0.01 | 2 | 0.01 | 2 | 0.16 | 40 | 0.07 | 17 | 0.01 | 2 | 0.01 | 2 | 0.01 | 2 | 0.01 | 2 |
| SOUND DATA | | | | | | | | | | | | | | | | | | |
| Inlet Static Pressure | In H2O | Pa | 1.50 | 373 | 1.50 | 373 | 1.50 | 373 | 1.50 | 373 | 1.50 | 373 | 1.50 | 373 | 1.50 | 373 | 1.50 | 373 |
| 2nd Band | Discharge | Radiated | 61 | 54 | 63 | 57 | 64 | 58 | 64 | 62 | 65 | 61 | 68 | 60 | 67 | 61 | 71 | 62 |
| 3rd Band | Discharge | Radiated | 61 | 50 | 61 | 50 | 64 | 51 | 66 | 53 | 66 | 53 | 68 | 53 | 66 | 55 | 68 | 56 |
| 4th Band | Discharge | Radiated | 56 | 45 | 56 | 46 | 58 | 47 | 61 | 47 | 60 | 47 | 61 | 48 | 60 | 49 | 66 | 51 |
| Outlet Width | In | mm | 12.0 | 305 | 12.0 | 305 | 12.0 | 305 | 12.0 | 305 | 12.0 | 305 | 14.0 | 356 | 14.0 | 356 | 16.0 | 406 |
| Outlet Height | In | mm | 8.0 | 203 | 8.0 | 203 | 8.0 | 203 | 10.0 | 254 | 10.0 | 254 | 12.5 | 318 | 12.5 | 318 | 15.0 | 381 |
| Return Width | In | mm | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- |
| Return Height | In | mm | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- |
| Remarks | | | Includes discharge silencer | | Includes discharge silencer | | Includes discharge silencer | | Includes discharge silencer | | Includes discharge silencer | | Includes discharge silencer | | Includes discharge silencer | | Includes discharge silencer | |

| EQUIPMENT NO. | | | A/C-1.1 | | A/C-2.1 | | A/C-2.2 | | A/C-3.1 | | A/C-3.2 | |
|-----------------------|--------|-----|------------------------|--------|------------------------|--------|------------------------|--------|----------------------|--------|----------------------|--------|
| | | | | | | | | | | | | |
| Make | | | Daikin | | Daikin | | Daikin | | Daikin | | Daikin | |
| Model | | | FTQ30TAVJU | | FTQ30TAVJU | | FTQ18TAVJU | | FTQ18TAVJU | | FTQ18TAVJU | |
| Location | | | 1st Storey - IT closet | | 2nd Storey - IT Closet | | 2nd Storey - IT Closet | | 3rd Storey - IT Room | | 3rd Storey - IT Room | |
| | | | | | | | | | | | | |
| Maximum Air Flow Rate | cfm | L/s | 1000.0 | 472 | 1000.0 | 472 | 600.0 | 283 | 600.0 | 283 | 600.0 | 283 |
| Air Pressure Drop | In H2O | Pa | 0.90 | 223.8 | 0.90 | 223.8 | 0.90 | 223.8 | 0.90 | 223.8 | 0.90 | 223.8 |
| | | | | | | | | | | | | |
| COOLING CAPACITY | MBH | kW | 30,000.0 | 8790.0 | 30,000.0 | 8790.0 | 18,000.0 | 5274.0 | 18,000.0 | 5274.0 | 18,000.0 | 5274.0 |
| | | | | | | | | | | | | |
| REMARKS | | | Indoor Unit | | Indoor Unit | | Indoor Unit | | Indoor Unit | | Indoor Unit | |
| | | | | | | | | | | | | |
| EQUIPMENT NO. | | | C/U-R.1 | | C/U-R.2 | | C/U-R.3 | | C/U-R.4 | | C/U-R.5 | |
| | | | | | | | | | | | | |
| Make | | | Daikin | | Daikin | | Daikin | | Daikin | | Daikin | |
| Model | | | RZR30TAVJUA | | RZR30TAVJUA | | RZR18TAVJUA | | RZR18TAVJUA | | RZR18TAVJUA | |
| Location | | | Roof | | Roof | | Roof | | Roof | | Roof | |
| COOLING CAPACITY | MBH | kW | 30,000.0 | 8790.0 | 30,000.0 | 8790.0 | 18,000.0 | 5274.0 | 18,000.0 | 5274.0 | 18,000.0 | 5274.0 |
| Refrigerant | | | R-410A | | R-410A | | R-410A | | R-410A | | R-410A | |
| | | | | | | | | | | | | |
| Unit weight | lbs | | 115 | | 115 | | 115 | | 115 | | 115 | |
| | | | | | | | | | | | | |
| Electrical Data | | | | | | | | | | | | |
| MCA | A | | 4.9 | | 4.9 | | 4.9 | | 4.9 | | 4.9 | |
| MOP | A | | 15 | | 15 | | 15 | | 15 | | 15 | |
| Volts/Phase/Cycle | | | 208/60/1 | | 208/60/1 | | 208/60/1 | | 208/60/1 | | 208/60/1 | |
| | | | | | | | | | | | | |
| REMARKS | | | Outdoor Unit | | Outdoor Unit | | Outdoor Unit | | Outdoor Unit | | Outdoor Unit | |
| | | | | | | | | | | | | |

| EQUIPMENT NO. | | | KEU-1.1 | |
|--------------------------|---------------------|-----|------------------------|------|
| | | | | |
| System | | | Kitchen Ecology Unit | |
| Location | | | Ground Floor - Storage | |
| Service | | | Kitchen | |
| | | | | |
| | | | | |
| Airflow Rate | cfm | L/s | 1,907 | 900 |
| External Static Pressure | In H ₂ O | Pa | 1.0 | 249 |
| Motor | hp | kW | 10.00 | 7.46 |
| Power | hp | kW | 6.30 | 4.70 |
| | | | | |
| Electrical | | | 480/3/60 | |
| Full Load Amps | A | | 7.2 | |
| | | | | |
| Make | | | Halton | |
| Model | | | RAH 1.0 RH | |
| Blower Model | | | EBM 355 | |
| Unit Weight | lbs | | 1194 | |
| | | | | |
| Remarks | | | | |
| | | | | |
| | | | | |
| | | | | |

| EQUIPMENT NO. | | | EF-R.1 | | EF-R.2 | |
|--------------------------|--------|-----|-----------|-----|---------------|-----|
| | | | | | | |
| System | | | Exhaust | | Exhaust | |
| Location | | | Roof | | Roof | |
| Service | | | 3rd Floor | | Basement - L3 | |
| | | | | | | |
| | | | | | | |
| Airflow Rate | cfm | L/s | 254 | 120 | 1,100 | 519 |
| External Static Pressure | In H2O | Pa | 3.0 | 746 | 2.0 | 497 |
| Brake | hp | kW | | -- | | -- |
| | | | | | | |
| Electrical | | | 120/1/60 | | 120/1/60 | |
| | | | | | | |
| Make | | | Greenheck | | Greenheck | |
| Model | | | CSP-A390 | | G-140-VG | |
| Type | | | Exhaust | | Exhaust | |
| | | | | | | |
| Remarks | | | - | | - | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 03 – AS-BUILT DRAWINGS.
- 1.1.3. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.4. Section 26 08 00 – COMMISSIONING.
- 1.1.5. Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. REQUIREMENTS FOR MANUALS

- 3.1.1. A minimum of three copies of complete and approved operating and maintenance instructions for all electrical equipment and systems shall be supplied before substantial completion. Provide additional copies if required under the General Requirements. In addition to the three copies of manuals, the contractor to provide a manual in a searchable PDF format on USB stick or sent via electronic transfer. As-Built Drawings to be included on the USB stick or sent via electronic transfer.
- 3.1.2. The contractor to identify the cost of AS-BUILT DRAWINGS and the Operation and Maintenance Manuals as a separate line item on their progress draw. The values to be broken out can be found in Section 26 05 03 – AS-BUILT DRAWINGS. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received and reviewed without comments.
- 3.1.3. Binders shall be three-ring, hard-cover, loose-leaf type and identified on the binding edges as “Maintenance Instructions and Data Book”, for “UofT - Health & Wellness at Koffler.”
- 3.1.4. Terminology used in all the sections shall be consistent.
- 3.1.5. Volume One shall contain the master index of all systems, the name of the Contractor, Electrical Subcontractors and the date of substantial performance for the Contract.
- 3.1.6. Volume One shall contain a section with all necessary warranty information.
- 3.1.7. Each binder shall have a complete index for all volumes.
- 3.1.8. Each binder shall be no more than half filled.
- 3.1.9. There shall be a separate section for all materials used on the project which fall under the WHMIS legislation. There shall be Material Safety Data Sheet (MSDS), hazard data sheet, for each of the materials.
- 3.1.10. There shall be a separate section for all Insurance Certificates, Test Certificates, Verification Forms and Test Forms.
- 3.1.11. All relevant information relating to a system or product shall be contained within one binder.
- 3.1.12. The manual sections shall follow the specification sections.

- 3.1.13. Any diagrams, installation drawings, single line diagrams charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved they shall be carefully folded and contained within a clear plastic wallet within the manual.

3.2. DATA FOR MANUALS

- 3.2.1. Equipment data shall contain:
- 3.2.1.1. Operating instructions.
 - 3.2.1.2. Operating conditions such as temperature and pressure.
 - 3.2.1.3. Location of equipment.
 - 3.2.1.4. Maintenance instructions and schedules for one-year routine.
 - 3.2.1.5. Recommended list of spare parts.
 - 3.2.1.6. Maintenance schedule.
 - 3.2.1.7. A trouble shooting table showing where to look for problems under various conditions of malfunction.
 - 3.2.1.8. All wiring diagrams.
 - 3.2.1.9. Equipment operating curves.
 - 3.2.1.10. Equipment nameplate data and serial numbers.
- 3.2.2. System data shall contain:
- 3.2.2.1. A listing of all systems.
 - 3.2.2.2. All panel, mcc and fire alarm schedules and locations.
 - 3.2.2.3. Equipment name tags.
 - 3.2.2.4. Cleaning, maintaining and preserving instructions for all material, products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.
- 3.2.3. Sub-Contractor manuals are required for:
- 3.2.3.1. Switchboards and power distribution systems.
 - 3.2.3.2. Lighting systems.
 - 3.2.3.3. Emergency power systems.
 - 3.2.3.4. Fire alarm systems.
- 3.2.4. As-Built documentation shall contain:
- 3.2.4.1. Reviewed As-Built Shop Drawings.
 - 3.2.4.2. As-Built Construction Drawings.
 - 3.2.4.3. Originals of test forms.
 - 3.2.4.4. Originals of test certificates.
 - 3.2.4.5. Cyber Security Report Letter and backup schedule as required by Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.3. OPERATING INSTRUCTIONS

- 3.3.1. Instruct the Owner's representative in all aspects of the operation and maintenance of systems and equipment.

- 3.3.2. Where commissioning is a requirement of the project, the Contractor shall comply with all requirements of Section 26 08 00 – COMMISSIONING, for duration of tests.
- 3.3.3. Instruct the Owner for a minimum of five (5) working days.
- 3.3.4. All instruction sessions to be video-taped and copy must be provided to the Engineer's Representative/owner.
- 3.3.5. Arrange for and pay for the services of engineers and other manufacturers' representatives required for instruction on the systems and the equipment as requested by the Engineer's Representative and/or the Owner.
- 3.3.6. At the time of final review, provide a sheet for each system and piece of equipment showing the date instructions were given. Each sheet shall show the duration of instruction, name of persons receiving instruction, other persons present (manufacturer's representative, Engineer's Representative, etc.), system or equipment involved and signature of the Owner's staff stating that they understood the system installation, operating and maintenance requirements. This information shall be inserted in the manuals after all instructions have been completed.
- 3.3.7. Review information with the Owner's representative to ensure that all information required has been provided.
- 3.3.8. Electrical equipment and systems included in the instruction requirements, include but not limited to the following:
 - 3.3.8.1. Switchboards and related power distribution equipment.
 - 3.3.8.2. Emergency generator.
 - 3.3.8.3. Automatic transfer switches.
 - 3.3.8.4. Fire alarm systems.

3.4. TRIAL USAGE

- 3.4.1. The Owner shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties nor be construed as acceptance, and no claim for damage shall be made against the Owner for any damage or breakage to any part or parts due to the tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or workpersonship of any kind.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.

1.2. DESCRIPTION OF SECTION

- 1.2.1. The specification is divided into sections of work and a section may consist of the work of more than one subcontractor. The responsibility as to which electrical subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Electrical Contractor.

1.3. SECTIONS AFFECTED

- 1.3.1. These instructions apply to and form a part of all electrical sections.

1.4. SCOPE

- 1.4.1. Provide all labour, materials, equipment and services to complete the work of the electrical division as further specified and as shown on the drawings.
- 1.4.2. Should any discrepancy appear between any parts of the specifications and/or the drawings to cause doubt as to the true meaning and intent of the drawings and specifications, a ruling shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the following will be assumed:
- 1.4.2.1. Where a discrepancy occurs between the specification and the drawings, the more expensive/onerous alternative will be deemed as included in the contract.
- 1.4.2.2. Where a discrepancy occurs in the drawings the more expensive/onerous alternative will be deemed as included in the contract.
- 1.4.2.3. Where a discrepancy occurs in the specifications the more expensive/onerous alternative will be deemed as included in the contract.
- 1.4.3. For any equipment/device where circuit numbers and/or panel designation labels are missing and not indicated on the drawings or specifications, a clarification shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the Contractor shall power the equipment/device from the respective 120 V/208 V or 600 V electrical panel serving the equipment in that area at no additional cost to the Owner.

1.5. REGULATIONS

- 1.5.1. All work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of all authorities having jurisdiction except where the requirements of the drawings and specifications exceed the codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.
- 1.5.2. These specifications are supplementary to the requirements above.
- 1.5.3. Comply with all guidelines and standards issued by the authorities having jurisdiction.
- 1.5.4. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the contractor shall notify the Engineer's Representative.

1.6. PERMITS, FEES, AND REVIEWS

- 1.6.1. Make submissions to obtain all permits. Include for and pay for all fees and arrange for all reviews required for the work of this division.
- 1.6.2. If required by code, plans and specifications have been previously submitted to the Authority Having Jurisdiction.
- 1.6.3. Furnish certificates of Acceptance from the Authority Having Jurisdiction and include them in the Operation and Maintenance manual.

1.7. VOLTAGE RATINGS

- 1.7.1. Operating voltages are as specified in CAN3-C235 (latest edition).
- 1.7.2. Motors, electric heating, control and distribution devices and equipment are to operate satisfactorily at 60 Hz within operating limits established by the above standard.

1.8. COORDINATION WITH MECHANICAL DIVISIONS.

- 1.8.1. Unless indicated otherwise on the Electrical Drawings, Electrical Contractor will be responsible for the supply and installation of the following:
 - 1.8.1.1. Starters.
 - 1.8.1.2. Line and load side wiring for starters.
 - 1.8.1.3. Reduced voltage starters including "Soft Start" starters.
 - 1.8.1.4. Line and load side wiring to variable speed drives, including but not limited to wiring of associated harmonic filters, AC line input reactors, dV/dT filters, and output filters.
 - 1.8.1.4.1. Where harmonic filter is complete with a capacitor switching system, route a harmonic filter output conductor through the current transformer window within the harmonic filter. Coordinate with Mechanical Contractor and follow harmonic filter manufacturer's written instructions.
 - 1.8.1.5. Disconnect switches for all mechanical equipment.
 - 1.8.1.6. All power wiring (120 V & above) to all mechanical equipment.
 - 1.8.1.7. Electrical ramp heating cables and controls.
 - 1.8.1.8. All motorized damper power connections (120 V & above).
 - 1.8.1.9. Fire alarm devices.
 - 1.8.1.10. Wiring to electric space heaters.
- 1.8.2. Mechanical Divisions will be responsible for the supply and installation of the following:
 - 1.8.2.1. All variable speed drives and control wiring to starters.
 - 1.8.2.2. Pipe tracing and related controls.
 - 1.8.2.3. Electric hot water heaters.
 - 1.8.2.4. All electrical heaters including baseboard heaters, cabinet heaters, force flow heaters and radiant heaters.
 - 1.8.2.5. All interposing relays, relays, contactors and 120 V control devices.
 - 1.8.2.6. All 120 V and low voltage control wiring and conduits.

- 1.8.3. Determine exact location of starters, motors and line voltage controls based on the Mechanical Drawings to coordinate with the locations of all equipment to ensure the required clearances are maintained. If no wall location is suitable for the motor starters, then mount the starters on a plywood backboard on Unistrut supports near the respective equipment to meet the applicable code requirements for motor isolation switches. If a motor or piece of equipment is listed on one of the starter schedules but is not shown on the floor plans, the contractor is to reference the Mechanical Drawings for the location of the respective piece of equipment. No additional costs will be entertained.
- 1.8.4. Should the Mechanical Contractor change any of the motor or equipment sizes from those identified on the Mechanical Schedules and Drawings at any stage of the project to aide their installation, the Mechanical Contractor will incur all extra electrical costs to revise the electrical feeders/wiring, breakers, fuses, starters and equipment to supply power to the revised piece of equipment.
- 1.8.5. Should the Mechanical Contractor provide alternates to any mechanical equipment selection by deviating from the make and model identified on the Mechanical Schedules and Drawings, the Mechanical Contractor will incur all extra costs to revise the electrical provisions including but not limited to feeders/wiring, breakers, fuses, starters and equipment to supply power to the alternate piece of equipment.
- 1.8.6. Where power for any flush valves, hands-free faucets, or other powered plumbing fixtures are shown on the Drawings, provide either a hard wired direct connection or a duplex receptacle, as required for the valve/faucet/fixture in question, based on coordination with the Mechanical Contractor.

1.9. PLYWOOD BACKBOARDS, EQUIPMENT MOUNTING, & HOUSEKEEPING PADS

- 1.9.1. Provide fire rated plywood backboards as shown on the drawings and mount where all communication equipment is to be wall mounted. Plywood is to be 21 mm, urea-formaldehyde (UF) free and shall be either, Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or CSA Z809 - (latest edition) certified. Plywood to be either fire rated with the appropriate label displayed once installed or coated with fire retardant paint. Do not paint over plywood fire rating certification stamp. All Certification not to be painted.
- 1.9.2. For clause above, submit documentation as a shop drawing for review by the LEED Representative prior to ordering.
- 1.9.3. Surface mounted electrical equipment boxes are to be installed on galvanized Unistrut stand-offs. Electrical equipment boxes shall include, but not be limited to electrical panels, LV lighting control, fire alarm, security, communication, electrical sub-metering, etc. Panels are to be grouped on common base wherever practical.
- 1.9.4. Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment and where noted on the drawings. All housekeeping pads to be a minimum of 100 mm high above finished floor and shall not extend beyond 50mm beyond the electrical equipment unless shown otherwise on the drawings.

1.10. FINISHES

- 1.10.1. Metal enclosure surfaces are to be finished by the application of rust resistant primer on both the inside and outside, with at least two coats of enamel.
- 1.10.2. Clean and touch up all surfaces of equipment scratched or marred during shipment or installation. Match the original paint.
- 1.10.3. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

- 1.10.4. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.

1.11. SAFETY

- 1.11.1. Protect exposed live equipment during construction for personnel safety.
- 1.11.2. Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- 1.11.3. Arrange for the installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.

1.12. FIRE STOPS

- 1.12.1. Provide fire stops in accordance with front end, and Division 1 documents and as described herein. Contractor to coordinate fire stops with General Contractor.
- 1.12.2. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.
- 1.12.3. Fire stops and smoke seal systems: in accordance with CAN/ULC-S115 (latest edition).
- 1.12.3.1. Asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 (latest edition) and not to exceed opening sizes for which they are intended.
- 1.12.3.2. Fire stop system rating for service penetrations: to suit the latest edition of the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
- 1.12.3.3. Fire stop system rating for sealing junction of rated walls to rated floors and ceilings: to suit the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
- 1.12.4. Service penetration assemblies: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.
- 1.12.5. Service penetration fire stop components: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.
- 1.12.6. Fire resistance rating of installed fire stop assembly not less than the fire resistance rating of surrounding floor and wall assembly, and in accordance with the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
- 1.12.7. Fire stops and smoke seals at openings intended for ease of re-entry, such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
- 1.12.8. Fire stops and smoke seal all electrical penetrations through rated assemblies as per ULC Standards.
- 1.12.9. Where sound and vibration control is required, use an elastomeric seal; do not use a cementitious or rigid seal at such locations.
- 1.12.10. Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- 1.12.11. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

- 1.12.12. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- 1.12.13. Sealants for vertical joints: non-sagging.
- 1.12.14. Colour: if range available to Engineer's Representative's choice of standard colours, generally to match background colour where visible in finished spaces.
- 1.12.15. Through non-fire or non-smoke separations or where waterproof membrane is field applied, where pipes are insulated, sleeves shall be sized to accommodate the insulation and vapour barrier.
- 1.12.16. Where-holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.
- 1.12.17. Submit a complete fire stop system shop drawing package, identifying the products that may be used on the project. Prior to submitting data, review with Authority having Jurisdiction to confirm acceptability of proposed materials and assemblies.
- 1.12.18. Installation
- 1.12.18.1. Install fire stops and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- 1.12.18.2. Seal-holes or voids made by through penetrations, poke through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- 1.12.18.3. Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- 1.12.18.4. Tool or trowel exposed surfaces to a neat finish.
- 1.12.18.5. Remove excess compound promptly as work progresses and upon completion.

1.13. ACOUSTIC TREATMENT

- 1.13.1. Electrical Contractor will be responsible for coordinating the electrical installation with the recommendations of the acoustic consultant and their report where one has been included in the contract documents.
- 1.13.2. Refer to the recommendations of the acoustic report where provided, and provide and install acoustic treatments as necessary. This may include separation of receptacles in stud bays, sealing of junction boxes, application of sound insulating materials etc. Coordinate the installation of these materials with the General Contractor and Drywall/Partition Subtrade.
- 1.13.3. Do not install back to back receptacles/back boxes within the same stud bay wherever possible. Where it is not possible to stagger receptacles, provide acoustic seal around receptacle/back box to provide acoustic isolation/separation of spaces.

1.14. HOISTING

- 1.14.1. Electrical Contractor will be responsible for the hoisting of all the equipment in the contract. Contractor to coordinate with General Contractor for use of the general hoisting facilities. If hoist facilities are inadequate, then subcontractors must provide their own. Subcontractors must inform general contractors in writing of requirements before tender closing date. Any hoisting required in addition to that provided by the General, will be included in the bid price.
- 1.14.2. Electrical Contractor to include for the qualified millwrights to move and place all equipment over 1000 lbs. Contractor to provide proof of millwright certification.

1.15. CLEANING AND WASTE REMOVAL

- 1.15.1. Clean all electrical equipment that has been exposed to construction dust and dirt.
- 1.15.2. Contractor to clean all electrical equipment, inside and out, prior to turn over to Owner. Equipment is subject to review by Engineer's Representative and/or Owner.
- 1.15.3. Contractor is responsible to remove their own waste from the site. All re-usable materials shall be recycled.

1.16. SPRINKLERS

- 1.16.1. All electrical equipment shall be suitable for installation in a sprinklered environment and enclosures are to be CSA Type 1 with drip hood, sprinkler proof enclosure unless otherwise noted.

1.17. TEMPORARY LIGHT AND POWER

- 1.17.1. Temporary light and power for construction shall be provided, metered, and maintained by the electrical trade, as directed by the General Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their work.
- 1.17.2. All temporary light to be fluorescent or LED. Provide adequate lighting to meet all health and safety standards.

1.18. EXAMINATION AND PROTECTION OF SITE

- 1.18.1. Before submitting Bid, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.
- 1.18.2. Contractor to document any existing conditions on site and submit a pre-condition survey including pictures. Contractor will be responsible to return the site back to its original form, which includes but is not limited to ground repair including grading and new sod and repair of damaged walls, doors and/or floors.
- 1.18.3. Contractor is to protect trees and plants on site and on adjacent properties. Plants to be protect with burlap. Trees and roots within construction area to be protected by the erection of temporary 2 m high plywood hoarding at the drip line of the tree. Contractor to avoid unnecessary traffic, dumping and storage of materials at or near trees or plants.
- 1.18.4. When requested by the Owner and/or Engineer's Representative, the Contractor is to provide digital pictures of the site, including but not limited to progress of work and installed equipment, via e-mail to the Owner and/or Engineer's Representative.

1.19. DRAWINGS AND INSTALLATION

- 1.19.1. The drawings are intended to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.
- 1.19.2. The location, arrangement and connection of equipment and materials shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Owner.
- 1.19.3. Certain details indicated on the drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the drawings.

- 1.19.4. The actual location of switches, outlets and luminaires, etc. shall be reviewed by the Engineer's Representative before installation.
- 1.19.5. The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.
- 1.19.6. Changes and modifications necessary to ensure co-ordination and avoid interference and conflicts with other trades or to accommodate existing conditions, shall be made at no extra cost to the Owner.
- 1.19.7. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.
- 1.19.8. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.19.9. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Engineer's Representative before proceeding with the work.
- 1.19.10. Contractor is to review Architect's specifications, drawings and details to confirm locations of devices and equipment.
- 1.19.11. This Contractor is responsible to mark-out his work, fully coordinated with all other trades, in sufficient time for review by Architectural Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by Architectural Consultant. Do not proceed with any work until the Architectural Consultant has reviewed the layout drawings.
- 1.19.12. The Contractor will reimburse the Engineer's Representative for their time spent on answering any written questions or requests for information where the answer is clearly identified on the drawings or in the specifications.

1.20. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

- 1.20.1. The Contractor is to complete installation, interference and setting drawings, dimensioned and to scale for all systems. They shall be made available for review by the Engineer's Representative, if requested. The drawings are required to make clear the work intended or to show its relation to adjacent work or to the work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, drawings of the area involved shall be prepared by this division.
- 1.20.2. Slab layout drawings are to be submitted for review by the Structural Engineer's Representative. These slab layout drawings are to be included in the as-built drawings. Refer to Section 26 05 03 – AS-BUILT DRAWINGS.
- 1.20.3. Interference drawings are required for shafts, ceiling spaces, basement areas, typical floors and wherever there is possible conflict in the positioning of electrical equipment, piping, ductwork sub-trades or architectural features.
- 1.20.4. This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for conduit, bus ducts and equipment for review by the Structural Engineer and Architect. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.

1.21. SUPPLEMENTARY BID FORM AND SUBMISSIONS OF BID

- 1.21.1. Submit with tender, if included in the documents, a complete Electrical Supplementary Bid Form. Tenders not completed in full may, at the discretion of the Owner be rejected.

- 1.21.2. Several alternative, separate and itemized prices may have been requested. These shall be completed on the Electrical Supplementary Bid Form. Refer to the specific sections of the specifications and to the drawings for details.
- 1.22. Approved Manufacturers**
- 1.22.1. Where only one name appears in the specification, the bid shall include for the specified equipment.
- 1.22.2. Where two or more names are shown in the specifications as alternates or equal to, this division can select which manufacturer is to be carried.
- 1.22.3. The Contractor is to list substitute equipment as a price deduction to the Bid Price on the Electrical Supplementary Bid Form. Space has been provided to show manufacturers not specifically mentioned. Acceptance of substitute equipment shall be at the discretion of the Owner and/or Engineer's Representative. Any substitutes not listed on the Electrical Supplementary Bid Form will not be entertained.
- 1.22.3.1. The proposed substitution shall show product name and complete description and also what difference, if any, will be made in the amount of the Bid Price for each substitution, should it be accepted.
- 1.22.3.2. Materials and products specified by the name of the manufacturer, the brand or trade name, or catalogue reference, shall be the basis of the Bid Price.
- 1.22.3.3. Any alternate and/or substitute equipment listed shall be equal in performance and quality to that specified. If space, power, structural or any other requirements are different from the equipment specified, the cost of any changes shall be included for in the price shown on the Electrical Supplementary Bid Form.
- 1.22.3.4. The Owner reserves the right to accept or reject any substitution without question.
- 1.22.3.5. The "Base and Alternate Equipment" is for North American manufactured products. Where a listed manufacturer can offer either North American or non-North American source for the equipment, the country of origin shall be shown under "Substitute Equipment" and the cost savings shown under "Deduct from Tender Price".
- 1.23. PRODUCTS AND MATERIALS**
- 1.23.1. Make and quality of materials used in the construction of this project shall be subject to the approval of the Engineer's Representative.
- 1.23.2. All equipment and material are to be CSA certified or approved by an accredited organization. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authorities.
- 1.23.3. Factory assemble control panels and component assemblies.
- 1.23.4. Materials and equipment supplied by this division shall be new and free from defects and shall be equivalent in physical characteristics and performance to that specified by the manufacturer's name and catalogue reference.
- 1.23.5. Where a certain manufacturer's equipment has been specified by name or model number, the contractor shall be responsible for ensuring that the performance and quality meets the specified equipment and that the same access or maintenance space is available for an alternative manufacturer's equipment that is used and that interfacing connections with other trades can be made at no extra cost.
- 1.23.6. Within 30days of the award of contract, the Contractor is to submit a complete list of the manufacturers for all equipment being supplied on the project.

- 1.23.7. Availability
- 1.23.7.1. In submitting Bid, Contractor warrants that all materials are available in suitable time to meet Contract dates.
- 1.23.7.2. Subject to sentence .3 below, where the Contractor advises that the Contractor cannot supply materials in suitable time to meet Contract dates, and should it subsequently appear that Work may be delayed for such reason, the Engineer's Representative reserves the right to substitute more readily available products of similar character, even if more costly to the Contractor, at no increase in Contract Price.
- 1.23.7.3. Where the Contractor can show that the Contractor promptly ordered the originally specified materials the Owner will pay the differential in cost between the originally specified material and the substitute material without any mark-ups applicable by the Contractor, subcontractors, sub-subcontractors or suppliers. For greater certainty, the Contractor's failure to submit shop drawings or other submittals or seek direction in those instances where the Contract Documents so require in sufficient time to permit ordering materials is not cause for the Owner to pay the cost differential in sentence .2 above.

1.24. CO-OPERATION WITH CONSULTANTS

- 1.24.1. To assist in the successful execution of the project, the Contractor shall receive a job report that summarizes the expectations of the Consultant and the Contractor. This document covers topics such as progress billings breakdowns, shop drawing requirements, change order pricing breakdowns, the commissioning process, installation drawings, the specifications, as-built drawings and O+M manuals, along with a number of other items. This job report is intended to reiterate and elaborate on key items of the Contract Documents and is not intended to impose new requirements.
- 1.24.2. At the appropriate time during construction the Contractor shall submit the applicable documentation listed in the "Mechanical/Electrical Unfinished Building Occupancy Checklist". The list shall be issued by the Consultant during the course of the project; however, a sample checklist can be provided at any time upon request. The checklist shall be completed by the Contractor when the information required for occupancy is submitted. The Consultant shall review the information and checklist and shall identify when the information is complete. The Consultant's general review letter (required for building occupancy) shall only be issued when all the information requested in the checklist is submitted by the Contractor and deemed to be complete by the Consultant.
- 1.24.3. For electrical systems occupancy, provide a PDF copy of the following documents to the Engineer's office for review:
- 1.24.3.1. Electrical inspection authority inspection certificate/report with no deficiencies.
- 1.24.3.2. Fire alarm verification report with no deficiencies.
- 1.24.3.3. CAN/ULC-S561 "Standard for Installation and Services for Fire Signal Receiving Centres and Systems" certificate.
- 1.24.3.4. Maglock test and verification report with no deficiencies.
- 1.24.3.5. CAN/ULC-S1001 "Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems" reports for electrical systems with no deficiencies.
- 1.24.3.6. Letter confirming that all emergency lighting and exit signs are installed and illuminated.
- 1.24.3.7. Letter confirming that all unit equipment for emergency lighting (batteries, heads, exit signs) are installed and powered and have been tested to demonstrate that they last for the run time indicated in the Specifications or on the Drawings.
- 1.24.3.8. Emergency generator testing and commissioning reports with no deficiencies.

- 1.24.3.9. Emergency generator TSSA inspection report with no deficiencies.
- 1.24.3.10. Fire pump testing and commissioning reports with no deficiencies.
- 1.24.3.11. Emergency power (inverter) testing report with no deficiencies.
- 1.24.3.12. Seismic Engineer's letter for seismic restraint system (if applicable).
- 1.24.3.13. Letter confirming that all openings in walls and floors for electrical services have been fire stopped.
- 1.24.3.14. Cyber Security Report Letter and backup schedule as required by Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.24.3.15. Additional items as indicated by the Engineer's Representative.
- 1.24.3.16. Additional items as indicated on the Occupancy of Unfinished Buildings Checklist issued by Engineer's Representative.

1.25. CO-OPERATION WITH OTHER DIVISIONS

- 1.25.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.
- 1.25.2. Electrical conduits shall not touch or be supported on pipe or duct walls.
- 1.25.3. Each section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other sections or divisions. Where the space allocated to another section or division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various sections and divisions. Relocation of materials and work involved shall be paid for by the section responsible for the encroachment at no extra cost to the Owner.
- 1.25.4. The supply of all items is to have built-in to the delivery schedule, ample time for rapid progress of work. Proceed with work determined by the construction schedule.
- 1.25.5. The Electrical Contractor shall coordinate the exact breaker/fuse sizes with all mechanical equipment shop drawings prior to rough-in and ordering of the electrical distribution equipment. Size of breakers/fuses shown on drawings are based on generic equipment manufacturers and sizes may change depending on successful equipment manufacturer. No additional costs shall be allowed for non-coordinated mechanical shop drawing reviews by the Electrical Contractor.

1.26. TEMPORARY USE OF EQUIPMENT

- 1.26.1. Where the electrical systems are operated during construction, the Electrical Contractor shall maintain the system and equipment in proper operating condition.
- 1.26.2. Before any area of the building is turned over to the Owner for acceptance and for beginning of the guarantee/warranty period, the systems and equipment shall be returned to the initial new condition.
- 1.26.3. Permanent electrical equipment is only to be used upon permission of Owner and Engineer's Representative and is only to be used on a limited basis. All equipment must be cleaned prior to turnover.

1.27. TESTING

- 1.27.1. General

Refer to the testing requirements outlined in each individual specification section and provide all required staffing, materials, tools and expertise to perform the required testing. Where specification Section 26 08 01 - TECHNICAL SERVICES DIVISION STARTUP SERVICE has been included, ensure all testing is performed accordingly by the Technical Services Division Startup Service trade.

1.27.1.1. This specification is intended to capture the requirements for factory testing, factory witness testing, site startups, site testing and training of electrical equipment. This specification represents a minimum requirement and does not absolve the equipment manufacturers from performing any tests required by the standards referenced in the individual specification sections.

1.27.1.2. The testing process for the Electrical Systems shall include:

1.27.1.2.1. Verification that the installation meets the requirements of the contract documents.

1.27.1.2.2. Verification that the system's performance meets the design intent.

1.27.1.2.3. Building operator training.

1.27.1.2.4. As-Built documentation, operating and maintenance manuals, and systems operating manuals.

The Contractor, Engineer's Representative, Technical Services Division Startup Service (where called for in the Specification) and Commissioning Agent (where identified as part of the project) shall provide the services to complete the process. See further explanation below defining the areas of responsibility.

1.27.1.3. Provide labour, equipment and material to conduct the testing process as outlined in this Section.

1.27.2. Factory testing

1.27.2.1. All equipment is to have factory testing performed by the equipment manufacturer. These tests are to include the manufacturers standard factory testing, and any required testing to conform to the standards, and any additional testing referenced in the individual specification sections.

1.27.2.2. The manufacturer is to perform the required testing and submit test reports recording the results of all tests to the Electrical Contractor for review and if found acceptable submit to Engineer's Representative for Shop Drawing review and the final copy included in the O&M Manuals. Test reports are to be submitted and reviewed by the Electrical Contractor and Engineer's Representative prior to shipment to site.

1.27.2.3. Any deficiencies noted in the factory testing are to be corrected prior to shipment of electrical equipment unless otherwise agreed to by the Electrical Contractor.

1.27.3. Factory Witness Testing

1.27.3.1. For all factory witness testing, the manufacturer is to act as the test leader and is responsible for all required organization, coordination, performance of testing and documentation of test results. The manufacturer is to ensure the tests being performed are in alignment with the requirements of the Specification in advance of the testing and provide hard copies of the latest Shop Drawings and test scripts for each attendee of the witness test. Any deviations to the tests being requested in the Specifications and Drawings must be communicated to the Electrical Contractor and Engineer's Representative in advance and must be accompanied with a rationale and/or an alternate test method that demonstrates that the intent of the specified test would be met.

1.27.3.2. Each factory witness test is to include at a minimum:

1.27.3.2.1. Introductions.

1.27.3.2.2. A walkthrough of the latest Shop Drawing and review of latest Shop Drawing commentary with discussion on any remaining open items.

1.27.3.2.3. A walkthrough of the test script.

1.27.3.2.4. A walkthrough of the Design Specifications and Drawings noting/reiterating any required deviations from the design documents in terms of testing requirements.

1.27.3.2.5. Performance of tests

1.27.3.2.6. At the conclusion of all factory witness tests, the manufacturer is to produce signed factory test results recording all noted results and documenting any remaining deficiencies. Report to include

record of the testing instruments used along with calibration dates (where required) and serial numbers.

1.27.3.3. Factory witness testing shall be attended by the persons as listed below, attendance at the witness testing is at the discretion of each representative and is to be confirmed by all parties prior to witness testing.

1.27.3.3.1. One (1) Electrical Contractor Representative

1.27.3.3.2. One (1) Engineer Representative

1.27.3.3.3. One (1) Commissioning Agent Representative

One (1) Technical Services Division Startup Service Representative

1.27.3.4. Manufacturers to include for the complete cost of the attendees listed above to attend the factory witness testing for the equipment. Cost to include but not limited to all travel, food and lodging costs. Manufacturer to note, attendees may be coming from different locations within Canada.

1.27.3.5. Manufacturer to provide factory witness test scripts to the Contractor as a formal Shop Drawing in advance of the factory witness test for review by the Contractor, Engineer and Commissioning Agent through the formal Shop Drawing review process. Factory witness test shall not be scheduled without a reviewed test script.

1.27.3.6. Manufacturer to notify the attendees minimum two (2) weeks prior to the date the tests are to be performed. Where travel out of province is required, provide minimum four (4) weeks notice.

1.27.3.7. Manufacturer to perform their own internal quality assurance and control check prior to any factory witness test such that the manufacturer is prepared to perform the complete demonstration of the equipment.

1.27.3.8. Any deficiencies noted in the factory testing is to be corrected prior to shipment of the electrical equipment.

1.27.4. Site Startup

1.27.4.1. Manufacturer to include for the costs of technician(s) to perform initial system startup on site as required by the Specifications and Electrical Contractor. Extent of technician(s) involvement to be coordinated with the needs of the Specifications and the Electrical Contractor.

1.27.5. Site tests

1.27.5.1. Manufacturer to include for the costs of technician(s) to perform site tests as required by the Specifications and Electrical Contractor. Refer to tests identified in the individual Specification sections and include all personnel and equipment to perform testing.

1.27.6. Materials

1.27.6.1. The Contractor and Manufacturer shall provide all instrumentation and equipment necessary to conduct the tests as specified in the specifications. The Contractor shall ensure the instrumentation to be used are properly and adequately calibrated and if required by the Engineer's Representative or Commissioning Agent to provide the dates the instrumentation was last calibrated.

1.28. TRAINING

1.28.1. The Manufacturer is to include for qualified technician(s) with project specific knowledge to perform in depth training for facility management team members.

1.28.2. Training may include up to ten (10) attendees and may be video recorded by others.

1.28.3. Training program to include:

- 1.28.3.1. One site 'in class' introduction session covering the basics of system operation.
- 1.28.3.1.1. Manufacturer to submit a course outline before training commences.
- 1.28.3.1.2. Manufacturer to provide course training documentation (if required) for attendees.
- 1.28.3.2. On site 'hands on' session covering the specific equipment design and operation details, including:
 - 1.28.3.2.1. All operating procedures including automatic and manual intervention procedures.
 - 1.28.3.2.2. All regular maintenance procedures.
 - 1.28.3.2.3. Troubleshooting procedures.
 - 1.28.3.2.4. Spare parts required.
- 1.28.4. Timing of training to be coordinated with Electrical Contractor and Owner/Facility Management staff and is to be provided in advance of systems supporting critical loads to allow for full ability to operate the systems. The Electrical Contractor/Manufacturer to notify the Owner/Facility Management team a minimum two (2) weeks prior to the date of training.

1.29. LIFE SAFETY INTEGRATION TESTING

- 1.29.1. Provide testing of the integration of all life safety and fire protection systems.
- 1.29.2. The Integrated Testing Coordinator (ITC) will complete an Integration Testing Plan (ITP). Carry out the testing as described by the ITC in the ITP, and in accordance with CAN/ULC-S1001 as it relates to any electrical systems.
- 1.29.3. The ITC and development of the ITP are not the responsibility of this Contractor.
- 1.29.4. The testing of the integrated systems shall include, but not be limited to the following systems and all associated components:
 - 1.29.4.1. Fire Alarm System
 - 1.29.4.2. Fire Signal Receiving Centre
 - 1.29.4.3. Mass Notification
 - 1.29.4.4. Elevators
 - 1.29.4.5. Emergency Generators and/or Inverters
 - 1.29.4.6. Audio/Visual Systems
 - 1.29.4.7. Lighting Control Systems
 - 1.29.4.8. Notification Systems (Public Address)
 - 1.29.4.9. Sprinkler Systems
 - 1.29.4.10. Standpipe Systems
 - 1.29.4.11. Fire Pumps
 - 1.29.4.12. Water Supplies
 - 1.29.4.13. Water Supply Control Valves
 - 1.29.4.14. Heat Tracing for Life Safety Systems
 - 1.29.4.15. Fixed Fire Suppression Systems
 - 1.29.4.16. Cooking Equipment Fire Suppression Systems
 - 1.29.4.17. Automatic Door Operators for Stair Relief

- 1.29.4.18. Hold-Open Devices
- 1.29.4.19. Electromagnetic Locks
- 1.29.4.20. Smoke Control Systems and Associated Dampers
- 1.29.4.21. Venting to Aid Firefighting
- 1.29.4.22. Smoke Alarms
- 1.29.4.23. Hazardous Protection Monitoring
- 1.29.4.24. Gas / CO Detection Systems
- 1.29.4.25. Prevention of Smoke Recirculation (AHUs)
- 1.29.5. Coordinate with all other trades to carry out the appropriate testing.
- 1.29.6. Be responsible for carrying out and coordinating the testing work associated with the ITP. All work shall be coordinated with the ITC and shall include but not be limited to:
 - 1.29.6.1. Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.
 - 1.29.6.2. Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.
 - 1.29.6.3. Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001 "Integrated Systems Testing of Fire Protection and Life Safety Systems."
 - 1.29.6.4. Provide fire alarm verification report along with all other documentation requested by the ITC as it relates to the electrical systems in conformance with CAN/ULC-S1001 "Integrated Systems Testing of Fire Protection and Life Safety Systems."

1.30. STATEMENT OF PRICES

- 1.30.1. To form a basis for progress payments the successful bidder shall submit a sample progress draw for the various portions of the work. The format of the sample progress draw shall be as shown in the example progress draw below. The sample progress draw shall include a breakdown which illustrates all categories shown on the example progress draw which are relevant to the project. The categories shall be broken down to clearly illustrate the value of the material being supplied as the first subcategory and the value of the labour being supplied as the second subcategory, as shown on the example progress draw. The electrical Engineer's Representative reserves the right to request that additional categories be added to the progress draw if the Engineer's Representative feels that doing so will aid in assessing the contractor's progress on site, thereby expediting contractor payment. Progress draws not including the categories shown on the example progress draw where relevant to the project and / or not providing separate labour value and separate material value subcategories will be rejected.
- 1.30.2. The total price of all portions of the work shall equal the total price of the work covered under the electrical division. Cost for as-built drawings and manuals to be carried as a separate line item.
- 1.30.3. Contractor to list and track all fixed per unit cost luminaires as part of Light Fixtures - Materials on the progress draw.
- 1.30.4. Contractor to list and track each of the approved changes on separate lines on the progress draw.
- 1.30.5. Costs of temporary facilities and utilities shall be amortized over the duration of the Work. Claims for 'mobilization', 'bidding costs', or similar lump sums at or before start of work are not acceptable.

EXAMPLE PROGRESS DRAW

| Electrical Contractor Name Billing Application Electrical Division Project Name | | | | | | | | |
|---|-----------------------|----------|-----------------------|---------------------|---------------------|----------|---------------------|----------------------------|
| Application Number – xx | | | | Date – xxxx to xxxx | | | | |
| <u>Description</u> | <u>Contract Value</u> | <u>%</u> | <u>Billed To Date</u> | <u>%</u> | <u>Prev. Billed</u> | <u>%</u> | <u>This Billing</u> | <u>Balance to Complete</u> |
| Permits / Mobilization | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Demolition & Removals | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Duct Banks – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Duct Banks – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Wire – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Wire – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Ltg. Branch Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Ltg. Branch Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Lighting Branch Wire – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Lighting Branch Wire – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Cable – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Cable – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Cable – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Cable – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Distribution Equipment – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Distribution Equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Generator / Inverter – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Generator / Inverter – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Light Fixtures – Material† | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Light Fixtures – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Lighting Controls – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Lighting Controls – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Equipment – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Wiring Devices – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Wiring Devices – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |

| | | | | | | | | |
|------------------------------|------------|-----|------------|-----|------------|-----|------------|------------|
| Hand Dryers – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Hand Dryers – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Commissioning / Training | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Demobilization / Clean-up | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Manuals / As-Built Drawings | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Subtotal | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Additions to Contract | | | | | | | | |
| CO # / PC # / CCN # | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| Cash Allowance # | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| Subtotal | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| Total Contract | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Less Holdback | | | xxx,xxx.xx | | xxx,xxx.xx | | xxx,xxx.xx | |
| Total | | | xxx,xxx.xx | | xxx,xxx.xx | | xxx,xxx.xx | |

† Inclusive of fixed per unit cost luminaires. Refer to luminaire schedule and/or electrical supplementary bid form for luminaire fixed unit costs.

1.31. METRIC CONVERSIONS

1.31.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, conduit and site services in both new and existing installations.

1.32. INTERRUPTION OF SERVICES

1.32.1. Any interruption of the electrical services to any part of the building shall come at a time agreeable to the Engineer's Representative. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.

1.32.2. Testing and operation of major equipment shall be approved by the Engineer's Representative to avoid excessive electrical utility charges. Such testing to be generally carried out after normal working hours or on weekends.

1.32.3. All such overtime work shall be carried out without additional cost to the Owners.

1.32.4. Modifications to existing electrical equipment, which will require shutdown, must be coordinated with the Owner and will only be permitted on weekdays from 10:00 pm to 6:00 am and on weekends from Friday at 7:00 pm to Sunday 6:00 pm. Exact weekends to be co-ordinated with the Owner. Consecutive weekends of shutdowns will not be allowed. Contractor to pay for all utility costs associated with shutdowns. Any work not associated with live equipment can be done during normal working hours. Work considered disruptive to the normal operation of the building will be done after normal business hours. Exact times to be co-ordinated with Owner.

1.32.5. Contractor to provide a minimum of 5 days written notice of a requirement for a shutdown. Contractor to include for separate meetings with the Owner and Engineer's Representative to discuss the shutdown in detail and to coordinate all the work being performed.

1.32.6. The Contractor is responsible for co-ordination and isolating of all existing services at all voltage levels required for the disconnections and connections to existing buildings. This includes shutting down and isolating existing low and medium voltage services. The owner will not perform any isolations for the contractor but will be present during the work. The contractor is to use qualified personnel for these shutdowns ensuring compliance with all applicable safety requirements.

- 1.32.7. The Contractor is responsible for any damages caused to existing systems when making connections.
- 1.32.8. The Contractor is to keep shutdowns of existing buildings to a minimum by scheduling the work and providing the required number of personnel to keep the shutdown to a minimum. This Contractor is to include for as many multiple teams of electricians as is feasible to keep the shutdown work to a minimum.

1.33. PRE-PURCHASED EQUIPMENT

- 1.33.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-purchased equipment and its associated equipment as if it had been purchased by the Contractor, with the single exception of payment.
- 1.33.2. The Electrical Trade shall provide a warranty for all pre-purchased equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-purchased equipment at no cost to the Owner during the warranty period.
- 1.33.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.
- 1.33.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-purchased equipment into a working system whether or not shown on the Drawings or specified herein.
- 1.33.5. The following list of equipment is pre-purchased:
- 1.33.5.1.

1.34. PRE-TENDERED EQUIPMENT

- 1.34.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-tendered equipment and its associated equipment as if it had been purchased by the Contractor, including payment.
- 1.34.2. The Electrical Trade shall provide a warranty for all pre-tendered equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-tendered equipment at no cost to the Owner during the warranty period.
- 1.34.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.
- 1.34.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-tendered equipment into a working system whether or not shown on the Drawings or specified herein.
- 1.34.5. The following list of equipment is pre-tendered: Insert the list of Owner Pre-tendered equipment or delete this if none are being included in the project
- 1.34.5.1.

1.35. VALUATION OF CHANGES

- 1.35.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:
- 1.35.1.1. Estimate and acceptance in a lump sum, unless the Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.
- 1.35.2. Contractor shall provide the Engineer's Representative with a detailed cost analysis of the contemplated change indicating:
- 1.35.2.1. Quantity of each material.

- 1.35.2.2. Unit cost of each material.
- 1.35.2.3. Time involved.
- 1.35.2.4. Sub-trade quotations including a complete analysis of costs.
- 1.35.2.5. Mark-ups, if applicable.
- 1.35.2.6. Value of GST or HST, as applicable.
- 1.35.2.7. Proposed change in Contract Time.
- 1.35.3. The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.
- 1.35.4. The following shall not be included in the cost of the work but are covered by the hourly labour rate:
 - 1.35.4.1. The Contractor's payroll, administrative, head office and site office expenses, including stationary, postage and other office supplies.
 - 1.35.4.2. The costs of the Contractor's Project Manager, clerical and administrative personnel, and executive personnel.
 - 1.35.4.3. Use of temporary offices, sheds, small/hand tools, storage, and site office consumables, etc., including but not limited to the cost of telephone, light, power, water and heat used therein.
 - 1.35.4.4. Transportation and overnight room expenses for out of town labour, if local labour is unavailable.
 - 1.35.4.5. Insurance premiums, all government payroll burdens, variable labour factors and union or association funds.
 - 1.35.4.6. Licenses and permits, except when these are special for a particular item of work.
 - 1.35.4.7. Printing charges for Proposed Changes, Change Orders and Drawings for Contractor's and Subcontractors' use in the work. Engineer's Representative will provide a PDF electronic copy of change notice documentation.
 - 1.35.4.8. The cost of preparing As-Built, layout and working drawings and shop drawings. This includes any and all AutoCAD/BIM costs related to interference drawings or other associated drawings that may be required as part of the changes.
 - 1.35.4.9. The cost of clean-up and disposal of waste material.
 - 1.35.4.10. Parking, travel, coffee break/rest periods, warranties, safety training, WHMIS and health and safety committee, and non-productive time.
 - 1.35.4.11. Rentals, additional bonding, project financing.
- 1.35.5. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-2020 GC 6.2.
- 1.35.6. The Contractor shall inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.
- 1.35.7. Special equipment rental rates will be charged at cost. The Contractor shall provide an official quotation of the equipment rental with the Proposed Change quotation as backup, otherwise special equipment rentals will not be accepted by the Owner/Consultant.

- 1.35.8. The maximum percentage fee for mark-ups shall be as stated in the Division 0/1 specifications or the Contract Supplementary Conditions.
- 1.35.9. All changes, change notices, revisions to contract, Supplemental Instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.
- 1.35.10. The material costs used shall be a discount to nationally available pricing guides (i.e. Trade Service, Allpricer, etc.) to reflect a value with a fair and reasonable markup to the actual cost of the materials purchased from distributors. The Owner and/or Engineer's Representative reserve the right to negotiate material pricing to a value that is fair and reasonable to the Owner.
- 1.35.11. Labour Rate
- 1.35.11.1. During the duration of the electrical contract, extra work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour units column 1(one). No additional factors will be accepted.

The hourly labour rate for all changes will be based on a Journeyman Electrician rate as listed on the Bid Form and/or Electrical Supplementary Bid Form. The Owner and/or Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be inclusive of overhead, markup and profit. The labour rate will be inclusive of all labour burden charges as stated in this 'Valuation of Changes' section above.

- 1.35.11.2. The following labour burdens are not part of the hourly labour cost, but are covered under the NECA labour unit rates: safety measures and regulations; drawing and specification study; layout, measuring and marking the installation location; material unloading, jobsite storage and delivery to the installation area; inspection, uncrating and shipping support removal; tool acquisition and return to storage; clean-up of excess material; and testing circuits for continuity.
- 1.35.11.3. At the request of the Owner or the Engineer's Representative, the Contractor is to submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.
- 1.35.12. When pricing additional work for Proposed Changes, the Electrical Contractor shall only price new materials that are required for the Proposed Change. Where existing materials and/or infrastructure (i.e. homerun conduits back to electrical panels) can be re-used for the Proposed Change, the Electrical Contractor shall utilize these items in the valuation of the Change at no extra cost.
- 1.35.13. Where a Proposed Change includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.
- 1.35.14. When pricing Proposed Changes containing both additions and credits, and where no work and/or materials have been installed on site, the Electrical Contractor shall only price the net new materials and net new labour that are required for the Proposed Change. Per unit labour and material costs shall be equal for credits and additions.

PROPOSED CHANGE ORDER

| | |
|-----------------|-----------------|
| Company Name: | CCN # |
| Address: | Date: |
| City, Prov.: | Project Name: |
| Postal Code: | Project Number: |
| | Page Number: |
| Telephone: | Change Order #: |
| Fax: | |
| E-Mail address: | |

Client Address:

Work Description

We reserve the right to correct this quote for errors and omissions.
This quote covers direct costs only.
This price is good for acceptance within 30 days from the date of receipt.

Itemized Breakdown

| Description | Qty | Net Price U | Total Mat(\$) | Labor U | Total Hours |
|-----------------------------|-----|-------------|---------------|---------|-------------|
| ¾' EMT | | xxx.xx C | | 5.00 C | |
| ¾' EMT STL SS CONN | | xx.xx C | | 10.00 C | |
| ¾' EMT STL SS CPLG | | xx.xx C | | 5.00 C | |
| ¾' EMT STRAO 1-H | | xx.xx C | | 4.00 C | |
| #10 x 1" SELF TAPPING SCREW | | x.xx C | | 5.50 C | |
| TOTALS | | | | | |

Description

Material

General Materials
Permitted Mark-up

(@ xx.xx %)

Material Total

Labour

Journeyman (xx Hrs. @ \$xx.00)
Foreman @ 10% (xx Hrs. @ \$xx.00)

Labour Total

Material and Labour Total

Final Amount

DEMOLITION

The demolition drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services follow the service through to ensure other areas of the building are not affected.

Whenever existing services or equipment are to be removed, all electrical connections for such services shall be removed and securely terminated in an approved manner. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this division.

Whenever it becomes necessary to relocate any electrical services equipment to make possible installation of the work under this contract, such relocation shall be done by this division without additional cost to the Owner.

Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate the demolition.

If applicable, review the mechanical, architectural, and other related discipline drawings, and include for removing and making safe all power connections to demolished equipment and devices, back to the source panel, except where indicated otherwise on the drawings.

Ensure that all electrical, life safety services, and services for existing equipment, in areas outside the areas of this work, that are required to remain in service, shall do so.

Relocate any electrical feeders or equipment that are required to remain in service, that are secured to existing walls, floors or ceilings to be demolished or that are buried and required to be excavated for new work.

Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.

Disconnect and remove existing light fixtures, devices, outlets, CCTV, security devices, etc. which are not to be reused. Such items shall be packaged and turned over to the Owner at a place designated by the Owner. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an approved manner.

Ensure that all existing equipment which is to be reused and/or relocated is thoroughly reviewed and refurbished to ensure correct operation when put back into service and to meet the requirements of the local authorities having jurisdiction. All existing electrical equipment which is no longer required shall be removed and disposed of off-site.

Carry out the work with a minimum of noise, dust and disturbance.

Provide tools and clean up equipment. Obtain the Owner's permission for the use of electrical, plumbing or drainage outlets.

Where a device is shown to be relocated on the drawings, contractor to remove and re-install device and back box and re-feed the device with new conduit and wire from the nearest existing accessible junction box.

Electrical Contractor is responsible for the patching and re-painting the entire wall where a device and/or box has been added, removed or relocated.

1.36. CYBER SECURITY

1.36.1. Coordinate with Owner's Information Technology representatives, obtain a copy of Owner's cyber security policy and provide all applicable cyber security configurations. Check with the DDesign Team if there Will be any devices or equipment connected to a network.

1.36.2. Definitions

- 1.36.2.1. Cyber Assets: Systems (including hardware, software, and data) and communication networks (including hardware, software, and data).
- 1.36.2.2. Critical Cyber Assets: Cyber assets that perform critical system functions. The loss or compromise of these cyber assets would adversely affect the operational reliability of the system.
- 1.36.2.3. Cyber Attack: The use of electronic means to interrupt, manipulate, destroy, or gain unauthorized access to a computer system, network, or device.
- 1.36.2.4. Cybercrime: Any crime where cyber – the internet and information technologies, such as software, firmware, computers, tablets, personal digital assistants or mobile devices – has a substantial role in the commission of a criminal offence.
- 1.36.2.5. Cyber Hygiene: Practices and steps that users of computers and other devices take to maintain system health and improve online security. These practices are often part of a routine to ensure the safety of identity and other details that could be stolen or corrupted.
- 1.36.2.6. Cyber Incident: Any unauthorized attempt, whether successful or not, to gain access to, modify, destroy, delete, or render unavailable any computer network or system resource.
- 1.36.2.7. Cyber Security: Technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access.
- 1.36.2.8. Cyber Threat or Cyber Security Threat: Malicious act that seeks to damage data, steal data, or disrupt digital life in general. Cyber threats include computer viruses, data breaches, Denial of Service (DDoS / DoS) attacks and other attack vectors.
- 1.36.2.9. Cyber Threat Actors: Broad term for any states, groups, or individuals who, with malicious intent, aim to take advantage of vulnerabilities, low cyber Security awareness, and technological developments to gain unauthorized access to information systems in order to access or otherwise affect victims' data, devices, systems and networks.
- 1.36.2.10. IP Multicast: Technique for one-to-many and many-to-many real-time communication over an IP Infrastructure network.
- 1.36.2.11. Endpoint: Remote computing device that communicates back and forth with a network to which it is connected. Such as a server, desktop, or laptop.
- 1.36.2.12. Network Certificates: Also known as a Digital Certificates, which are an electronic "password" that allows a person or organization to exchange data securely over the internet using the public key infrastructure (PKI). Digital Certificates are also known as a public key certificate or identity certificate. There are 3 Main types of certificates:
 - 1.36.2.12.1. Secure Socket Layer Certificate (SSL) Digi-SSL
 - 1.36.2.12.2. Software Signing (Code Signing Certificate) Digi-Code
 - 1.36.2.12.3. Client Certificate (Digital ID) Digi-ID
- 1.36.2.13. Social Engineering: Exploitation methods that target human vulnerabilities, such as carelessness and trust.
- 1.36.2.14. Technical Vulnerabilities: Weaknesses or flaws in the design, implementation, operation, or management of an information technology system, device, or service.
- 1.36.3. Cyber Security Measures
 - 1.36.3.1. Implement at minimum the following multi-layered Cyber Security measures to limit and / or reduce the Owner's potential risk from a cyber threat event; such as a Cyber Security data breach or Cyber Security attack.
 - 1.36.3.2. Password Management

- 1.36.3.2.1. Employ password management best practices such as:
 - 1.36.3.2.1.1. Do not use default passwords.
 - 1.36.3.2.1.2. Use strong and unique passwords for all applications. Use a minimum of 8 characters where there is no password policy inherent in the software; use a mixture of uppercase and lowercase letters, numbers, and include at least one special character (! @ # ?]).
 - 1.36.3.2.1.3. Reset passwords at regular intervals.
 - 1.36.3.2.1.4. Configure two-factor authentication for all accounts where possible in the system software.
 - 1.36.3.2.1.5. Do not use System Admin logins for simple tasks; create separate User accounts with rights levels appropriate for the job function. Create and define user accounts as appropriate such as Role based, Individual logins or assigned roles.
 - 1.36.3.2.1.6. Use different passwords for every account.
 - 1.36.3.2.1.7. Enforce secure password policies within the business environment.
 - 1.36.3.2.1.8. Have interface lock after a predefined # of failed login attempts for a pre determined time interval.
- 1.36.3.3. Port and Interface Management
 - 1.36.3.3.1. Employ Port Management techniques such as:
 - 1.36.3.3.1.1. Restrict access on network switch ports to assigned devices addresses.
 - 1.36.3.3.1.2. Lock down all open, unused and unsecure ports on the networking devices such as switches, routers, and firewalls.
 - 1.36.3.3.1.3. Shut off all unused communication services and hardware interfaces.
 - 1.36.3.3.1.4. Advise Owner on use of 3rd party port security monitoring.
- 1.36.3.4. Physical and Virtual Networks
 - 1.36.3.4.1. Provide a dedicated VLAN for network connected systems where a dedicated LAN has not been provided.
- 1.36.3.5. Encryption
 - 1.36.3.5.1. Use minimum TLS 1.2 for all network attached equipment and use TLS 1.3 where available.
- 1.36.3.6. Network Certificates
 - 1.36.3.6.1. Ensure Network Certificates are up to date and not expired for all equipment and systems.
- 1.36.3.7. Firmware & Software Update Management
 - 1.36.3.7.1. Use the latest stable Firmware / Software version on all devices / equipment as well as implement a Firmware / Software Update management process and procedure.
- 1.36.3.8. Manufacturer's System Hardening Guides
 - 1.36.3.8.1. Provide the Manufacturer's System hardening guides for the equipment being installed and implement as many recommendations / features as possible.
- 1.36.3.9. External Memory
 - 1.36.3.9.1. Restrict the use of external memory. Restrict or eliminate the use of devices such as external USB Thumb drives unless expressly allowed by the Owner's Information Technology representatives.
- 1.36.3.10. Log Off

- 1.36.3.10.1. Enable auto-log off timer for all software, websites and logins. Set auto-log off timer on local Workstation(s) being used to access the equipment with a reasonable timer in the case that an employee leaves the workstation unattended.
- 1.36.3.11. Anti-Virus Software
 - 1.36.3.11.1. Enable and configure anti-virus software on PC endpoints in accordance with the Owner's Information Technology requirements, unless it is to be installed and configured by the Owner.
- 1.36.3.12. Filtering Techniques
 - 1.36.3.12.1. Apply filtering techniques including the types listed below where possible:
 - 1.36.3.12.1.1. Web Filtering: A Web filter adds another layer to anti-phishing defences by blocking the web based component of phishing and malware attacks.
 - 1.36.3.12.1.2. Multicast Message Filtering: Filters the packets sent to multicast groups users are not subscribed to.
 - 1.36.3.12.1.3. Content Filtering: Is the use of a program to screen and / or exclude access to web pages or email deemed objectionable. A content filter will then block access to this content.
- 1.36.3.13. Back up Regularly
- 1.36.3.14. Provide backup schedule in the closeout submittals and configure system for automatic backups wherever possible.
- 1.36.3.15. Identify files that require manual backup and the backup procedure. This helps to protect against many types of data loss, especially if a Cyber Threat Actor gains access.
- 1.36.4. IT Devices and Systems
 - 1.36.4.1. Apply the Cyber security measures listed in the clauses above in part or in full, as possible, to a wide range of Information Technology (IT) Devices including:
 - 1.36.4.1.1. Firewalls
 - 1.36.4.1.2. Routers
 - 1.36.4.1.3. Network switches (Core and Edge Devices)
 - 1.36.4.1.4. Servers and databases
 - 1.36.4.1.5. Workstation computers
 - 1.36.4.1.6. Network connected system devices and controllers
 - 1.36.4.1.7. Wireless Access Points and wireless controllers
 - 1.36.4.1.8. Mobile phones and tablets
 - 1.36.4.1.9. Any IT System or endpoint connected to the network
- 1.36.5. Operational Technology (OT) Devices and Systems
 - 1.36.5.1. Apply the Cyber security measures listed in the clauses above, in part or in full, as possible, to a wide range of OT Network devices including:
 - 1.36.5.1.1. Industrial Control Systems such as:
 - 1.36.5.1.1.1. (PLC's) Programmable Logic Controllers are an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices.

- 1.36.5.1.1.2. (SCADA) Supervisory Control and Data Acquisition is a control system architecture comprising of computers, networked data communications and graphical user interfaces (GUI) for high level process supervisory management.
- 1.36.5.1.1.3. (DCS) Distributed Control System is a computerized control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system.
- 1.36.5.1.1.4. (CNC) Computer numerical Control is the automated control of machining tools (Drills, boring tools, lathes) and 3D printers by means of a computer.
- 1.36.5.1.2. Building Management Systems (BMS) and Building Automation Systems (BAS)
- 1.36.5.1.3. HVAC equipment
- 1.36.5.1.4. Lighting controls for both internal and external applications
- 1.36.5.1.5. Energy monitoring and metering equipment
- 1.36.5.1.6. Transportation and parking systems
- 1.36.5.1.7. Scientific equipment
- 1.36.5.1.8. Any other OT System or endpoint that can be connected to the network
- 1.36.6. Report Cybercrime
- 1.36.6.1. Advise the Owner and / or their representatives of any indication of a Cyber Incident of a criminal nature when performing any work on a network connected system.
- 1.36.7. Cyber Security Report Letter
- 1.36.7.1. Provide a Cyber Security Report Letter in the closeout documents to the client stating which Cyber Security measures have been implemented, when implementing any and / or all of the Cyber Security Measures mentioned in this Specification.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1. Refer to As-built Drawings in Section 01 70 00 (01 72 29) – CLOSEOUT SUBMITTALS.

1.3. RECORD OF REVISIONS ON SITE

- 1.3.1. Print and maintain two complete sets of white prints to mark the project progress, changes and deviations.
- 1.3.2. Maintain an updated copy of plans and schematics in the digital format for which the project is provided (i.e. AutoCAD or Autodesk Revit MEP) and be capable to produce documents in Adobe PDF upon request.

PART 2 PRODUCTS

2.1. AS-BUILT DRAWINGS

- 2.1.1. Request in writing from the Engineer's Representative all electrical Revit drawings. Complete release form provided by Engineer's Representative and pay the Engineer's Representative directly the costs identified in this section below prior to receiving the drawings. After the final as-built drawings have been reviewed, send the Engineer's Representative a copy via electronic transfer for their records and send a minimum of one copy on USB key with each set of maintenance manuals. Provide additional copies if required under the General Conditions. Use the latest release of Revit software, and provide electronic files saved in a version acceptable to the end user and engineer.
- 2.1.2. The contractor is to identify the cost of As-Built Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The following values are to be broken out:

| | |
|---------------------------|--|
| \$5,000 | For Electrical Contracts up to \$250,000 |
| 2% of Electrical Contract | For Electrical Contracts from \$250,000 to \$1,500,000 |
| \$30,000 | For Electrical Contracts over \$1,500,000 |

- 2.1.3. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received.
- 2.1.4. Final as-built prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Architect and Engineer must be deleted from the drawings.
- 2.1.5. Final as-built drawings to include all revisions made to the drawings during construction, including all approved changes. The as-built drawings are to also include the routing of all feeders except for branch circuits, all junction boxes to be shown, drawing legend to be updated to include all symbols and lines used to show as-built conditions, quantity of wires in each conduit, and circuit numbers of wires in each conduit. Include slab layout drawings in as-built drawing package.
- 2.1.6. CADD Requirements.
- 2.1.6.1. A complete list of layer names and brief description of each layer's use shall accompany all files.
- 2.1.6.2. Fonts for text shall be AutoCAD standard. Custom fonts, shape files, etc., are not to be used.
- 2.1.6.3. Final as-built drawings shall be returned on USB stick.

- 2.1.6.4. Each USB stick shall include a file containing Engineer's Representative and Owner, Contract number, file names and Drawing number. Provide a "readme.txt" file in ASCII format. A printed copy of the readme file shall accompany each USB stick.
- 2.1.6.5. All drawings shall be in the same units as issued on Bid Documents.
- 2.1.6.6. Provide a complete list of symbol (block) names with a description of each symbol.
- 2.1.6.7. Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.
- 2.1.7. Maintain records on site, as the job progresses, and record all changes and deviations from that shown on Contract Drawings. After review and approval of service lines in trenches, take "as-built" measurements, including all depths, prior to commencement of backfilling operations. Show the location of buried electrical ducts and conductors on the drawings and dimensioned from fixed points. Keep drawings up-to-date during construction and in addition to field measurements include Change Orders, Supplemental Instructions and all other changes.
- 2.1.8. On completion of the building, forward to the Engineer's Representative the digital drawings indicating all such changes and deviations for review by the Engineer's Representative.
- 2.1.9. If required, the Engineer's Representative will provide a quotation to this Contractor to transfer "As-Built" information from the mark-up documentation to the acceptable software.
- 2.1.9.1. Include a cost of \$400.00 per sheet for the transfer of marked up "As Built" information to Autodesk Revit MEP and forwarding of the electrical information by the Engineer's Representative to the Owner
- 2.1.10. The Electrical Contractor may request from the Engineer's Representative the most current electrical drawings in Autodesk Revit MEP sent via electronic transfer (at a nominal charge of \$1,000.00).
- 2.1.11. The Autodesk Revit MEP as-built documents shall meet all the Owner's and Engineer's Representative's requirements.

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. RELATED WORK

- 1.2.1. Comply with Div. 00 for submittal requirements and as amended below.

PART 2 PRODUCTS

2.1. SHOP DRAWINGS

- 2.1.1. Shop Drawings shall be organized by Specification Section. Ensure shop drawing package for a given Specification Section is complete, including all equipment, products, materials, and systems to be used as part of that Specification Section, and submit as a single shop drawing package. Do not submit numerous separate shop drawings for the same Specification Section. Do not combine more than one section into one submission. Incorrect submissions will be returned without review.
- 2.1.2. Submittals/Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. SWBD-1A).
- 2.1.3. Submit shop drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:
- 2.1.3.1. S+A project number and Contractor Shop Drawing Identifier in Subject Line
- 2.1.3.2. Attachments shall be limited to 10MB
- 2.1.3.3. Provide FTP hyperlink for all attachments in excess of 10MB with appropriate information for downloading the file (as required)
- 2.1.3.4. Shop Drawing Submission to the following email address:
ContractAdmin.Toronto@smithandandersen.com
- 2.1.4. Shop drawings submitted directly to Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.
- 2.1.5. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
- 2.1.6. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation – for example: lighting control sequence of operation – the Engineer's Representative may also request that this information be added to the maintenance and operating manual.
- 2.1.7. Provide a cover sheet with the project name, issue date, issue number, specification section number, and title of section with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

PART 3 EXECUTION

3.1. SUBMISSION

- 3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that he has checked the drawing for conformance with all requirements of the Drawings and Specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical and mechanical co-ordination is complete before submitting drawings for review.
- 3.1.2. Scanned PDF versions are not acceptable.
- 3.1.3. Equipment shall not be released for manufacture until the shop drawing has been reviewed by Engineer's Representative. Contractor shall assume responsibility and cost for field changes. Installation of any equipment shall not start until after final review of Shop Drawings by the Engineer's Representative has been obtained.
- 3.1.4. As part of the electrical Engineer's Representative's scope of the work, shop drawings shall be reviewed no more than twice. Should three or more reviews be required due to reasons of Contractor omissions causing resubmission requests, the Contractor shall reimburse the electrical Engineer's Representative for time expended in these extra reviews.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. MOUNTING HEIGHTS

- 3.1.1. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- 3.1.2. If mounting height of equipment is not specified or indicated, verify with the Consultant before proceeding with installation.
- 3.1.3. Unless indicated otherwise on the drawings or within the specifications, install electrical equipment at following heights.
- 3.1.3.1. Local switches: 1050 mm.
- 3.1.3.2. Wall receptacles:
- 3.1.3.2.1. General: 450 mm.
- 3.1.3.2.2. Above top of continuous baseboard heater: 200 mm.
- 3.1.3.2.3. Above top of counters or counter splash backs: 175 mm.
- 3.1.3.2.4. In mechanical rooms: 1200 mm.
- 3.1.3.2.5. In equipment storage rooms: 900 mm.
- 3.1.3.3. Receptacles for maintenance of equipment located on rooftops:
- 3.1.3.3.1. Not less than 750 mm above the finished roof, per Electrical Code.
- 3.1.3.4. Panelboards: 2000 mm to top of panel.
- 3.1.3.5. Telephone and interphone outlets: 450 mm.
- 3.1.3.6. Wall mounted telephone and interphone outlets: 1050 mm.
- 3.1.3.7. Fire alarm stations: 1200 mm, measured to the top of the manual pull station.
- 3.1.3.8. Wall Mounted Fire alarm audible devices: 2300 mm and not less than 150 mm from the ceiling, measured to the top of the device.
- 3.1.3.9. Television outlets not mounted behind a wall mounted television: 450 mm.
- 3.1.3.10. Wall mounted speakers: 2100 mm.
- 3.1.3.11. Clocks: 2100 mm.
- 3.1.3.12. Power Door Operator push buttons: 1050 mm.
- 3.1.3.13. Wall mounted Exit Signs
- 3.1.3.13.1. For 2400 mm to 2500 mm ceiling heights: 2100 mm.
- 3.1.3.13.2. For all ceilings heights greater than 2500 mm: 2400 mm.

- 3.1.3.14. Wall mounted Battery Packs and Emergency Heads
 - 3.1.3.14.1. For 2400 mm to 2500 mm ceiling heights: 2100 mm.
 - 3.1.3.14.2. For all ceilings heights greater than 2500 mm: 2400 mm.
- 3.1.3.15. Wall mounted occupancy sensors: 1050 mm.
- 3.1.3.16. Wall mounted visible signal devices: 2100 mm to centre of lens; or as allowed by CAN/ULC-S524 "Standard for Installation of Fire Alarm Systems" except where facility accessibility standards require otherwise.
- 3.1.3.17. Top of remote annunciator and passive graphic panels shall be no more than 1800 mm above finished floor.
- 3.1.3.18. Wall mounted emergency telephone (Fireman's Handset): 1350 to 1500 mm.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables, latest edition.
- 1.2.2. CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables, latest edition.
- 1.2.3. CSA C22.2 No. 51, Armoured Cables, latest edition.
- 1.2.4. CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables, latest edition.
- 1.2.5. CSA C22.2 No. 96, Portable Power Cables, latest edition.
- 1.2.6. CSA C22.2 No. 123, Metal Sheathed Cables, latest edition.
- 1.2.7. CSA C22.2 No. 124, Mineral-Insulated Cable, latest edition.
- 1.2.8. CSA C22.2 No. 131, Type TECK 90 Cable, latest edition.
- 1.2.9. CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations, latest edition.
- 1.2.10. CAN/ULC S139 / UL 2196 (Binational Standard), Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables, latest edition.
- 1.2.11. ASTM B800 - Standard Specification for 8000 Series Aluminium Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. BUILDING WIRES

- 2.1.1. Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

Contractor to provide copper conductors on conductors sizes up to and including #8 AWG. Contractor to provide copper conductors for sizes larger than #8 AWG unless identified as aluminium or NUAL on the drawings.

- 2.1.2. All conductors to have size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 to CSA C22.2 No. 38 rated as follows:
 - 2.1.2.1. Insulation rated at 1000 V for 600 V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current.
 - 2.1.2.2. Insulation rated at 600 V for the other 600 V and 347/600 V distribution systems not covered under item #1 above.
 - 2.1.2.3. Insulation rated at 600 V for all systems rated at 480 V and less.
- 2.1.3. All aluminium or NUAL conductors to be an aluminium alloy with CSA certified as an Aluminium conductor material (ACM) and meet the requirements of the Aluminium Association Inc. AA8030 and ASTM B800 standards. Provide an anti-oxidant compound, Ideal NOALOX, on all aluminum conductor terminations.

2.1.4. RWU90 wiring is to be used for underground installations.

2.2. TECK CABLE

2.2.1. Cables to CSA C22.2 No.131.

2.2.2. Conductors:

Bonding conductor: copper.

Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.2.3. Insulation:

2.2.3.1. Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.

2.2.4. Inner jacket: polyvinyl chloride material.

2.2.5. Armour: interlocking aluminum.

2.2.6. Overall covering: thermoplastic polyvinyl chloride material rated at a minimum of FT-4. Provide FT-6 jacket when TECK cables are run in return air plenum.

2.3. VARIABLE FREQUENCY DRIVE CABLES

2.3.1. Variable frequency drives are also known as variable speed drives.

2.3.2. Cables to CSA C22.2 No. 123 or No. 131, and to CSA C22.2 No. 174.

2.3.3. Conductors:

2.3.3.1. Three (3) bare copper bonding conductor sized to Table 16 of the electrical code.

2.3.3.2. Circuit conductors: copper, size as indicated on Drawings.

2.3.3.3. Profile of VFD Cable cross section shall be entirely symmetrical.

2.3.4. Shield: Flat copper tape shield, or continuously corrugated and welded aluminum sheath, depending on cable construction.

2.3.5. Insulation:

2.3.5.1. Chemically cross-linked thermosetting polyethylene (XLPE) with high dielectric strength to withstand repetitive high voltage spikes of 3.1 times the nominal system voltage rating due to VFD IGBT output.

2.3.5.2. Type RW90 or RWU90 CSA rated for 1000 V, and suitable for voltage spikes mentioned in .1 above.

2.3.6. Where compliant with CSA C22.2 No. 123, Armour: continuously corrugated and welded aluminum.

2.3.7. Where compliant with CSA C22.2 No. 131, Inner jacket: polyvinyl chloride material.

2.3.8. Where complaint with CSA C22.2 No. 131, Armour: interlocking aluminum.

2.3.9. Overall covering: thermoplastic polyvinyl chloride (PVC) material rated at a minimum of FT-4.

2.3.10. Cable to be complete with manufacturer's cable termination kits including terminating connectors for proper termination of shield to ground. Termination kits to ensure common mode stray currents are drawn away from the motor to extend motor life-span. Termination kits to include self-terminating connectors that provide 360 degree contact to the shield / sheath.

2.4. MINERAL-INSULATED CABLES

2.4.1. Conductors: solid bare soft-annealed copper, size as indicated.

- 2.4.2. Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.
- 2.4.3. Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 C.
- 2.4.4. Outer jacket: PVC applied over sheath, where installed in damp and wet locations.
- 2.4.5. Two (2) hour fire rating.
- 2.4.6. Conform to requirements of CSA C22.2 No. 124; and CAN/ULC S139.
- 2.4.7. All mineral-insulated cable larger than #6 AWG shall be single conductor. For conductors #6 AWG and smaller, multi-conductor mineral-insulated cable is acceptable.

2.5. FIRE RATED MC CABLE

- 2.5.1. Conductors: stranded annealed copper, size as indicated.
- 2.5.2. Insulation: low smoke silicon rubber.
- 2.5.3. Armour: continuously welded and corrugated copper sheath.
- 2.5.4. Outer Jacket: Provide black low smoke, zero halogen polyolefin, FT4 rated where installed in damp and wet locations.
- 2.5.5. Two (2) hour fire rating.
- 2.5.6. Conform to requirements of CSA C22.2 No. 123; and CAN/ULC S139 with hose stream.

2.6. ARMoured CABLES

- 2.6.1. Cables to: CSA C22.2 No. 51.
- 2.6.2. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
- 2.6.3. Type: AC90 (BX).
- 2.6.4. Armour: interlocking type fabricated from aluminium strip.
- 2.6.5. Type: ACWU90 - PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

2.7. ALUMINUM SHEATHED CABLE

- 2.7.1. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
- 2.7.2. Insulation: type RA90 rated 1000 V.
- 2.7.3. Sheath: aluminium applied to form continuous corrugated seamless sheath.
- 2.7.4. Outer jacket of PVC applied over sheath for direct burial or wet locations.

2.8. DIESEL LOCOMOTIVE CABLES (DLO)

- 2.8.1. Cable: to CSA C22.2 No. 96 Portable Power Cables, rated to 2000 V.
- 2.8.2. Conductor: stranded tinned annealed copper, size and number as indicated
- 2.8.3. Separator: paper or polyester tape separates the conductor from the rubber insulation to aid in stripping.
- 2.8.4. Insulation: premium grade Ethylene Propylene Rubber (EPR), rated 90 deg. C.
- 2.8.5. Jacket: black, heavy duty chlorinated polyethylene (CPE), sunlight resistant, rated at a minimum of FT-4.

2.9. WIRING TERMINATION

- 2.9.1. Lugs, terminals, screws used for termination of wiring to be to be dual rated for Copper/Aluminum (Cu/Al).
- 2.9.2. Lugs, terminals, and screws used for termination of multiple wires must be rated for their intended use.

PART 3 EXECUTION

3.1. GENERAL

- 3.1.1. Provide a minimum of one bonding conductor for each three ungrounded conductors on all conduit and cable runs. Provide separate bonding conductors for each ground fault circuit interrupter circuits. All bonding conductors to be copper and insulated with a green coloured insulation.
- 3.1.2. Size bonding conductor to applicable tables of the:
 - 3.1.2.1. Ontario Electrical Safety Code.
- 3.1.3. All equipment, junction boxes, pull boxes, liquid tight flex, etc. to be bonded to ground through bonding conductors.
- 3.1.4. Provide separate neutral conductor for each 120 volt circuit for all circuits feeding receptacles and power outlets.
- 3.1.5. Do not install cables or devices on the surface of, or within 100 mm of the underside of roof decks.
- 3.1.6. Ensure slack is provided in wiring connections to equipment which contains moving parts.
- 3.1.7. Provide a variable frequency drive (VFD) cable from each VFD unit to each motor. Wiring to be installed in accordance with the VFD and motor manufacturer instructions.
- 3.1.8. All cable terminations to be compression type fittings for wire sizes greater than #8 AWG. All compression type fittings to be two-hole long barrel type with lug inspection / viewing window. Where mechanical screw type lugs are allowed by the Engineer's Representative, they will be suitable for quantity of parallel runs of wire that are to be terminated under.
- 3.1.9. Armoured Cable Type AC90 (BX) may only be used for individual drops from slab mounted junction box to recessed mounted light fixtures or where noted on the drawings where wiring is required to be installed within an existing wall. The maximum allowable distance of armoured cable is 3 m. Contractor to receive written approval from the Engineer's Representative to run armoured cable further than 3 m from junction box. Daisy chaining of fixtures is only acceptable in dry wall ceilings. Wiring in conduit is to be brought to a junction box to allow for the transition to armoured cable. Armoured cable is not to be installed directly into electrical panels or run in walls for receptacles.
- 3.1.10. Branch circuit wiring to be upsized as follows to address voltage drop when:
 - 3.1.10.1. The entire length of the circuit wiring exceeds 25 m – branch wiring to be a minimum of No. 10 AWG.
 - 3.1.10.2. The entire length of the circuit wiring exceeds 40 m – branch wiring to be a minimum of No. 8 AWG.
 - 3.1.10.3. The entire length of the circuit wiring exceeds 60 m – branch wiring to be a minimum of No. 6 AWG.

- 3.1.11. Where feeders or branch circuits are run underground, upsize conductors to comply with the requirements of electrical code Rule 4-004, Ampacity of wires and cables, using Diagrams D8 to D11 and Tables D8A to D11B of the electrical code. Where conductors are upsized due to Tables D8A to D11B, upsize conduits to comply with the requirements of electrical code Rule 12-910, Conductors and cables in conduit and tubing.
- 3.1.12. Where one (1) hour or two (2) hour conductor fire rating is indicated on the Drawings, provide fire rated Mineral-Insulated cables or fire rated MC cables. Fire rated Mineral-Insulated and MC cables shall be installed in accordance with the manufacturer's installation instructions and the fire rated cable product listing in order to maintain their fire rating. Special attention shall be paid to cable supporting method and fire rating of the structure from which the cables are supported.
- 3.1.13. Where conductors supply power to emergency lighting and the emergency lights are located on a different floor level than the power source (i.e. panel), then the conductors shall be fire rated for at minimum one (1) hour using fire rated Mineral-Insulated cables. Conductors with two (2) hour fire rating shall be used where indicated on Drawings. Provide fire rated Mineral-Insulated cables or fire rated MC cables where conductors require fire ratings.
- 3.1.14. Where alternatives to fire rated cables are indicated on the Drawings, such as running conduits within concrete cast in place slabs, under concrete slabs on grade, or within fire rated shaft/riser, care must be taken to ensure that the required fire rating is maintained. Where drawings call for conduits to be run within concrete cast in place slabs, the slabs must be of sufficient thickness to achieve the required fire rating and be no less than 51 mm (2 in.) of concrete cover both above and below conduits where one (1) hour fire rating is required and 102 mm (4 in.) concrete cover both above and below conduits where two (2) hour fire rating is required. The contractor shall submit a letter confirming the concrete coverage or construction of fire rated assembly provides the sufficient fire rating of the enclosed conduits.
- 3.1.15. Wire Splicing
- 3.1.15.1. Splice up to and including No. 6 AWG with nylon insulated expandable spring type connectors.
- 3.1.15.2. Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.

3.2. INSTALLATION OF BUILDING WIRES

- 3.2.1. Install all building wiring in conduit unless otherwise noted. Conduit to be sized to the electrical code unless noted on the drawings or in the specifications.
- 3.2.2. All conductors are to be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. INSTALLATION OF TECK 90 CABLE, VARIABLE FREQUENCY DRIVE CABLE, ARMoured CABLE OR ALUMINUM SHEATHED CABLE

- 3.3.1. Group cables wherever possible on channels.
- 3.3.2. Terminate cables in accordance with manufacturer's installation instructions.
- 3.3.3. Fastenings:
 - 3.3.3.1. One-hole steel straps to secure surface cables 53 mm and smaller. Two-hole steel straps for cables larger than 53 mm.
 - 3.3.3.2. Channel type supports for two or more cables.
 - 3.3.3.3. Galvanized threaded rods: 6 mm diameter minimum to support suspended channels.
 - 3.3.3.4. Pre-engineered support systems complying with CSA C22.2 No. 18.4 "Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239)."
- 3.3.4. Connectors:

- 3.3.4.1. Watertight, approved for respective cables.
- 3.3.5. For single conductor cables, ground the sheath at the upstream (source) panel and provide insulated fibre plate at the load end, so as to prevent circulating sheath currents.
- 3.4. INSTALLATION OF MINERAL-INSULATED AND FIRE RATED MC CABLES**
 - 3.4.1. Handling:
 - 3.4.1.1. Cable shall be uncoiled by rolling or rotating supply reel. Do not pull from coil periphery or centre.
 - 3.4.2. Bending:
 - 3.4.2.1. Not less than six (6) times the cable diameter for cable not more than 250 kcmil.
 - 3.4.2.2. Not less than twelve (12) times the cable diameter for cable diameter for cable more than 350 and 500 kcmil.
 - 3.4.3. Splicing:
 - 3.4.3.1. Make all fire rated splices in the factory. In the event that a field splice is necessary, have the manufacturer's field technician make it in the field.
 - 3.4.4. Terminations:
 - 3.4.4.1. Make field made terminations using the cable manufacturer's termination kits. Use stripping tools, crimping tools and compression tools, available from the manufacturer for proper cable termination.
 - 3.4.4.2. Connections to ferrous cabinets for single conductor cables shall incorporate brass plates. Install per manufacturer's drawing.
 - 3.4.4.3. At cable terminations, use thermoplastic sleeving over bare conductors.
 - 3.4.5. Sheath induction reduction:
 - 3.4.5.1. When multi-phase circuits have paralleled single conductors, run cables in groups having one of each phase in each group.
 - 3.4.5.2. Separate each set of paralleled conductors by at least two single cable diameters.
 - 3.4.6. Exposed or Surface Installations:
 - 3.4.6.1. Cable shall be secured directly to fire rated building structure using:
 - 3.4.6.1.1. Straps: 13 mm wide x 38 mm long by 0.75 mm thick stainless steel or copper straps. Each strap shall contain two 5 mm-holes for securing with 5 mm by minimum 44 mm long steel anchors.
 - 3.4.6.2. Support 2 hr fire rated cables at 1 m intervals.
 - 3.4.7. Wall or floor penetrations:
 - 3.4.7.1. Provide approved fire stopping of all penetrations.
 - 3.4.7.2. Neatly train and lace cable inside boxes, equipment, and panelboards.
 - 3.4.7.3. Where cables are buried in cast concrete or masonry, sleeve for entry of cables.
 - 3.4.7.4. When penetrating a fire rated wall or fire rated floor, the cable must extend a minimum of 305 mm beyond the fire rated wall or fire rated floor. The 305 mm dimension can be in any direction as 305 mm of cable length is required to allow for proper heat dissipation such that cable terminations do not overheat.

3.5. FIELD QUALITY CONTROL

- 3.5.1. Prior to energizing wires/cables, measure insulation resistance of each wire/cable. Ensure readings are acceptable per installation recommendations. Tabulate and submit for approval as a submittal.
- 3.5.2. All Wires and Cables to be tested on site as defined in Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE and herein. Contractor to oversee all testing and correct any deficiencies noted.

3.6. INSTALLATION OF CONTROL CABLES

- 3.6.1. Install control cables in conduit.
- 3.6.2. Ground control cable shield.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 21 – WIRES AND CABLES UNDER 2000 V.

1.2. REFERENCES

- 1.2.1. CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, latest edition.
- 1.2.2. Electrical Code – Section 24 – Patient care areas, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.4. DESCRIPTION

- 1.4.1. Patient care areas are grouped in three (3) categories, as follows:
 - 1.4.1.1. Basic care
 - 1.4.1.2. Intermediate care
 - 1.4.1.3. Critical care
- 1.4.2. Patient care classification shall be identified on the layout drawings as follows;
 - 1.4.2.1. PCC-B: Patient Care Classification Basic
 - 1.4.2.2. PCC-I: Patient Care Classification Intermediate
 - 1.4.2.3. PCC-C: Patient Care Classification Critical
- 1.4.3. Hospital grade outlets shall be identified as such on the drawings.

PART 2 PRODUCTS

2.1. RECEPTACLES

- 2.1.1. Devices to be CSA approved, ULC listed and labelled.
- 2.1.2. Hospital grade with green dot symbol, extra heavy duty, back and side wired, duplex U-ground, 15 ampere or 20 ampere, 125 V, 2-pole, 3-wire grounding duplex receptacles.
- 2.1.3. Hospital grade with green dot symbol, tamper resistant, extra heavy duty, back and side wired, duplex U-ground, 15 ampere or 20 ampere, 125 V, 2-pole, 3-wire grounding duplex receptacles:
 - 2.1.3.1. Mark tamper resistant receptacles with "TAMPER RESISTANT" OR "TR".
- 2.1.4. Receptacles shall be coloured as follows;
 - 2.1.4.1. Emergency powered receptacles: coloured red
 - 2.1.4.2. Normal powered receptacles: coloured white
 - 2.1.4.3. UPS powered receptacles: coloured blue

- 2.1.5. Receptacles shall be circuited in accordance with CSA Z32 requirements.
- 2.1.6. Receptacles shall be labeled as follows;
 - 2.1.6.1. The circuit number and supplying panelboard shall be permanently identified at the outlet.
 - 2.1.6.1.1. Label shall be incorporated into the face of the receptacle, or
 - 2.1.6.1.2. A lamacoid secured to the wall above the receptacle.
 - 2.1.6.2. It shall be clearly visible with the cover plate in place and should not be on the cover plate itself.
 - 2.1.6.3. Receptacles within the patient care area which are not to be used for patient care shall be clearly labelled "Not for Patient Care use"
- 2.1.7. Lettering of circuit identification shall be not less than 12 mm characters.
- 2.1.8. Conductors: shall be copper. Minimum size: 12 AWG.

2.2. WIRING TERMINATION

- 2.2.1. Lugs, terminals, and screws used for termination of wiring to be copper conductors.
- 2.2.2. Lugs, terminals, and screws used for termination of multiple wires must be rated for their intended use.

PART 3 EXECUTION

3.1. GENERAL

- 3.1.1. Provide Hospital Grade receptacles in all patient care areas and as identified on the drawings.
- 3.1.2. Provide Hospital Grade tamper resistant receptacles where indicated below and as identified on the drawings:
 - 3.1.2.1. Provide tamper resistant receptacles within the Mental Health Department and within any areas used for the treatment of mental health patients.
 - 3.1.2.2. Provide tamper resistant receptacles within the Pediatric Department and within areas accessible to children.
- 3.1.3. Branch circuit wiring to be upsized as follows to address voltage drop when:
 - 3.1.3.1. The entire length of the circuit wiring exceeds 25 m – branch wiring to be a minimum of No. 10 AWG.
 - 3.1.3.2. The entire length of the circuit wiring exceeds 40 m – branch wiring to be a minimum of No. 8 AWG.
 - 3.1.3.3. The entire length of the circuit wiring exceeds 60 m – branch wiring to be a minimum of No. 6 AWG.

3.2. BONDING TO GROUND

- 3.2.1. Bonding conductors shall be installed in accordance with electrical code requirements.
- 3.2.2. Each multi-wire (2-wire, etc.) branch circuit shall be provided with its own equipment bonding conductor.
- 3.2.3. All bonding conductors shall be insulated with a green coloured insulation. The use of uninsulated bonding conductors such as certain types of AC90 (BX) cabling shall not be acceptable.
- 3.2.4. All receptacles and other permanently connected equipment shall be bonded to ground by copper equipment bonding conductors, sized in accordance with electrical code Table 16 as applicable, but in no case smaller than No. 12 AWG.

- 3.2.5. Bonding conductors shall terminate either at the panelboard supplying the branch circuits to the patient care environment from which they arise or on a separately installed busbar that is bonded to that panelboard.
- 3.2.6. Bond to ground exposed metal non-current carrying parts of equipment located within the patient care environment; which includes space within the room 1.5m beyond the perimeter of the bed in its normal location and to within 2.3m of the floor.
- 3.2.7. Typical equipment to be bonded to ground includes;
 - 3.2.7.1. Fixtures
 - 3.2.7.2. Headwall units
 - 3.2.7.3. Service strips
 - 3.2.7.4. Intercom stations
 - 3.2.7.5. Nurse call stations
 - 3.2.7.6. View Boxes
 - 3.2.7.7. Receptacles
 - 3.2.7.8. Switches
 - 3.2.7.9. Cover Plates
 - 3.2.7.10. Conduits
 - 3.2.7.11. Integrated Bedside Terminals
 - 3.2.7.12. Articulating arms which can be extended into the patient care environment
 - 3.2.7.13. Outlet boxes, and
 - 3.2.7.14. Other equipment as required by code.
- 3.2.8. Where branch circuits for a patient care environment are supplied from more than one panelboard, the panelboards shall be bonded together with a single copper equipment bonding conductor sized in accordance with Table 16 of the electrical code, but in no case smaller than a No. 6 AWG. Contractor to provide and install appropriately sized bonding conductor between panels as necessary.

3.3. NEUTRAL CONDUCTORS

- 3.3.1. In intermediate and critical care areas, provide a separate neutral conductor for each branch circuit phase conductor back to the panel supplying the outlet.
- 3.3.2. Where multiple circuits share a conduit, derate conductors, where required, on the basis that the neutral conductors are full current carrying conductors.

3.4. TESTING OF WIRING FOR PATIENT CARE AREAS

- 3.4.1. Isolated power systems and branch circuits serving receptacles intended for patient care shall be tested in accordance with CSA Z32; including but not necessarily limited to; voltage drop, retentive force, polarity, and voltage difference testing.
- 3.4.2. The testing shall be performed by an Independent Testing Organization (ITO) who is independent of the equipment manufacturers and is a recognized expert in testing to the CSA Z32 requirements.
- 3.4.3. Deficiencies noted by the ITO shall be corrected then retested by the ITO until the ITO is satisfied.
- 3.4.4. Patient care areas shall not be placed into service until the ITO is satisfied and a formal report sealed by a professional engineer has been issued by the ITO.

- 3.4.5. The ITO shall issue a copy of the report to the healthcare facility, to the engineer of record and to the compliance engineer.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 41– Grounding and Bonding of Equipment, latest edition.
- 1.2.2. Ontario Building Code, latest edition.
- 1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.
- 1.2.4. IEEE Standard 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, latest edition.

1.3. DESCRIPTION

- 1.3.1. Provide system grounding to meet requirements of current applicable codes.

1.4. SHOP DRAWINGS AND PRODUCT DATA

- 1.4.1. Submit shop drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.4.2. Submit shop drawings for ground bars and ground rod inspection wells for engineer's review prior to manufacture.
- 1.4.3. Submit main system ground test report as a shop drawing for engineer's review. Include final reviewed report in the project O&M manuals.

PART 2 PRODUCTS

2.1. GROUNDING & BONDING EQUIPMENT

- 2.1.1. Meet standard of CSA C22.2 No. 41 – Grounding and Bonding of Equipment, latest edition.

2.2. CONDUCTORS

- 2.2.1. Bare or insulated, stranded, soft drawn annealed copper wire, for: ground bus, electrode interconnections, metal structures, ground connections, telephone ground.

2.3. LUGS

- 2.3.1. All grounding connections to be made with compression type fittings and lugs with lug inspection / viewing window.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install complete permanent, continuous, system and circuit, equipment, grounding and bonding systems including, conductors, connectors, and accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.

- 3.1.2. Provide main station ground grid as shown on drawing but the ground grid shall consist of a minimum of four (4) driven ground rods. Copper ground rods shall be not less than 3 m long and 19 mm in diameter and where practicable located adjacent to the equipment to be grounded (i.e. main electrical room). Interconnect all ground rods underground with a #2/0 AWG bare ground conductor.
- 3.1.2.1. If main ground grid cannot be installed directly below the main electrical room, then provide a remote ground grid by installing the ground rods at the lowest floor level of the building and provide two grounding conductors of a minimum of #4/0 AWG copper to connect the ground grid to the main electrical room equipment. Run the two conductors through separate routes separated by a minimum of 5 m.
- 3.1.3. Supply and install a new ground bus system consisting of a length of copper bus, 25 mm thick ebony pad with chamfered edges as shown on the drawings. A minimum of two 1200 mm ground bars are to be provided in transformer vault(s), main electrical room(s) and generator room(s). Where a perimeter ground bus is shown on the drawings, supply and install a 50 mm x 6 mm copper bus on all walls attached at 1.5 m intervals on 13 mm standoffs. The perimeter ground bus shall be continuous around the room and shall be continued above or below all openings such as doors and vents.
- 3.1.4. Interconnect the ground bars to the ground grid with a minimum #2/0 AWG bare copper ground conductor if the ground grid is adjacent to the main electrical room(s). Where the ground grid is remote, connect the ground bars to the remote ground grid as described in 3.1.2.(1) above.
- 3.1.5. Supply and install inspection box for each ground rod. Inspection box is to be suitable for installation in heavy traffic areas and is to come complete with a lockable lid and security key.
- 3.1.6. Connect to the ground bus all metal equipment enclosures, as well as all other metal parts such as mechanical pipes, ducts, waste lines, door frames, railings, grilles, fences, etc. with minimum #2/0 AWG bare copper conductors.
- 3.1.7. For solidly grounded systems, transformer neutrals, main service entrance switchboard neutrals and all similar bonding connections, the bonding conductors shall be sized in accordance with Table 16 of the Electrical Code.
- 3.1.8. Provide cable grips to receive all grounding conductors. Identify all grounding conductors at the ground pad using lamacoid nameplates. Ground bus system to be provided in rooms as shown.

3.1.9. Terminate the following conductors at the ground bus system:

- Service neutral -as indicated on drawings
- Telecommunications ground -as per TIA Standard 607, latest edition

| TBB/GE linear length m (ft) | TBB/GE size (AWG) |
|--------------------------------|----------------------|
| less than 4 (13) | 6 |
| 4 – 6 (14 – 20) | 4 |
| 6 – 8 (21 – 26) | 3 |
| 8 – 10 (27 – 33) | 2 |
| 10 – 13 (34 – 41) | 1 |
| 13 – 16 (42 – 52) | 1/0 |
| 16 – 20 (53 – 66) | 2/0 |
| 20 – 26 (67 – 84) | 3/0 |
| 26 – 32 (85 – 105) | 4/0 |
| 32 – 38 (106 – 125) | 250 kcmil |
| 38 – 46 (126 – 150) | 300 kcmil |
| 46 – 53 (151 – 175) | 350 kcmil |
| 53 – 76 (176 – 250) | 500 kcmil |
| 76 – 91 (251 – 300) | 600 kcmil |
| Greater than 91 (301) | 750 kcmil |

where,

TBB = Telecommunications Bonding Backbone

- Main system ground -#2/0 AWG or 2 x # 4/0 AWG for remote ground grids
- Bonding conductor -as per Table 16 of CSA C22.1

- 3.1.10. Ground all metallic water, gas, and waste systems with a minimum #6 AWG copper in accordance with code requirements.
- 3.1.11. Install bonding connections to typical equipment included in, but not necessarily limited to, following list: frames of motors, starters, control panels, building steel work, elevators, distribution panels and outdoor lighting.
- 3.1.12. Commission an approved certified testing Agency to perform a main system ground test. Submit the main system ground test report as a shop drawing for engineer's review. Provide a copy of the report in the maintenance manual. (Refer to Part 3.2).
- 3.1.13. Install connectors in accordance with manufacturer's instructions.
- 3.1.14. Ground rods to be interconnected by grounding grid conductors (sized as per sections above) and buried to a maximum depth of 600 mm below the rough station grade and a minimum depth of 150 mm below the finished station grade.
- 3.1.15. Protect exposed grounding conductors from mechanical damage.
- 3.1.16. Install bonding conductor for flexible conduit and connect at both ends to grounding bushing with solderless lug, clamp or cup washer and screw. Neatly cleat bonding conductor to exterior of flexible conduit.
- 3.1.17. Provide separate, insulated bonding conductor within each feeder and branch circuit raceway.
- 3.1.18. Interface with the lightning protection system, if one is installed for this building.

3.2. TESTING

- 3.2.1. The contractor shall pay for the testing and verification of the entire building ground system using a certified testing Agency. Tests shall include main ground grid and ground rods, and grounding connections between all electrical and communication rooms. The agency shall provide complete test reports indicating test methodology and results. All costs shall be included in contract bid.
- 3.2.2. Following are acceptable methods of testing the ground grid. Testing shall be in accordance with IEEE Standard 81 (latest edition).
- 3.2.2.1. Two-Point Method
- 3.2.2.2. Three-Point Method
- 3.2.2.3. Ratio Method
- 3.2.2.4. Staged Fault Tests
- 3.2.2.5. Fall-of-Potential Method

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

- 1.2.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.2.2. Conduit and equipment provided under the Electrical division shall be complete with all necessary supports and hangers required for a safe and workpersonlike installation.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Provide “U” type support Strut as manufactured by Unistrut.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.
- 3.1.2. Auxiliary structural members shall be provided under the electrical section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested.
- 3.1.3. Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.
- 3.1.4. Approved type expansion shields and bolts may be used for conduit up to 103 mm diameter where the pre-setting of concrete inserts is not practical. Submit Shop Drawings.
- 3.1.5. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer's Representative. Drawings of the proposed method of suspension must be submitted for review.
- 3.1.6. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413 – Parking Structures (latest edition) and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval.
- 3.1.7. Suspending one hanger from another shall not be permitted.
- 3.1.8. All hangers, supports, brackets and other devices used outside the building wall shall be galvanized. If galvanized components cannot be used submit samples of proposed substituted for review before installation.

3.2. HORIZONTAL RUNS ON THE ROOF

- 3.2.1. Where conduit or cables are run horizontally across a roof, conduit or cable shall be supported from pre-manufactured UV resistant sleepers with closed cell foam base.
- 3.2.2. Sleepers shall be “E-Z Sleeper” product from Pipe-Ease Inc. or approved equivalent.
- 3.2.3. Wood Blocks are not acceptable.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 53 – IDENTIFICATION.
- 1.1.4. Section 26 05 63 – ACCESS DOORS AND ACCESSIBILITY.

1.2. REFERENCE

- 1.2.1. Ontario Electrical Safety Code, latest edition.
- 1.2.2. Ontario Building Code, latest edition.
- 1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit shop drawings and product data for cabinets in accordance with specification Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. SPLITTERS

- 2.1.1. Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Provide CSA Type 1 enclosures in non-sprinklered environments and CSA Type 4/12 in sprinklered environments.
- 2.1.2. Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated. Lugs to be dual rated for Copper/Aluminum (Cu/Al).
- 2.1.3. At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2. JUNCTION AND PULL BOXES

- 2.2.1. Welded steel construction with screw-on flat covers for surface mounting.
- 2.2.2. Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3. CABINETS

- 2.3.1. Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- 2.3.2. Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface or flush mounting. The plywood backboard is to have a fire-resistant coating on the front. Do not paint over plywood fire rating certification stamp.

PART 3 EXECUTION

3.1. SPLITTER INSTALLATION

- 3.1.1. Install splitters and mount plumb, true and square to the building lines.
- 3.1.2. Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2. JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- 3.2.1. Install pull boxes in inconspicuous but accessible locations.
- 3.2.2. Mount cabinets with top not higher than 2000 mm above finished floor.
- 3.2.3. Install terminal block as indicated in Type T cabinets.
- 3.2.4. Only main junction and pull boxes are indicated. Install pull boxes as follows:
 - 3.2.4.1. A conduit run exceeds 30 m and;
 - 3.2.4.2. 360 degree of combined bends between pull boxes for power conduits or 180 degree of combined bends between pull boxes for communication and low voltage conduits.

3.3. IDENTIFICATION

- 3.3.1. Provide equipment identification in accordance with Section 26 05 53 – IDENTIFICATION.
- 3.3.2. Install identification labels indicating system name, voltage, and phase.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

- 1.2.1. Ontario Electrical Safety Code, latest edition.
1.2.2. Ontario Building Code, latest edition.
1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

PART 2 PRODUCTS

2.1. OUTLET AND CONDUIT BOXES GENERAL

- 2.1.1. Size boxes in accordance with the electrical code.
2.1.2. Square or larger outlet boxes as required for special devices.
2.1.3. Gang boxes where wiring devices are grouped.
2.1.4. Blank cover plates for boxes without wiring devices.
2.1.5. 347V outlet boxes for 347 V switching devices.
2.1.6. Combination boxes with barriers where outlets for more than one system are grouped.

2.2. SHEET STEEL OUTLET BOXES

- 2.2.1. Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 mm x 50 mm x 38 mm or as indicated. 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
2.2.2. Provide cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles connected to rigid conduit.
2.2.3. Provide electro-galvanized steel utility boxes for surface mounted boxes connected to surface-mounted EMT conduit, minimum size 100 mm x 54 mm x 48 mm.
2.2.4. Square or octagonal outlet boxes for lighting fixture outlets.
2.2.5. Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3. MASONRY BOXES

- 2.3.1. Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4. CONCRETE BOXES

- 2.4.1. Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5. FLOOR BOXES

- 2.5.1. Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

- 2.5.2. Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16 mm and 21 mm conduit. Minimum size: 73 mm deep.

2.6. OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- 2.6.1. Electro-galvanized, sectional, screw ganging steel boxes, minimum size 75 mm x 50 mm x 63.5 mm with two double clamps to take non-metallic sheathed cables.

2.7. FITTINGS - GENERAL

- 2.7.1. Bushing and connectors with nylon insulated throats.
- 2.7.2. Knock-out fillers to prevent entry of debris.
- 2.7.3. Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- 2.7.4. Double locknuts and insulated bushings on sheet metal boxes.

2.8. SERVICE FITTINGS

- 2.8.1. 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for duplex receptacles. Bottom plate with two knockouts for centered or offset installation.
- 2.8.2. Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate Amphenol jack connectors.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Support boxes independently of connecting conduits.
- 3.1.2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- 3.1.3. For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- 3.1.4. Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- 3.1.5. Non-combustible electrical outlet boxes that penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating, do not require fire stops provided,
- 3.1.5.1. They do not exceed:
- 3.1.5.1.1. 100 cm² each in area, and
- 3.1.5.1.2. an aggregate area of 650 cm² in any 9.3 m² of surface area, AND
- 3.1.5.2. The annular space between the membrane and the box does not exceed 3 mm.
- 3.1.6. Where the conditions of clause 3.1.5 are not met, provide fire stops for the outlet boxes.
- 3.1.7. Opposing outlets on non-fire rated partition walls shall have a minimum 150 mm horizontal separation. Outlets shall not be mounted back to back.
- 3.1.8. Conform to the fire stopping requirements of the building code: unless provided with a fire stop in accordance with CAN/ULC-S115, "Fire Tests of Fire Stop Systems", electrical outlet boxes on opposite sides of a vertical fire separation required to have a fire-resistance rating shall be separated by a horizontal distance of not less than 600 mm, or be installed in adjacent stud cavities.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 31 – SPLITTERS, JUNCTION, PULL BOXES AND CABINETS
- 1.1.3. Section 26 05 32 – OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1.2. REFERENCES

- 1.2.1. CAN/CSA C22.2 No.18- Outlet Boxes, Conduit Boxes, and Fittings, latest edition.
- 1.2.2. CSA C22.2 No.45.1- Electrical Rigid Metal Conduit - Steel, latest edition.
- 1.2.3. CSA C22.2 No.56- Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, latest edition.
- 1.2.4. CSA C22.2 No.83- Electrical Metallic Tubing, latest edition.
- 1.2.5. CSA C22.2 No.211.2- Rigid PVC (Unplasticized) Conduit, latest edition.
- 1.2.6. CAN/CSA C22.2 No.227.3- Flexible Non-metallic Tubing, latest edition.
- 1.2.7. CSA C22.2 No.227.1 - Electrical Non-Metallic Tubing, latest edition.

PART 2 PRODUCTS

2.1. CONDUITS

- 2.1.1. Electrical rigid metal conduit: to CSA C22.2 No.45.1, galvanized steel or aluminum threaded.
- 2.1.2. Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- 2.1.3. Electrical metallic tubing (EMT): to CSA C22.2 No.83, with couplings.
- 2.1.4. Rigid PVC conduit: to CSA C22.2 No.211.2.
- 2.1.5. Flexible metal conduit: to CSA C22.2 No.56, steel or liquid-tight flexible metal.
- 2.1.6. Electrical non-metallic tubing (ENT): to CSA C22.2 No. 227, with couplings.

2.2. CONDUIT FASTENINGS

- 2.2.1. One-hole steel straps to secure surface conduits NPS 2 and smaller. Two-hole steel straps for conduits larger than NPS 2.
- 2.2.2. Beam clamps to secure conduits to exposed steel work.
- 2.2.3. Channel type supports for two or more conduits at 1 m on centre.
- 2.2.4. Hot dipped galvanized threaded rods, 6 mm dia. minimum, to support suspended channels.
- 2.2.5. For non-fire rated applications, pre-engineered support systems complying with CSA C22.2 No. 18.4 "Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239)."

2.3. CONDUIT FITTINGS

- 2.3.1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- 2.3.2. Factory 90 degree elbow where 90 bends are required for 1" and larger conduits when a hydraulic bender is not used.

2.3.3. Connectors, and couplings for EMT conduit are to be set-screw steel type. Below the level of suspended ceilings, in a sprinklered environment, provide watertight fittings and "O" rings on all conduit runs and when conduit is terminated at any piece of electrical equipment.

2.3.4. Provide plastic bushings for all connectors, rigid nipples and rigid conduit 35 mm or larger.

2.4. EXPANSION FITTINGS FOR RIGID CONDUIT

2.4.1. Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

2.5. FISH CORD

2.5.1. Fish cord to be made of polypropylene.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. All conduits on project to be surface mounted. Conduits are not allowed in cast in-place concrete or concrete slabs unless written consent is received from the Engineer's Representative and Owner. Only once approved by the Engineer's Representative and Owner do the clauses contained within this section and the respective sections relating to conduits in cast in-place concrete or concrete slabs apply.

3.1.2. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.1.3. Do not install conduits, associated raceway system, or devices on the surface of, or within 100 mm of the underside of roof decks.

3.1.4. Conceal conduits except in mechanical and electrical service rooms or in unfinished areas. Conduits to have their own support system and are to be supported independently of the ceiling grid or ceiling support system.

3.1.5. Where vertically run conduit passes through a slab, Contractor to provide a 100 mm high concrete pad with the pad extending 100 mm on all sides of the conduit.

Use electrical metallic tubing (EMT) conduit except where specified otherwise.

3.1.6. Use epoxy coated conduit in corrosive areas.

3.1.7. Use rigid galvanized steel threaded conduit where conduit is subject to mechanical damage.

3.1.8. Use rigid PVC conduit underground or in corrosive areas and where indicated.

3.1.9. Use flexible metal conduit for connection to motors or vibrating equipment in dry areas, connection to recessed luminaires without a prewired outlet box, connection to surface or recessed luminaires and work in movable metal partitions. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.10. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations. Use only liquid tight fittings when using liquid tight flexible metal conduit. Liquid tight flexible metal conduit to have a jacket with an FT6 rating when used in plenums otherwise provide a minimum FT4 rating. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.11. Use explosion proof flexible connection for connection to explosion proof motors.

3.1.12. Install conduit sealing fittings in hazardous areas. Fill with compound.

Minimum conduit size for lighting and power circuits: NPS 21 mm, unless otherwise noted on the Drawings.

3.1.13. Minimum conduit size for data / voice cabling: as indicated on drawings, otherwise 27 mm.

- 3.1.14. Install EMT conduit from a raised floor branch circuit panel to outlet boxes located in sub floor.
- 3.1.15. Install EMT conduit from a raised floor branch circuit panel to junction box in sub-floor. Run flexible metal conduit from junction box to outlet boxes for equipment connections in sub-floor.
- 3.1.16. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- 3.1.17. Mechanically bend steel conduit over 21 mm diameter.
- 3.1.18. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- 3.1.19. Install fish cord in empty conduits.
- 3.1.20. Run two 27 mm spare conduits up to ceiling space and two 27 mm spare conduits down to sub-floor space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes or in case of an exposed concrete slab, terminate each conduit in flush concrete or surface type box.
- 3.1.21. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- 3.1.22. Dry conduits out before installing wire.
- 3.1.23. All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Landlord and/or structural Engineer's Representative before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Landlord. Check and verify the location of existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all tenant areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebar to minimize cutting of rebar when core drilling. Provide x-ray study before drilling or cutting where required by the Landlord and/or structural Engineer's Representative.
- 3.1.24. Provide sleeves for all new conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.
- 3.1.25. Where cables and conduits pass through partitions and through floors that are not fire rated, provide an air-tight seal around the cables and conduits.
- 3.1.26. Where cables and conduits pass through floors and fire rated walls, pack space between conduit (or cable) and sleeve with an approved fire stop as specified in Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 3.1.27. Prior to installation of any wire or cable in the ducts, pull through each duct a flexible mandrel not less than 300 mm long and size for the internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Provide photo and video evidence of compliance with this clause and send to Engineer's Representative for review within 24 hours of Work occurring.

3.2. SURFACE CONDUITS

- 3.2.1. Run parallel or perpendicular to building lines.
- 3.2.2. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- 3.2.3. Run conduits in flanged portion of structural steel.
- 3.2.4. Group conduits wherever possible on suspended or surface mounted channels.
- 3.2.5. Do not pass conduits through structural members, except as indicated.
- 3.2.6. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- 3.2.7. Conduits must not be used to support other conduits.

3.3. CONCEALED CONDUITS

- 3.3.1. Run parallel or perpendicular to building lines.
- 3.3.2. Do not install horizontal runs in masonry walls.
- 3.3.3. Do not install conduits in terrazzo or concrete toppings.

3.4. CONDUITS IN CAST-IN-PLACE CONCRETE

- 3.4.1. Locate to suit reinforcing steel. Install in centre one third of slab.
- 3.4.2. Protect conduits from damage where they stub out of concrete.
- 3.4.3. Install sleeves where conduits pass through slab or wall.
- 3.4.4. Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- 3.4.5. Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- 3.4.6. Encase conduits completely in concrete with minimum 25 mm concrete cover.
- 3.4.7. Organize conduits in slab to minimize cross-overs.

3.5. CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- 3.5.1. Run conduits 27 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.6. CONDUITS UNDERGROUND

- 3.6.1. Slope conduits to provide drainage.
- 3.6.2. For all non-PVC conduits run underground, provide waterproof joints with heavy coat of bituminous paint.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. SECTION INCLUDES

- 1.2.1. Cable trays and accessories.

1.3. REFERENCES

- 1.3.1. Ontario Electrical Safety Code.
- 1.3.2. Ontario Building Code.
- 1.3.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.
- 1.3.4. CSA-C22.2 No. 126.1 – Metal Cable Tray Systems, latest edition.
- 1.3.5. CSA-C22.2 No. 126.2 – Non-metallic Cable Tray Systems, latest edition.
- 1.3.6. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel, latest edition.
- 1.3.7. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, latest edition.
- 1.3.8. ASTM A 123 – Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel, latest edition.
- 1.3.9. ASTM A 510 – Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, latest edition.
- 1.3.10. NEMA VE 1 – Metal Cable Tray Systems, latest edition.
- 1.3.11. NEMA VE 2 – Cable Tray Installation Guidelines, latest edition.
- 1.3.12. ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire, latest edition.
- 1.3.13. ASTM A 580 – Standard Specification for Stainless Steel Wire, latest edition.
- 1.3.14. ASTM D 769 – Standard Specification for Black Oxide Coatings, latest edition.

1.4. SHOP DRAWINGS AND PRODUCT DATA

- 1.4.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.4.2. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.
- 1.4.3. Product Data: Provide data for fittings and accessories.
- 1.4.4. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agencies specified under article 1.3 –References. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.5. PROJECT RECORD DOCUMENTS

- 1.5.1. As-Built Drawings to indicate actual routing of cable tray and locations of supports.

1.6. QUALIFICATIONS

- 1.6.1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years of experience.

- 1.6.2. Furnish products listed and classified by UL Inc., CSA, CUL, as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1. LADDER-TYPE CABLE TRAY

- 2.1.1. Description: CSA-C22.2 No. 126, NEMA VE 1.
- 2.1.2. Load Class: Unless otherwise noted on the drawings, cable tray shall be **Choose an item..**
- 2.1.3. Material: Hot dipped galvanized steel.
- 2.1.4. Inside Width: as indicated.
- 2.1.5. Inside Depth: 100 mm or as indicated.
- 2.1.6. Straight Section Rung Spacing: 300 mm on centre for electrical wiring or 150 mm on centre on communication cable trays.
- 2.1.7. At junctions of cable trays provide manufactured transition pieces with a bending radius equal to or larger than the width of the cable tray.
- 2.1.8. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- 2.1.9. Covers: not required unless indicated on Drawings.

2.2. WIRE BASKET SECTIONS AND COMPONENTS

- 2.2.1. Provide wire basket of types and sizes indicated; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
- 2.2.2. Materials and Finishes: Material and finish specifications for wire basket sections and components to be electrodeposited zinc plating in accordance with ASTM B 633, Type III, SC-1, with straight sections made from carbon steel wire, ASTM A 510, Grade 1008, unless one of the following finishes is noted on the drawings:
- 2.2.2.1. Stainless Steel: Straight sections and accessories shall be made from AISI Type 316L Stainless Steel meeting the minimum mechanical properties of ASTM A 580.
- 2.2.2.2. Powder Coat: Straight sections shall be powder coated black with an average paint thickness of 1.2 mils (30 microns) to 3.0 mils (75 microns). Colour to be custom and selected during shop drawing stage.
- 2.2.2.3. Hot Dipped Galvanizing: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A 510, Grade 1008 and shall be hot dipped galvanized after fabrication in accordance with ASTM A 123.
- 2.2.3. Type of Wire Basket Support System
- 2.2.3.1. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
- 2.2.3.2. Wire basket shall be made of high strength steel wires and formed into a standard 50 mm by 100 mm wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
- 2.2.3.3. Wire basket sizes shall conform to the following nominal criteria:
- 2.2.3.3.1. Straight sections shall be furnished in standard lengths.
- 2.2.3.3.2. Wire diameter shall be 5 mm minimum on all mesh sections.

- 2.2.3.3.3. Wire basket shall have a minimum usable loading depth of 100 mm unless 50 mm or 150 mm is noted on the drawings by a width noted on the drawings. If no width is detailed then 300 mm will be the minimum.
- 2.2.3.4. All fittings shall be field formed, from straight sections, in accordance with manufacturer's instructions.
- 2.2.3.5. All splicing assemblies shall be UL/CSA approved as a bonding conductor. When using powder coated wire basket as bonding conductor, the paint must be completely removed at all contact points of splice/ground bolt attachment.
- 2.2.3.6. Wire basket supports shall be trapeze hangers unless center support hangers or wall brackets are noted on the drawings. Trapeze hangers or center support hangers shall be supported by 1/4 inch or 3/8 inch diameter threaded rods or pre-engineered support systems complying with CSA C22.2 No. 18.4 "Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239)."
- 2.2.3.7. Special accessories shall be furnished as required to protect, support and install a wire basket support system.
- 2.2.4. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- 2.2.5. Covers: not required unless indicated on drawings.

2.3. WARNING SIGNS

- 2.3.1. Nameplates: 12.7 mm high black letters on yellow plastic nameplates, with the following wording:
 - 2.3.1.1. WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

2.4. MANUFACTURERS

- 2.4.1. The following are approved manufacturers:
 - 2.4.1.1. CER- Canadian Electric Raceways.
 - 2.4.1.2. Pursley.
 - 2.4.1.3. B-Line.
 - 2.4.1.4. Pilgrim.
 - 2.4.1.5. Columbia-MBF-Cope
 - 2.4.1.6. Legrand

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install in accordance with manufacturer's instructions.
- 3.1.2. Install metallic cable tray in accordance with NEMA VE 1. Install wire basket in accordance with NEMA VE-2, to ensure that the cable tray equipment complies with requirements of all applicable codes including the local electrical code.
- 3.1.3. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 3 m.
- 3.1.4. Use expansion connectors where required.
- 3.1.5. Grounding and bonding:
 - 3.1.5.1. Provide continuity between tray components.

- 3.1.5.2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
- 3.1.5.3. Provide #6 AWG bare copper bonding conductor through entire length of tray; bond to each component.
- 3.1.5.4. Connections to tray may be made using mechanical or exothermic connectors.
- 3.1.6. Install warning signs at 15.25 m centers along cable tray, located to be visible.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. SCOPE

- 1.2.1. These poke-thru devices provide the interface between power and communication cabling in an above grade concrete floor and the workstation or activation location where power and/or communication device outlets are required. These poke-thru devices provide flush device outlets that will not obstruct the floor area.

1.3. CLASSIFICATION AND USE

- 1.3.1. This poke-thru shall have been examined and tested by Underwriters Laboratories Inc. to Standard UL514A and/or UL514C and tested to Canadian Standard C22.2 and bear the cULus mark. This poke-thru device shall also have been tested by Underwriters Laboratories Inc. as to fire resistance and bear the fire classification mark. Devices shall be classified for use in 1-, 1 1/2-, or 2-hour rated, unprotected reinforced concrete floors and 1-, 1 1/2-, or 2-hour rated floors employing unprotected steel floor units and concrete toppings (D900 Series Designs) or concrete floors with suspended ceilings (fire resistive designs with suspended ceilings should have provisions for accessibility in the ceiling below the poke-thru fittings).

1.4. SHOP DRAWINGS AND PRODUCT DATA

- 1.4.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Poke-Thru Assembly. This assembly consists of an insert and an activation cover. Overall poke-thru assembly length shall be 413 mm.
 - 2.1.1.1. Insert:
 - 2.1.1.1.1. The insert body shall have the necessary channels to provide complete separation of power and communication services. There shall be one 21 mm channel for power and two 16 mm channels for communication cabling. The channels shall be arranged such that communication cables can be conduit protected and connected to the insert body using a die-cast zinc conduit connector with two 16 mm threaded openings to accept both rigid and flexible conduit connections.
 - 2.1.1.1.2. The body will consist of an intumescent fire stop material to maintain the fire-rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain fire-rating of the unit and the floor slab. The insert shall have a spring steel retaining ring that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 21 mm conduit stub that is connected to the insert body and a 402 ml stamped steel junction box for wire splices and connections. The stamped steel junction box shall also contain the necessary means to electrically ground the poke-thru assembly.
 - 2.1.1.2. Activation Cover:
 - 2.1.1.2.1. The activation cover shall be manufactured of die-cast aluminum alloy and be capable of being powder coated or plated. Coated finish to be textured, two-stage epoxy paint in gray, black, or ivory. Activation cover shall also be available in a solid brass forging. Brass finish shall be a

brushed finish with a lacquer sealant. The activation cover shall be a total of 178 mm in diameter. The activation cover slide holder shall be manufactured from textured PVC and be available in black, ivory, and brass colors. The activation slide cover shall be a total of 102 mm in diameter. The activation shall also be supplied with a 20 amp duplex receptacle prewired with three #12 THHN AWG conductors for power applications. The activation shall provide a flush cover assembly with duplex receptacle covers with spring loaded slides that snap back in place when the power receptacle is not in use.

- 2.1.1.2.2. The activation shall have two locations to mount communication connectors. Connectors shall be mounted using a mounting bracket. Mounting brackets shall be provided to mount communication connectors. The activation cover shall also provide slide covers for the two communication locations. Each communication slide cover shall close and lock into place when connector is not in use. Each communication slide shall have a location to label the communication service on the surface of the slide cover.

2.2. MANUFACTURERS

- 2.2.1. The following are approved manufacturers:
- 2.2.1.1. Legrand - Wiremold
- 2.2.1.2. Hubbell
- 2.2.1.3. NOCOM / Canadian Electrical Raceways (CER)
- 2.2.1.4. Wellmark

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Unit shall permit all wiring to be completed at floor level. Unit shall mount in a 76 mm cored-hole with a minimum diameter of 78 mm.
- 3.1.2. Use is defined by the UL Fire Resistance Directory as a minimum spacing of 610 mm on center and not more than one device per each 6 sq. m of floor area in each span.
- 3.1.3. Prior to and during installation, refer to system layout and/or approval drawings. Installer shall comply with detailed manufacturer's instruction sheet included with each device.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

- 1.2.1. Ontario Electrical Safety Code.
- 1.2.2. Ontario Building Code.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. EQUIPMENT IDENTIFICATION

- 2.1.1. Electrical equipment and accessories shall have identifiers that will consist of Lamacoid(s) permanently affixed to the equipment.
 - 2.1.1.1. Lamacoid shall have text with height as indicated below:
 - Size A: 25mm
 - Size B: 13mm
 - Size C: 6mm
 - 2.1.1.2. When identifying pieces of electrical equipment, except for breakers/switches, the Primary Lamacoid of size A shall indicate the equipment identifier tag as per Figure 2 – Numbering system for electrical equipment below. The Secondary Lamacoid of size C shall be installed immediately below the Primary and indicate the source of supply identifier tag and room number. For any subsequent requirements, refer to the specific equipment sections within this document. Allow for an average of fifty (50) to one hundred (100) letters per nameplate.
 - 2.1.1.3. Identification to be in English.
 - 2.1.1.4. Lamacoid text and background colour shall be white text on a black background, except in the following cases:
 - White background with:
 - Green text upstream of ATS or primary ATS(s) within the building for emergency source (life/non-life safety).
 - Red text for ATS(s) and equipment (life/non-life safety) downstream of ATS(s) within the building.
 - Blue text for UPS sourced equipment.
 - Red background with white text for:
 - Critical equipment
 - Safety or hazard information
 - 2.1.1.5. Sample:
 - Standard naming convention:

078-NDP-B1-06-DA

FED FROM 078-NTX-B1-41-AD

In Rm. 1008

- Equipment upstream of ATS(s) fed from the emergency source within the building, inclusive of emergency source (life/non-life safety):
- Any isolations of green labelled equipment will not result in load loss.

006-ECB-B2-06-AA

FED FROM 006-EDP-B2-06-AA

In Rm. 0022

- ATS(s) and equipment (life/non-life safety) downstream of ATS(s) within the building:
- Any isolations of red labelled equipment will result in load loss.

005-EAT-05-02-DF

FED FROM 005-EDP-03-06-DA

In Rm. 3337

- Blue text for UPS sourced equipment:

160-URP-12-02-AA

FED FROM 160-UUP-12-02-AA

In Rm. 1275

- Critical equipment or safety or hazard information:

DANGER

Operate Under Utilities Engineer's Authorization
ONLY

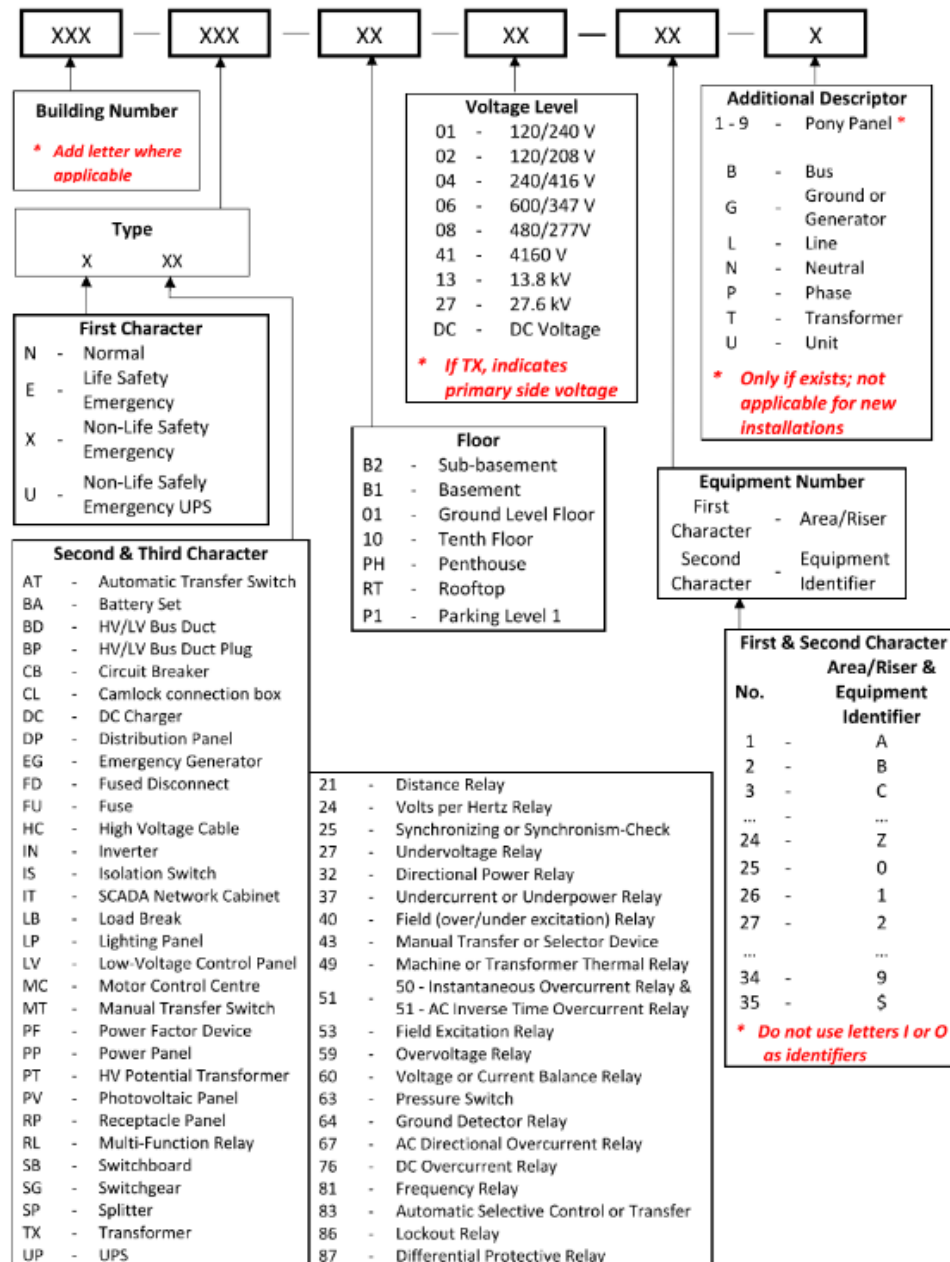
The numbering system for electrical equipment shall follow the guidelines outlined in Figure 2 – Numbering System for Electrical Equipment. Panelboard example:

- Primary Lamacoid: 155-NSB-03-02-AA

- Secondary Lamacoid: Fed from 155-NSG-B1-02-AA in room B05

Figure 2:

Numbering System for Electrical Equipment



- 2.1.1.6. Wording on nameplates to be approved by Engineer's Representative prior to manufacture.
- 2.1.1.7. Nameplates for splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.
- 2.1.1.8. Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- 2.1.1.9. Transformers: indicate capacity, primary and secondary voltages, and upstream source where Transformer is fed from.
- 2.1.1.10. Mechanical equipment: indicate equipment name and full circuit number including panel board identification.
- 2.1.1.11. Switchboards, Distribution Panels, and Panelboards: Name designation, rated ampacity, voltage, number of phases, and number of wires, if neutral is rated for 200%, interrupting capacity in units of kA, upstream source from which panelboard is fed, month and year manufactured, and serial number.
- 2.1.1.12. Automatic Transfer Switches (ATS): Name designation, rated ampacity, voltage, transfer switch arrangement (e.g. 3 pole with no neutral, 3 pole with solid neutral, 3 pole with overlapping neutral, 4 pole), withstand rating in units of kA, upstream normal power source from which ATS is fed, upstream emergency power source from which ATS is fed, month and year manufactured, and serial number.
- 2.1.1.13. Provide nameplates on all electrical equipment including:
 - 2.1.1.13.1. Splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes
 - 2.1.1.13.2. Disconnects, starters and contactors, and Mechanical equipment
 - 2.1.1.13.3. Transformers
 - 2.1.1.13.4. Switchgear, Switchboards, Distribution Panels, and Panelboards
 - 2.1.1.13.5. Automatic Transfer Switches
 - 2.1.1.13.6. Generators
 - 2.1.1.13.7. UPS equipment
 - 2.1.1.13.8. Lighting control systems
- 2.1.2. Labels:
 - 2.1.2.1. A printed label, similar to a Brady label 6 mm high letters unless specified otherwise, for internal components, such as relays, fuses, terminal blocks.

2.2. WIRING IDENTIFICATION

- 2.2.1. Identify wiring with permanent legible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- 2.2.2. Maintain phase sequence and colour coding throughout.
- 2.2.3. Colour code: in conformance with the electrical code.
- 2.2.4. Use colour coded wires in communication cables and control wiring, matched throughout system.

2.3. CONDUIT AND CABLE IDENTIFICATION

- 2.3.1. Colour code conduits, boxes and metallic sheathed cables.
- 2.3.2. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- 2.3.3. Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour:

- 2.3.3.1. up to 250 V Normal Power = Green
- 2.3.3.2. up to 600 V Normal Power = Blue
- 2.3.3.3. up to 250 V Emergency Power = Black
- 2.3.3.4. up to 600 V Emergency Power = Orange
- 2.3.3.5. High Voltage, greater than 750 V = Large independent label clearly identifying the voltage
- 2.3.3.6. Telephone/Data = White
- 2.3.3.7. Fire alarm = Red
- 2.3.3.8. Other security systems = Yellow
- 2.3.3.9. Controls = Purple

2.4. RECEPTACLE IDENTIFICATION

- 2.4.1. For health care projects, conform to requirements of Section 26 05 21.01 – PATIENT CARE WIRING.
- 2.4.2. All receptacles including systems furniture receptacles and whip connections are to be labelled with the respective circuit numbers with a printed label, similar to a Brady label, with 12 mm characters. Circuit number to include full circuit number including panel board identification.
- 2.4.3. Label to be placed on wall above cover plate or on cover plate. Location of label to be consistent throughout project.

2.5. MANUFACTURERS AND CSA LABELS

- 2.5.1. Visible and legible after equipment is installed.

2.6. WARNING SIGNS

- 2.6.1. Provide warning signs, as specified, and/or to meet the requirements of the Inspection Authorities.

2.7. FUSE SIZE LABELLING

- 2.7.1. Contractor to install a label on all equipment with fuses to identify the fuse sizes and class that are installed in the respective equipment.
- 2.7.2. Contractor to also install a label on all equipment with fuses to identify the maximum allowable fuse size based on the size of the respective feeders.

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

- 1.2.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.2.2. Submit drawings showing size, type and location of all access doors, for review, before installation.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Access doors shall be Acudor, or LeHage or Mifab. Coordinate with other trades on site. All access doors on site shall be from the same manufacturer.
- 2.1.2. Doors in solid walls shall be equal to Acudor Model UF5000 with 14 U.S. gauge, prime painted steel door panel, rust resistant concealed hinges and screwdriver operated lock .
- 2.1.3. Doors in plaster partitions or ceiling shall be equal to Acudor model AP5010 16 US gauge, prime painted steel, concealed hinges and screwdriver operated lock.
- 2.1.4. Doors in drywall partitions or ceiling shall be equal to Acudor model DW 5040, 20 US gauge, prime painted steel, concealed hinges and screwdriver operated lock .
- 2.1.5. Access doors in fire rated walls or ceilings shall be equal to Acudor Model FW 5050 and ULC labeled with insulated door panel, concealed hinge, self-closing, self-latching, and prime painted. Provide master key operated catch in areas accessible to the public.
- 2.1.6. All doors in tiled walls shall be 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock.
- 2.1.7. Minimum size of doors shall be 300 mm x 450 mm. Wherever possible 600 mm x 600 mm doors shall be used.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. All parts of the installation requiring periodic maintenance shall be accessible. Wherever pull boxes, junction boxes and other appurtenances are concealed by building construction, access doors shall be furnished by this section and installed under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.). This section is responsible for the proper location of the access doors.
- 3.1.2. Wherever possible, items requiring access shall be located in easily accessible areas (i.e. exposed or T-bar ceilings).
- 3.1.3. Group items in order to minimize the number of access doors required.
- 3.1.4. Each access door shall be installed to provide complete access to equipment for maintenance and servicing.
- 3.1.5. Make any changes to locations of access doors as directed by the Engineer's Representative.

- 3.1.6. The final installed locations of all access doors shall be shown on the As-Built Drawings.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

- 1.2.1. CSA Z462 – Workplace Electrical Safety, latest edition.
- 1.2.2. IEEE 1584 – IEEE Guide for Performing Arc Flash Hazard Calculations, latest edition.
- 1.2.3. NFPA 70E – Standard for Electrical Safety in the Workplace, latest edition.

1.3. SUMMARY

- 1.3.1. The electrical power system studies for the project shall be performed by an approved electrical power systems contractor. The type and content of each study is specified in the following articles.
- 1.3.2. The extent of the power systems studies shall include from the main utility connection down to the branch circuit panels. All relays and fuse sizes to be included to ensure the best operation of the entire system. The studies shall also be performed to include the operation of the emergency power generation system.
- 1.3.3. Contractor to label and re-label with the appropriate Client approved label all equipment that is new or the calculated values have changed from what is currently shown.

1.4. SHOP DRAWINGS AND PRODUCT DATA

- 1.4.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.4.2. Completed electrical power system studies shall be bound and submitted to the Engineer. Submit initial version(s) of the power system studies during the project shop drawing stage. Submit another “final” version of the power system studies at the end of the project utilizing the final/installed values. The study must be stamped and signed by a professional engineer in the applicable jurisdiction of the project for all submissions.
- 1.4.3. Contractor providing electrical power systems study to allow for revisions/adjustments based on review comments and actual transformer impedances.
- 1.4.4. Provide a minimum of three (3) bound coloured copies of all submissions to Owner and Engineer for review. Modify studies based on comments received and continue to re-issue until an accepted version is agreed upon.
- 1.4.5. Provide a copy of the working electronic file in native program format along with each of the final copies of the studies. Identify what software was used to complete the studies. The information contained within the project file remains the property of the owner and can be used by the Owner for future system modifications.
- 1.4.6. Provide samples of the proposed arc flash labels. All labels to match the Owners standard labels.
- 1.4.7. Contractor shall submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, contractor shall submit at a minimum a preliminary short circuit study for review.

PART 2 PRODUCT

2.1. ELECTRICAL POWER SYSTEM STUDIES

2.1.1. Short-Circuit Analysis

2.1.1.1. Calculation of maximum RMS symmetrical three-phase short-circuit and single line to ground fault current at each significant location in the electrical system shall be made using a digital computer.

2.1.1.2. Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the computer calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.

2.1.1.3. A tabular computer printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.

2.1.1.4. The study shall include a computer printout of input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.

2.1.1.5. Include a computer printout identifying the maximum available short-circuit current in RMS symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.

2.1.1.6. The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.

2.1.1.7. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for the improvements to the system.

2.1.1.8. The contractor shall be responsible for supplying conductor information (lengths, types, number per phase, etc.) in a timely manner to allow the short-circuit analysis to be completed prior to final installation.

2.1.1.9. Any inadequacies shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.

2.1.2. Protective Device Time-Current Coordination Analysis

2.1.2.1. The time-current coordination analysis shall be performed with the aid of a digital computer and will include the determination of settings, ratings, or types for the over-current protective devices supplied.

2.1.2.2. A sufficient number of computer generated log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected over-current devices and other pertinent system parameters.

2.1.2.3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.

2.1.2.4. The study shall include a separate, tabular computer printout containing the suggested device settings of all adjustable over-current protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.

- 2.1.2.5. A computer generated system one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
- 2.1.2.6. A discussion section which evaluates the degree of system protection and service continuity with over-current devices, along with recommendations as required for increasing system protection or device coordination.
- 2.1.2.7. Significant deficiencies in protection and/or coordination shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified.
- 2.1.3. Power Factor Correction Study

A Power Factor Correction Study shall be performed to determine the appropriate level of compensation needed to achieve the desired power factor.

Impacts on harmonic and transient concerns shall be evaluated in order to determine the optimum size and configuration of the equipment.

The study shall make appropriate recommendations in order to provide proper operation of the electrical system.

The study shall be based on Choose an item.in order to characterize the power factor of the system over a period of time and under varying load conditions.

System loading tables shall be provided which include power factor data and estimated levels of power factor compensation provided.

Evaluation of system operation using the estimated levels of compensation will be provided with consideration to harmonic and transient concerns.

Final levels of compensation will be determined and used as the base case condition for the harmonic and transient studies.

All conclusions, recommendations, and equipment specifications as a result of the Power Factor Correction Study will be summarized in the final report.

- 2.1.4. Arc Flash/Incident Energy Study
 - 2.1.4.1. An Arc Flash/Incident Energy Study shall be performed to determine the incident energy and arc flash protection boundary at each piece of electrical equipment and to identify the level of PPE required by people working on that respective equipment.
 - 2.1.4.2. The study shall take into account all the information set forth in the short circuit study and the coordination study. Contractor to use the minimum and maximum fault currents provided by the utility to determine the worst incident energy levels. Provide two columns in your arc flash summary sheet identifying the current at both fault levels. Contractor to revisit the coordination study and revise coordination to provide the minimum incident energy levels as possible. Provide recommendations to reduce the incident energy levels even further at the risk of affecting the coordination to allow Owner and Engineer's Representative to review options and provide feedback.
 - 2.1.4.3. Calculate the arc flash hazard, incident energy level and the flash protection boundary as per IEEE 1584. PPE level recommendations as per NFPA 70E / CSA Z462.
 - 2.1.4.4. All electrical equipment to be identified with the incident energy, flash protection boundary and level of PPE required.
 - 2.1.4.5. Purpose made labels to be provided on all electrical equipment. All equipment where levels were not calculated are to be provided with a standard warning label. Label samples to be submitted for review by Owner and Engineer's Representative.

2.2. APPROVED ELECTRICAL POWER SYSTEMS CONTRACTORS

- 2.2.1. The power system studies shall be completed by qualified and experienced personnel.

- 2.2.2. The specified electrical power system studies shall be performed by:
- 2.2.2.1. G.T. Wood.
 - 2.2.2.2. K-Line – K-Tek.
 - 2.2.2.3. Schneider-Electric Services.
 - 2.2.2.4. Eaton - Cutler-Hammer Service Group.
 - 2.2.2.5. Pelikan Inc.
 - 2.2.2.6. General Electric (GE).
 - 2.2.2.7. Eastenghouse.
 - 2.2.2.8. AC Tesla.
 - 2.2.2.9. Brosz Technical Services.
 - 2.2.2.10. Enkompass Power and Energy Corp.

PART 3 EXECUTION

3.1. GENERAL

- 3.1.1. Contractor to include for all on site surveys and investigations in order to obtain all the relevant information to complete all the studies.

The relays and equipment will be set up on site by the Technical Services Division Startup Service Contractor. Coordinate with this Contractor to ensure information is relayed accordingly.

Review work on site to ensure equipment has been set up as per the coordination study. Have the Technical Services Division Startup Service Contractor test systems at random to ensure the coordination study has been adhered to.

- 3.1.2. Submit a report and a letter reporting to the Engineer and Owner that the coordination study information has been followed.
- 3.1.3. Contractor to revise fuse sizes as identified in the report and modify the drawings to represent as-built conditions.

3.2. LABELLING

- 3.2.1. Install arc flash labels on all equipment. Coordinate with the electrical contractor.

3.3. TRAINING

- 3.3.1. Provide one day of in-depth training on arc-flash safety detailing the industry and code requirements including the details of the specific project for the Owner and the Owner's representatives.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Sleeves passing through stud partitions shall be 0.75 mm 22 US Gauge steel.
- 2.1.2. Sleeves passing through masonry walls shall be Schedule 40 steel pipe.
- 2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal or factory fabricated reusable type.
- 2.1.4. Where a housekeeping pad cannot be installed, sleeves passing through floors with waterproof membrane shall have a flashing collar, 50 mm wide at the membrane level. Flashing collar shall be continuously welded to sleeve. Sleeves shall extend 50 mm above the finished floor and shall be Schedule 40 steel pipe.
- 2.1.5. Where conduits pass through exterior foundation walls 6 mm thick steel sleeve of inside diameter not less the 75 mm greater than the outside diameter of the pipe shall be used and shall be complete with anchor collar. Thunderline Link-Seal wall seal or approved equal shall be used for the annular space between the sleeve and the conduit. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.
- 2.1.6. Provide adequate bracing for support of sleeves during concrete and masonry work.
- 2.1.7. Unless otherwise specified on the drawings, sleeves passing through the roof shall be liquid tight flexible conduit flashing consisting of a gooseneck shaped aluminum flashing sleeve with an integral deck flange, EPDM end cap seal and EPDM base seal.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Electrical Division for the Electrical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.
- 3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer's Representative.
- 3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers. At non-rated barriers fill the annular space between the service and the sleeve with fire rated insulation as specified for rated separations and caulk around the edges with a minimum 12 mm thick of fire rated compound or acoustic non-setting mastic.
- 3.1.4. Through all fire or smoke separations, after testing, the annular space between conduit sleeves shall be fire stopped.

- 3.1.5. Where-holes are to be installed in existing structure, contractor is to core drill the-holes required. Contractor is required to scan all areas prior to coring and confirm layout with structural engineer prior to completing work. When installing sleeves in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.
- 3.1.6. All sleeves are to extend 150 mm above finished floor to accommodate a 100 mm concrete pad. Contractor to pour the concrete pad with the pad extending 100 mm on all sides of the sleeve.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Div. 00, and Section 26 05 01, and shall be carried out by experienced workers.
- 2.1.2. Include for all cutting and patching for all Electrical services.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Cut all openings no larger than is required for the services. Core drill for individual services.
- 3.1.2. Obtain approval from the structural Engineer's Representative before cutting or core drilling any openings or-holes in slabs or structural elements.
- 3.1.3. Locate all openings in structure elements requiring cutting and patching, and x-ray the structure to obtain Structural Engineer's Representative's approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar, and completely avoiding electrical conduit.
- 3.1.3.1. Cut-holes through slabs only.
- 3.1.3.2. Do not cut-holes through beams.
- 3.1.3.3. Holes to be cut are 200 mm (Diameter) or smaller only.
- 3.1.3.4. Maintain at least 100 mm clear from all beam faces. Space at least 3-hole diameters on Centre.
- 3.1.3.5. For-holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.
- 3.1.3.6. For-holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.
- 3.1.4. X-ray scanning:
- 3.1.4.1. X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity. The company shall be licensed by the Canadian Nuclear Safety Commission (CNSC), and all radiography work shall be performed in accordance with the Nuclear Safety and Control Act.
- 3.1.4.2. Follow any safety requirements stipulated by the property manager.
- 3.1.4.3. Minimum requirements: All people must be evacuated within a radius of 10 m from each exposure location. Prior to conducting exposures verify this "safe zone". If the 10 m radius includes public areas such as a sidewalk, lobby, or elevator, these areas must be controlled (e.g. elevators shut down or prevented from stopping on floors at which exposures are taking place). In addition, if exposure locations are near the walls of adjacent tenants, ensure the notification and evacuation of people within the 10 m radius. The 10 m radius applies to the camera floor and the floor directly below only. The qualified technician shall ensure adequate precautions for the additional floors above and below the camera floor.
- 3.1.5. Patch all openings after services have been installed to match the surrounding finishes.

- 3.1.6. In existing areas all cutting, and core drilling for individual services except where specifically noted, is part of this division work.
- 3.1.7. The cost of x-ray scanning, cutting, patching and finishing is included in this division contract.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 73 – ELECTRICAL POWER SYSTEM STUDIES.
- 1.1.3. Section 26 05 14 – POWER CABLE AND OVERHEAD CONDUCTORS
- 1.1.4. Section 26 05 21 – WIRES AND CABLES UNDER 2000 V
- 1.1.5. Section 26 05 26 – GROUNDING AND BONDING
- 1.1.6. Section 26 09 24 – LIGHTING CONTROL EQUIPMENT – LOW VOLTAGE
- 1.1.7. Section 26 12 13 – LIQUID FILLED, MEDIUM VOLTAGE TRANSFORMERS
- 1.1.8. Section 26 12 16 – DRY TYPE POWER TRANSFORMERS
- 1.1.9. Section 26 12 19 – PAD MOUNTED, LIQUID FILLED, MEDIUM VOLTAGE TRANSFORMERS
- 1.1.10. Section 26 13 13 – METAL CLAD SWITCHGEAR
- 1.1.11. Section 26 13 17 – METAL ENCLOSED SWITCHGEAR
- 1.1.12. Section 26 23 00 – SECONDARY SWITCHGEAR
- 1.1.13. Section 26 24 02 – SERVICE ENTRANCE BOARD
- 1.1.14. Section 26 24 13 – SWITCHBOARDS
- 1.1.15. Section 26 24 19 – MOTOR CONTROL CENTRES
- 1.1.16. Section 26 25 00 – BUSWAYS
- 1.1.17. Section 26 27 02 – SURGE PROTECTION DEVICE
- 1.1.18. Section 26 28 17 – AIR CIRCUIT BREAKERS
- 1.1.19. Section 26 28 18 – ADVANCED HIGH RESISTANCE GROUNDING SYSTEM
- 1.1.20. Section 26 33 53 – UNINTERRUPTIBLE POWER SYSEMS - STATIC
- 1.1.21. Section 26 28 21 – MOULDED CASE CIRCUIT BREAKERS
- 1.1.22. Section 26 32 14 – POWER GENERATION – DIESEL
- 1.1.23. Section 26 36 23 – AUTOMATIC LOAD TRANSFER EQUIPMENT

1.2. REFERENCE

- 1.2.1. ANSI/NETA ATS 2021 - Standard for Acceptance Testing Specifications for Electrical Power Equipment & Systems, latest edition.

1.3. OVERVIEW

- 1.3.1. As part of this project, start-up services will be performed on the electrical distribution and control equipment as specified. This specification is intended as a part of the electrical portion of this project.
- 1.3.2. The start-up service company must follow jobsite electrical safety requirements, installation standards and electrical testing standards.

- 1.3.3. Documentation of all procedures performed shall be provided. 3 copies shall be provided and forwarded to the engineer. Written documentation must contain recorded test values of all electrical tests performed per the individual product specification.
- 1.3.4. Include a copy of all procedures and test results in the operating and maintenance manual.
- 1.3.5. Start-up service scheduling must be available through a 24 hour, toll free national dispatch system.
- 1.3.6. The start-up service company shall be present when the distribution equipment is energized. Jobsite and equipment access must be provided by the electrical contractor.
- 1.3.7. The contractor shall supply a power source, specified by the start-up service company, for on-site test equipment.
- 1.3.8. The contractor is to attend all factory witness testing required within the respective specification sections. The contractor is responsible to cover all their costs and include them in their bid.
- 1.3.9. The contractor is to set-up and test all devices as defined in the reports produced under specification Section 26 05 73 – ELECTRICAL POWER SYSTEM STUDIES.

PART 2 PRODUCT

2.1. GENERAL

- 2.1.1. Conduct the following tests, at time suitable to Engineer, with Engineer present as witness.
- 2.1.2. Perform tests using qualified personnel. Provide necessary instruments and equipment.

2.2. INSPECTION AND TEST PROCEDURES

- 2.2.1. Perform all testing identified in the ANSI/NETA ATS standard in addition to the following tests.
- 2.2.2. Wires and Cables Under 2000 V
 - 2.2.2.1. Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 mega-ohms.
 - 2.2.2.2. Insulation resistance is checked phase-to-phase, phase-to-ground, and across open contacts at 1000 VDC.
 - 2.2.2.3. Tabulate a list of all feeders and test results, and submit for approval.
- 2.2.3. Switchgear and Switchboard Assemblies
 - 2.2.3.1. Visual and Mechanical Inspection
 - 2.2.3.1.1. Assemblies shall be inspected for physical damage.
 - 2.2.3.1.2. Bussing compartment inspection shall include the following:
 - 2.2.3.1.2.1. Check tightness of accessible bolted bus joints by torque wrench method.
 - 2.2.3.1.2.2. Check insulators for cracks and contamination.
 - 2.2.3.1.3. All electrical, key, and mechanical interlock systems shall be verified for correct operation.
 - 2.2.3.1.4. Closure shall be attempted on locked open devices. Opening/withdrawal attempt shall be made on locked closed devices.
 - 2.2.3.1.5. Mechanical operations of circuit breaker in cell shall be checked and auxiliary devices activated.
 - 2.2.3.1.6. Draw-out trays, contact alignment, ease of operation, proper grounding, and interlocks shall be checked.

- 2.2.3.1.7. Circuit breaker cell shall be inspected for contamination, physical damage, loose hardware, shutter mechanism, control plug, guide rail, floor nameplates, ground bus, auxiliary contacts, and linkages.
- 2.2.3.1.8. Circuit breaker shall be inspected for contamination, physical damage, main finger/stab penetration and secondary connections.
- 2.2.3.2. Electrical Tests
 - 2.2.3.2.1. Insulation resistance of each bus section shall be measured phase-to-phase and phase-to-ground.
 - 2.2.3.2.2. Over-potential test shall be performed for each bus section, phase-to-phase and phase-to-ground for medium voltage equipment,
 - 2.2.3.2.3. Electrical operation of the circuit breaker shall be checked in the test and connected position.
 - 2.2.3.2.4. The control power source shall be checked.
 - 2.2.3.2.5. The circuit breaker control scheme shall be tested.
 - 2.2.3.2.6. A phasing check shall be made on double-ended and/or emergency source switchgear at tie points to ensure correct bus phasing.
- 2.2.3.3. Test Values
 - 2.2.3.3.1. Bolt torque levels are checked in accordance with manufacturer's specifications.
 - 2.2.3.3.2. Insulation resistance testing is to be performed in accordance with the manufacturer's recommendations.
- 2.2.4. Circuit Breaker-Low Voltage Draw-out, Or Fixed Insulated Case
 - 2.2.4.1. Visual and Mechanical Inspection
 - 2.2.4.1.1. Inspect physical condition, cleanliness and nameplate compliance with single-line diagram.
 - 2.2.4.1.2. Check draw-out mechanism, lubrication and grounding (if applicable).
 - 2.2.4.1.3. Check all indicating devices for proper operation.
 - 2.2.4.1.4. Check cell fit and element alignment.
 - 2.2.4.1.5. Check primary stab penetration (if applicable).
 - 2.2.4.1.6. Check secondary connections with the circuit breaker in the connected and test positions (if applicable).
 - 2.2.4.1.7. Bolt torque levels are checked on all accessible hardware in accordance with manufacturer's specifications.
 - 2.2.4.2. Electrical Tests
 - 2.2.4.2.1. Contact resistance is to be measured.
 - 2.2.4.2.2. Insulation resistance is checked phase-to-phase, phase-to-ground, and across open contacts at 1000 VDC.
 - 2.2.4.2.3. Minimum long-time pick-up current is determined when possible; delay time determined at 300% of pick-up by secondary injection.
 - 2.2.4.2.4. Short-time pickup and time delay is determined by secondary injection.
 - 2.2.4.2.5. Instantaneous pickup current is determined by secondary injection.
 - 2.2.4.2.6. Ground fault pickup current and time delay is determined by secondary injection.

- 2.2.4.2.7. Trip unit reset characteristics are verified.
- 2.2.4.2.8. Final settings are made in accordance with customer's prescribed settings.
- 2.2.4.2.9. Auxiliary devices, such as under voltage relays, blown main fuse detector, shunt close, shunt trip, spring charging motor, and auxiliary contacts are activated to ensure operation as applicable.
- 2.2.4.2.10. Secondary Current Injection shall be performed on the power circuits.
- 2.2.5. Circuit Breaker-Low Voltage (Molded Case)
 - 2.2.5.1. Visual and Mechanical Inspection.
 - 2.2.5.1.1. Circuit breaker is checked to insure smooth operation.
 - 2.2.5.1.2. The case is inspected for cracks or other defects.
 - 2.2.5.1.3. Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.
 - 2.2.5.2. Electrical Tests on Breakers of 100 Amps or Larger
 - 2.2.5.2.1. Contact resistance is to be measured.
 - 2.2.5.2.2. Insulation resistance is checked at 1000 VDC for one minute from pole to pole and from each pole to ground and across open contacts of each phase.
 - 2.2.5.2.3. Test trip release on each circuit breaker.
 - 2.2.5.2.4. Minimum long-time pick-up current is determined when possible. Long-time delay is determined by secondary current injection method at 300% of rating.
 - 2.2.5.2.5. Instantaneous pick-up current determined by secondary injection using run-up or pulse method.
- 2.2.6. Power and Insulated Case Circuit Breakers-Low Voltage
 - 2.2.6.1. Visual and Mechanical Inspection.
 - 2.2.6.1.1. Check mechanical operation.
 - 2.2.6.1.2. Cell fit and element alignment is to be checked.
 - 2.2.6.1.3. Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.
 - 2.2.6.1.4. Check arc chutes for foreign matter, cracks and secure installation.
 - 2.2.6.1.5. Clean primary contact surfaces and lubricate if required.
 - 2.2.6.2. Electrical Tests
 - 2.2.6.2.1. Contact resistance is to be measured.
 - 2.2.6.2.2. Insulation resistance is checked at 1000 VDC for one (1) minute from pole to pole and from each pole to ground and across open contacts of each phase.
 - 2.2.6.2.3. Minimum long-time pick-up current is determined when possible; delay time is determined at 300% of pick-up by secondary injection.
 - 2.2.6.2.4. Short-time pick-up and time delay is determined by secondary injection.
 - 2.2.6.2.5. Instantaneous pick-up current is determined by secondary injection.
 - 2.2.6.2.6. Ground-fault pick-up current and delay is determined by secondary injection.
 - 2.2.6.2.7. Trip unit reset characteristics are verified.
 - 2.2.6.2.8. Final settings are made in accordance with Engineer's prescribed settings.

- 2.2.6.2.9. Auxiliary devices, such as under voltage relays, blown main fuse detector, shunt close, shunt trip, spring charging motor and auxiliary contacts are activated to ensure operation as applicable.
- 2.2.6.2.10. All functions of the trip units will be tested with test kits.
- 2.2.6.2.11. Secondary Current Injection shall be performed on the power circuits.
- 2.2.7. Air Switches - Low and Medium Voltage
 - 2.2.7.1. Visual and Mechanical Inspection
 - 2.2.7.1.1. Inspect the switch for physical damage, proper installation, anchorage, and grounding.
 - 2.2.7.1.2. Inspect interior insulation arc chutes and interphase barriers.
 - 2.2.7.1.3. Perform mechanical operator tests. Clean and lubricate as necessary.
 - 2.2.7.1.4. Check blade alignment and arc interrupter operation.
 - 2.2.7.1.5. Check the fuse linkage and element for proper holder and current rating. Record the fuse data.
 - 2.2.7.1.6. Check key interlock for safe operation and proper key distribution.
 - 2.2.7.2. Electrical Tests
 - 2.2.7.2.1. Over-potential test voltages are applied phase-to-phase and phase-to-ground.
 - 2.2.7.2.2. Contact resistance is measured across each switch blade and fuse line, measured in micro-ohms.
 - 2.2.7.2.3. Perform insulation resistance test on each phase-to-ground and from phase-to-phase.
- 2.2.8. Protective Relays
 - 2.2.8.1. Visual and Mechanical Inspection
 - 2.2.8.1.1. Inspect relays for physical damage, presence of foreign material and moisture.
 - 2.2.8.1.2. Check conditions of spiral spring, disc clearance and corrosion (if present). Inspect cover glass interior and relay components.
 - 2.2.8.1.3. Check for mechanical freedom of movement, proper travel and alignment, and tightness of mounting hardware and tap screws.
 - 2.2.8.2. Electrical Tests
 - 2.2.8.2.1. This test is only performed on wiring to non-solid state relays
 - 2.2.8.2.2. The following tests are performed at settings specified by the Engineer:
 - 2.2.8.2.2.1. Pickup parameters on each operating element.
 - 2.2.8.2.2.2. Timing at three (3) points on the time dial curve.
 - 2.2.8.2.2.3. Pickup target and seal in units.
 - 2.2.8.2.2.4. Operation of restraint, directional, and other elements are checked as required.
 - 2.2.8.2.3. Phase angle and magnitude contribution tests are performed on all differential and directional type relays, once energized, to prove proper polarity and connection.
- 2.2.9. Instrument Transformers
 - 2.2.9.1. Visual and Mechanical Inspection
 - 2.2.9.1.1. Inspect for physical damage and compliance with single-line diagram.
 - 2.2.9.1.2. Check mechanical clearance and proper operation of all disconnecting and grounding devices.
 - 2.2.9.1.3. Verify proper operation of grounding or shorting devices.

- 2.2.9.2. Electrical Tests
 - 2.2.9.2.1. Current transformer ratio is measured by primary current injection, or voltage method.
 - 2.2.9.2.2. Potential transformer ratio is measured.
 - 2.2.9.2.3. Insulation resistance is measured primary to ground, secondary to ground, and primary to secondary.
 - 2.2.9.2.4. Secondary wiring connections are verified by secondary current injection.
 - 2.2.9.2.5. Transformer polarity markings are verified.
- 2.2.10. Grounding Systems
 - 2.2.10.1. Visual and Mechanical Inspection.
 - 2.2.10.1.1. Inspect ground system for compliance with plans and specifications.
 - 2.2.10.2. Electrical Tests.
 - 2.2.10.2.1. The fall of potential test is performed per IEEE Standard No. 81, Section 9.04 on the main ground electrode or system.
 - 2.2.10.2.2. The two (2) point method test is performed per IEEE Standard No. 81, Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or derived neutral points.
- 2.2.11. Ground Fault Systems
 - 2.2.11.1. Visual and Mechanical Inspection.
 - 2.2.11.1.1. Monitor panels (if present) shall be manually operated for both trip test and no trip test.
 - 2.2.11.2. Electrical Tests.
 - 2.2.11.2.1. System neutral insulation resistance is measured to insure no shunt ground paths exist. The neutral ground disconnect link is removed, neutral insulation resistance measured and the link replaced.
 - 2.2.11.2.2. The relay pickup current is determined by primary injection at the sensor and the circuit interrupting device operated.
 - 2.2.11.2.3. The relay timing is tested by injecting one hundred fifty percent (150%) and three hundred percent (300%) of pickup current into sensor. Total trip time is electrically monitored.
 - 2.2.11.2.4. Zone interlock systems are tested by simultaneous sensor current injection and monitoring zone blocking function.
 - 2.2.11.2.5. Verify that system will operate at 57% rated control voltage (if applicable).
 - 2.2.11.3. Test Parameters.
 - 2.2.11.3.1. System neutral insulation resistance will be a minimum of preferably one (1) mega-ohm or greater.
 - 2.2.11.3.2. Relay pickup current will be within ten percent (10%) of device dial or fixed setting, and in no case greater than twelve hundred (1200) amperes.
 - 2.2.11.3.3. Relay timing will be in accordance with published time-current characteristic curves, but in no case longer than one (1) second.
- 2.2.12. Metering and Instrumentation
 - 2.2.12.1. Visual and Mechanical Inspection.
 - 2.2.12.1.1. Verify meter connections in accordance with single-line meter and relay diagram.

- 2.2.12.1.2. Inspect for physical damage.
- 2.2.12.2. Electrical Tests.
- 2.2.12.2.1. Ammeter accuracy is checked using current injection.
- 2.2.12.2.2. Voltmeter accuracy checked.
- 2.2.13. Motor Control Centers
- 2.2.13.1. Visual and Mechanical Inspection.
- 2.2.13.1.1. Inspect the MCC for physical damage, proper anchorage and grounding.
- 2.2.13.1.2. Compare equipment nameplate data with design plans.
- 2.2.13.1.3. Compare overload heaters with motor full load current for proper size.
- 2.2.13.1.4. Bolt torque levels are checked in accordance with manufacturer's or CSA Standards specifications.
- 2.2.13.2. Electrical Tests.
- 2.2.13.2.1. The following insulation tests are performed:
- 2.2.13.2.2. Insulation resistance of each bus section is measured phase-to-phase and phase-to-ground for one (1) minute.
- 2.2.13.2.3. Insulation resistance of each starter section is measured phase-to-phase and phase-to-ground with the starter contacts closed and the protective device open.
- 2.2.13.2.4. Insulation resistance of each control circuit is measured with respect to ground.
- 2.2.13.3. Control devices are initiated to check proper operation.
- 2.2.13.4. Motor overload units are to be tested by injecting secondary current through the overload unit and monitoring trip time.
- 2.2.14. Transformers-Dry Type
- 2.2.14.1. Visual and Mechanical Inspection.
- 2.2.14.1.1. Verify the operation of auxiliary devices, such as fans, pumps, sudden pressure device, indicators, tap changer, and gas pressurization system.
- 2.2.14.1.2. Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.
- 2.2.14.1.3. Inspect primary and secondary connections for tightness and for signs of overheating.
- 2.2.14.1.4. Inspect and clean bushings and insulators.
- 2.2.14.1.5. Check fuses for correctness of type and size.
- 2.2.14.1.6. Check for grounding and neutral continuity between primary and secondary circuits of transformer.
- 2.2.14.2. Tests shall be conducted in accordance with the provisions of ANSI C57.12.91.
- 2.2.14.3. As a minimum perform the following tests:
- 2.2.14.3.1. Resistance Measurements
- 2.2.14.3.2. Turns ratio test is performed between windings for all tap positions.
- 2.2.14.3.3. Polarity and phase rotation.
- 2.2.14.3.4. Excitation Current and no load losses on rated voltage and 110% of rated voltage.

- 2.2.14.3.5. Impedance and load loss.
- 2.2.14.3.6. Applied potential.
- 2.2.14.3.7. Induced potential.
- 2.2.14.3.8. Pressure test.
- 2.2.14.3.9. Core insulation test.
- 2.2.14.3.10. Insulation power factor test prior to transformer start-up to establish baseline values, per procedure noted in IEEE C57.12.91.
- 2.2.14.3.11. Insulation resistance tests are performed winding to winding and winding to ground.
- 2.2.14.4. Carry out following insulation tests using a 1,000 V megger with 20,000 mega-ohm scale and resulting insulation resistance corrected to base of 20 deg. C. (68 deg. F.).
 - 2.2.14.4.1. High voltage to ground with secondary grounded for duration of test.
 - 2.2.14.4.2. Low voltage to ground with primary grounded for duration of test.
 - 2.2.14.4.3. High to low voltage.
- 2.2.14.5. Summarize all results in a report for Engineer's Representative's review and include final report in Operating and Maintenance Manuals.
- 2.2.15. Transformer-Liquid Filled.
 - 2.2.15.1. Visual and Mechanical Inspection.
 - 2.2.15.1.1. Verify the operation of auxiliary devices, such as fans, pumps, sudden pressure device, indicators, tap changer, and gas pressurization system.
 - 2.2.15.1.2. Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.
 - 2.2.15.1.3. Check all liquid in tank and bushings for proper level.
 - 2.2.15.1.4. Inspect primary and secondary connections for tightness and for signs of overheating.
 - 2.2.15.1.5. Inspect and clean bushings and insulators.
 - 2.2.15.1.6. Check oil level and temperature indicators.
 - 2.2.15.1.7. Check fuses for correctness of type and size.
 - 2.2.15.1.8. Check for grounding and neutral continuity between primary and secondary circuits of transformer.
 - 2.2.15.2. Tests shall be conducted in accordance with the provisions of ANSI C57.12.90.
- 2.2.15.3. As a minimum perform the following tests:
 - 2.2.15.3.1. Resistance Measurements
 - 2.2.15.3.2. Turns ratio test is performed between windings for all tap positions.
 - 2.2.15.3.3. Polarity and phase rotation.
 - 2.2.15.3.4. Excitation Current and no load losses on rated voltage and 110% of rated voltage.
 - 2.2.15.3.5. Impedance and load loss.
 - 2.2.15.3.6. Applied potential.
 - 2.2.15.3.7. Induced potential.

- 2.2.15.3.8. Pressure test.
- 2.2.15.3.9. Core insulation test.
- 2.2.15.3.10. Insulation power factor test per procedure noted in IEEE C57.12.91.
- 2.2.15.3.11. Insulation resistance tests are performed winding to winding and winding to ground.
- 2.2.15.3.12. A sample of the insulation oil to be forward to a laboratory and tested. The results are to be included with the testing reports for the transformer and are to be included in the manuals.
- 2.2.15.4. Carry out following insulation tests using a 10,000 V megger with 20,000 mega-ohm scale and resulting insulation resistance corrected to base of 20 deg. C. (68 deg. F.).
 - 2.2.15.4.1. High voltage to ground with secondary grounded for duration of test.
 - 2.2.15.4.2. Low voltage to ground with primary grounded for duration of test.
 - 2.2.15.4.3. High to low voltage.
- 2.2.15.5. Summarize all results in a report.
- 2.2.16. Metal Enclosed Bus Duct - Low And High Voltage
 - 2.2.16.1. Visual and Mechanical Inspection.
 - 2.2.16.1.1. Inspect the bus for physical damage and proper connection in accordance with single-line diagram.
 - 2.2.16.1.2. Inspect for proper bracing, suspension alignment, and enclosure ground.
 - 2.2.16.1.3. Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.
 - 2.2.16.2. Electrical Tests
 - 2.2.16.2.1. Measure insulation resistance of each bus run phase-to-phase and phase-to-ground for one (1) minute.
 - 2.2.16.2.2. Over potential test voltages are applied on each bus run phase-to-phase and phase-to-ground.
 - 2.2.16.2.3. Phase rotation and phase cross voltage tests are performed on each bus tie section energized by separate sources. (Must be performed when bus sections are de-energized from their permanent sources.)
- 2.2.17. Cables - High Medium Voltage
 - 2.2.17.1. Visual and Mechanical Inspection
 - 2.2.17.1.1. Inspect exposed cable section for tracking corona or physical damage.
 - 2.2.17.1.2. Inspect shield grounding, cable support, and termination.
 - 2.2.17.1.3. Apply grounds upon completion to drain all absorbed potential to zero volts.
 - 2.2.17.2. Pre-acceptance tests:
 - 2.2.17.2.1. After installing cable but before splicing and terminating, perform insulation resistance test with 10000 V megger on each phase conductor.
 - 2.2.17.2.2. Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
 - 2.2.17.2.3. Verify phasing of cabling.
 - 2.2.17.3. Acceptance Tests:
 - 2.2.17.3.1. Electrical Tests (New continuous cable i.e. Not spliced to old cable)

- 2.2.17.3.1.1. A dc hi-potential to be applied in at least five (5) equal increments until maximum test voltage is reached. DC leakage current to be recorded at each step after a constant stabilization time, consistent with system charging current delay.
- 2.2.17.3.1.2. Perform shield continuity test.
- 2.2.17.3.1.3. Terminations to be corona suppressed by guard ring, field reduction sphere or other suitable methods.
- 2.2.17.3.1.4. Each conductor to be individually tested with all other conductors grounded. All shields are to be grounded.
- 2.2.17.3.1.5. Perform dc hi-potential test using step voltage method. Maximum test voltage shall be in accordance to the ICEA and manufacturer's recommended levels.
- 2.2.17.3.2. Existing Cables
- 2.2.17.3.2.1. Existing cables insulation resistance to be tested using a 10kV megger before cables are cut into for splicing and again after splicing of new cables is complete prior to being re-energized.
- 2.2.18. Adjustable Frequency Drives
- 2.2.18.1. Visual and Mechanical Inspection.
- 2.2.18.1.1. Inspect controller for physical damage.
- 2.2.18.1.2. Inspect for proper grounding.
- 2.2.18.1.3. Check customer cables, power wiring and control wiring to insure correct installation.
- 2.2.18.1.4. Check for proper heaters used in ISO/Bypass unit.
- 2.2.18.1.5. Check transformer taps for proper connection.
- 2.2.18.1.6. Check all terminal wiring.
- 2.2.18.1.7. Verify motor and drive sizing.
- 2.2.18.2. Electrical Tests.
- 2.2.18.2.1. Verify input voltages.
- 2.2.18.2.2. Verify all transformer output voltages.
- 2.2.18.2.3. Test all pilot devices, e.g., lights, speed pots, meters.
- 2.2.18.2.4. Check DIP switches for proper setup.
- 2.2.18.2.5. Calibrate max speed.
- 2.2.18.2.6. Set up acceleration and deceleration potentiometers to application.
- 2.2.18.2.7. Set up hand minimum speed.
- 2.2.18.2.8. Calibrate all meters.
- 2.2.18.2.9. Align drive to customer's automatic control signal.
- 2.2.18.2.10. Assist in proper connection of alarm, smoke detectors, and remote devices.
- 2.2.18.2.11. Check for proper motor rotation.
- 2.2.18.2.12. Set up all option cards.
- 2.2.18.2.13. Operate drive at all allowable speed and load conditions.
- 2.2.18.2.14. Configure snip out resistors.

2.2.18.2.15. Confirm ISO/Bypass unit operation.

2.3. INFRARED SCANNING

2.3.1. Two months after the occupancy of the building by the Owner the Contractor is to infrared scan the entire electrical distribution system up to and including all panelboards.

2.3.2. Contractor to re-scan the entire electrical distribution system up to and including all panelboards two months prior to the completion of the warranty period.

2.3.3. Contractor to use current infrared detection technology.

2.3.4. Contractor is to provide a complete report, identifying areas of concern. Contractor to provide copies of all infrared video taken on USB stick to the Owner for their records.

2.3.5. Electrical Contractor is to repair any loose connection/terminations or replace any faulty equipment under warranty.

2.4. REPORTS

2.4.1. Provide Engineer's Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

2.4.2. Technical Services Division Startup Service Contractor shall submit to the consultant a report, in addition to the test reports, summarizing their acceptance that all tests were completed to the satisfaction of the Technical Services Division Startup Service Contractor following each factory witness test and each on-site test. Append all factory test reports as an appendix to this report.

2.4.3. Manufacturer is responsible to cover all costs incurred due to failure of equipment during factory testing, including but not limited to, additional travel and accommodation expenses and extra time to witness tests.

2.4.4. Assemble all testing results into a common binder and organize based on specification sections. Include all manufacturer testing results. Submit 3 copies of this manual along with the Operation and Maintenance manuals.

2.5. ACCEPTABLE CONTRACTORS

2.5.1. The Technical Services Division Startup Service Contractor shall have a minimum of 5 years of experience in performing similar services.

2.5.2. The work in this section is to be performed by:

2.5.2.1. Schneider Services.

2.5.2.2. Eaton Electrical Services & Systems.

2.5.2.3. Siemens Services.

2.5.2.4. GT Wood.

2.5.2.5. Pelikan.

2.5.2.6. Rondar.

2.5.2.7. Eastenghouse.

2.5.2.8. AC Tesla.

2.5.2.9. Brosz Technical Services.

2.5.2.10. Enkompass.

PART 3 EXECUTION

3.1. NOT USED
END OF SECTION

PART 1 GENERAL**1.1. WORK INCLUDED**

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 51 13 – LIGHTING EQUIPMENT.
- 1.1.4. Lighting Control Sequence of Operations as attached to Specifications or as shown on drawings.

1.2. REFERENCES

- 1.2.1. CAN/CSA-C22.2 No. 141, Emergency Lighting Equipment, latest edition.
- 1.2.2. CAN/CSA-C22.2 No. 205, Signal Equipment, latest edition.
- 1.2.3. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
- 1.2.4. International Electrotechnical Commission (IEC)
- 1.2.5. National Electrical Manufacturers Association (NEMA)
- 1.2.6. Underwriters Laboratories, Inc. (UL)
- 1.2.7. UL 508 – Standard for Industrial Control Equipment
- 1.2.8. UL 916 – Standard for Energy Management Equipment
- 1.2.9. UL 924 – Standard for Emergency Lighting and Power Equipment

1.3. SUMMARY

- 1.3.1. This specification is intended to fully describe all of the design, engineering, programming, hardware, software, ancillary devices and associated technical services required to provide a building-wide networked lighting control system. This system is specified to perform scheduled and automated lighting control sequences.
- 1.3.2. Lighting Control System includes computer-based software that provides control, configuration, monitoring and reports. System includes the following components:
 - 1.3.2.1. Energy Control Unit
 - 1.3.2.2. System Server
 - 1.3.2.3. 0-10 V Dimming, Fixed Output Ballasts or 0-10 V LED Drivers
 - 1.3.2.4. System Field Devices (Input and Output Modules)
 - 1.3.2.5. Occupancy Sensors – Low Voltage
 - 1.3.2.6. Photo Sensors – Low Voltage
 - 1.3.2.7. Wallstations – Low Voltage
 - 1.3.2.8. Lighting Control System Software - Graphical User Interface based
 - 1.3.2.9. Communication Wire
 - 1.3.2.10. Area Lighting Controllers and/or Room Controllers (to dim/switch a group of luminaires)
 - 1.3.2.11. Interface to Audio Visual equipment (for integration with 3rd party LCD Touch Screen Panel)
 - 1.3.2.12. Interface to BACnet

1.3.2.13. Interface to customizable Energy dashboard

1.4. DESCRIPTION OF SYSTEM

1.4.1. The work covered in this section is subject to the requirements in the General Conditions of the Specifications. Contractor shall coordinate the work in this section with the trades covered in other sections of the specification to provide a complete and operable system.

1.4.2. Extent of the lighting control system work is indicated by drawings and by the requirements of this section. It is the intent of this section to provide an integrated, energy saving lighting control system as described herein from a single supplier. Contractor is responsible for confirming that all components and accessories of the lighting control system interoperate as a single system.

1.4.3. Contractor shall ensure that lighting system control devices and assemblies are fully compatible and can be integrated into a system that operates as described in the lighting control notes on drawings and as described within this specification. Any incompatibilities between devices, assemblies, and system controllers shall be resolved between the contractor and the System Provider, as required to ensure proper system operation and maintainability.

1.4.4. The lighting control system shall include a fully distributed WAN/LAN network of global controller/routers, individually addressable System Field Devices that are not integral to luminaires, sensors, switches, relays and other ancillary devices required for a complete and operable system. The system WAN/LAN start-up shall be by the control system Manufacturer or Contractors certified by the Manufacturer.

1.4.5. The lighting control system shall utilize non-proprietary industry standard 0-10 V dimming or fixed output ballasts and/or 0-10 V LED drivers, occupancy sensors, daylight sensors, etc.

1.4.6. UL 924 listed devices shall have the ability to control 120 V / 277 V load.

1.4.7. System software interface shall have the ability to notify communication failures to system users via system & email messages. Email messages shall be available in html and text formats.

1.4.8. On-going system expansion, service and support shall be available from multiple factory certified vendors. Recommended service agreements may be submitted at the time of bid complete with manufacturers suggested inventory and pricing for system parts and technical support labor.

1.4.9. The electrical drawings may show a lighting control system designed with a specific manufacturer as a Basis of Design. There are pre-approved alternate manufacturers listed herein, which are acceptable lighting control systems to be used; however, by using pre-approved alternate manufacturers, the Contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring, etc. as required to suit the alternate pre-approved manufacturer's lighting control system. The Contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted for review and approval prior to rough-in. Where additional components or devices are required to meet the same design intent as indicated in the drawings and specifications, the Contractor shall include for all costs.

1.5. LIGHTING CONTROL APPLICATIONS

1.5.1. Provide a minimum application of lighting controls as follows:

1.5.1.1. Space Control Requirements – Provide occupancy/vacancy sensors as shown and noted on the electrical drawings. Occupancy/vacancy sensors to provide Manual- or Partial-ON functionality or Automatic-ON as described in the drawings and specifications.

1.5.1.2. Bi-Level Lighting – Provide multi-level controls in all spaces as indicated in the electrical drawings and specifications.

- 1.5.1.3. Task Lighting / Plug Loads – Where indicated on the drawings, provide automatic shut off of plug loads and task lighting. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
- 1.5.1.4. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) and as indicated in the drawings, where daylight contribution is available. Daylighting control shall operate as follows:
 - 1.5.1.4.1. All luminaires within defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
 - 1.5.1.4.2. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes and/or as indicated in the drawings and specifications.
 - 1.5.1.4.3. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
 - 1.5.1.4.4. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
- 1.5.2. All enclosed rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

1.6. SHOP DRAWINGS AND PRODUCT DATA

- 1.6.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.6.2. Submit manufacturer's data on lighting control system and components and the product data specified below at the same time as a package. Shop drawing submission shall include but not limited to the following:
 - 1.6.2.1. Complete list of all parts needed to fully install selected system components.
 - 1.6.2.2. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed. Submitted shop drawings shall detail control system, as supplied, including one-line diagrams, wire counts, coverage patterns, interconnection diagrams showing field-installed wiring and physical dimensions of each item.
 - 1.6.2.3. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - 1.6.2.3.1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
 - 1.6.2.3.2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
 - 1.6.2.3.3. Show exact location of all digital devices, including at minimum sensors, load controllers, and switches for each area on reflected ceiling plans. Contractor must provide AutoCAD and PDF format reflected ceiling plans. For sensors, prove sensor is suitable for the proposed application.
- 1.6.3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.

- 1.6.4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades as required.
- 1.6.5. Software Operational Documentation:
 - 1.6.5.1. Software operating and upgrade manuals
 - 1.6.5.2. Program Software Backup: On portable memory storage device, USB stick, complete with data files.
 - 1.6.5.3. Printout of software application and graphic screens, or upon request, a live demonstration of Control, Configure and Analyze functionality or a video demonstrating above stated system capabilities.
- 1.6.6. Catalog sheets, specifications and installation instructions.
- 1.6.7. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
- 1.6.8. Copy of applicable warranty.
- 1.6.9. Additional information as required on a project specific basis.

1.7. PROJECT CONDITIONS

- 1.7.1. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - 1.7.1.1. Ambient temperature: 0 deg. to 40 deg. C (32 deg. to 104 deg. F).
 - 1.7.1.2. Relative humidity: Maximum 90 percent, non-condensing.

1.8. WARRANTY

- 1.8.1. Provide a five year limited manufacturer's warranty on all equipment to be free of defects in materials and workpersonship.
- 1.8.2. On-going system expansion, service and support shall be available from multiple factory certified vendors. Recommended service agreements shall be submitted at the time of bid complete with manufacturers suggested inventory and pricing for system parts and technical support labor.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Control system: by one manufacturer and assembled from compatible components.

2.2. CENTRAL LIGHTING CONTROL SOFTWARE

- 2.2.1. The system shall offer central lighting control for the facility lighting administrator to perform energy management, configuration maintenance, monitoring operations, and providing support to building occupants.
- 2.2.2. Native central control software shall be utilized for energy reporting status and complete programming without the need for any third party hardware or software. Systems that require any third party linked software or graphics is not acceptable.
- 2.2.3. Software shall provide information on general system settings via mouse click on a floor plan. Left clicking over a device on the graphical software interface shall show a description of the selected device/function attribute.

- 2.2.4. The system shall provide an Interactive, Web-based graphical user interface (GUI) showing floor plans and lighting layouts that are native to the lighting control software. The only means required to program and operate the lighting control system shall be programmed and operated from a user interface that is based on a plan view graphical screen on the user's computer or the lighting control system's main computer. Shall include the navigational features listed below to allow for user's orientation within the controlled space, geographic heading and/or landmarks:
- 2.2.4.1. Interactive;
 - 2.2.4.2. Vector based;
 - 2.2.4.3. Zoom;
 - 2.2.4.4. Rotate;
 - 2.2.4.5. Pan;
 - 2.2.4.6. Tilt.
- 2.2.5. The system shall allow the building operator to navigate through an entire facility both in two-dimensional and three-dimensional multi-floor view, allowing for fast and easy navigation.
- 2.2.6. Three-dimensional view shall exclude walls and other structural features to avoid shadowing and cluttering of the plan view.
- 2.2.7. Shall display multiple floors in single view resulting in easier system performance visualization for the entire site as well as individual zones or spaces.
- 2.2.8. The system shall allow system performance visualization across a portfolio of buildings via a single interface.
- 2.2.9. All programming, assignments of lighting loads to control strategies, lighting status and lighting energy reporting shall be native to the software and executed from this GUI. Editing shall be available from this GUI in a drag and drop format or from drop down menus without the need for any third party software. Systems that utilize or require third party linked graphics are unacceptable. The GUI shall continuously indicate the status of each connected device on the system and a warning indicator on the software if a device goes offline. Systems requiring spreadsheet editing for programming and that don't offer real time feedback are not acceptable.
- 2.2.10. Software settings and properties shall be selectable per individual device, room based, floor based or global building based.
- 2.2.11. Lighting Control Software interface shall provide current status and enable configuration of all system zones including selected individual luminaire availability, current light level, maximum light level, on/off status, occupancy status, and emergency mode (response to an emergency signal) status.
- 2.2.12. The system shall have the ability to display various lighting system parameters such as Lighting status (ON/OFF); Lighting levels, Load shedding status, or Lighting energy consumption, Occupancy status in a colorized gradient ("weather" map) type of graphical representation.
- 2.2.13. Energy Analysis data shall be exportable in CSV or image file formats.
- 2.2.14. The system shall allow import of native AutoCAD files.
- 2.2.15. Reporting feature shall be native to the lighting control software and capable of reporting the following parameters for each device and zone individually without requiring any third party hardware and software:
- 2.2.15.1. Energy consumption broken down by energy management strategy.
 - 2.2.15.2. Energy demand broken down by energy management strategy.

- 2.2.15.3. Occupancy data by zone.
- 2.2.15.4. Building wide occupancy status
- 2.2.15.5. Time Schedule configuration status
- 2.2.15.6. Lighting energy consumption in a color gradient (“weather map” type) view
- 2.2.15.7. Energy performance reports shall be printable in a printer friendly format and downloadable for use in spreadsheet applications, etc.
- 2.2.16. The software shall offer user configurable fade times (up to 86400 seconds) for individual or group of luminaire during transition between scenes.
- 2.2.17. The system shall be programmable for Time Clock Scheduling of lights on or off via the Lighting Control Software interface.
- 2.2.18. There shall be an “Emergency Mode”, when activated through the system, that will immediately adjust lights to full light output and retain that level until the mode is deactivated in the event of an emergency. This setting shall override all other inputs. The system shall interface with the building emergency monitoring system at a convenient point and not require multiple connections.
- 2.2.19. All ballasts and/or drivers shall be centrally addressable, on a per luminaire or multiple luminaire/zone basis, through the Central Control Software. The basis of design shall utilize 0-10V Dimming, Fixed Output Ballasts and/or 0-10V LED Drivers connected to an Output Module. To simplify ongoing maintenance, the system shall not require manual recording of addresses for the purpose of start-up or reconfiguration.
- 2.2.20. System shall be capable of operating independent of building’s existing network infrastructure if desired and shall not rely on Tenant supplied PCs for operation.
- 2.2.21. Firewall Technologies & VLAN Configuration methods shall be utilized to separate tenants from the lighting control network and ensure the integrity of lighting control network.
- 2.2.22. The assignment of individual or group of system components to zones shall be performed via the Central Control Software such that physical rewiring will not be necessary when workspace reconfiguration or re-zoning is performed. Removal of covers, faceplates, ceiling tiles, etc. shall not be required.
- 2.2.23. Occupancy sensor time delays shall be configurable through software. Light level sensor parameters shall be configurable through software.
- 2.2.24. System shall auto-configure lighting controls for spaces that have been combined or divided temporarily by moving wall or similar systems.
- 2.2.25. System shall automatically lock wallstations and/or disable sensors based on one of the following system inputs: contact closure, a time schedule or the status of a monitored space.
- 2.2.26. The light management system shall be capable of interfacing digitally with a building automation system via BACnet/IP. The lighting control system shall be capable of communicating the status of output devices (lighting loads) as well as input devices (dry contacts, switches, occupancy sensors, vacancy sensors, and photocells) to the BAS. Building Automation System shall utilize data from lighting control system input devices such as occupancy sensors to determine the status (occupied/unoccupied) of the mechanical control zones and perform climate adjustments accordingly.

2.3. DIGITAL WALLSTATIONS

- 2.3.1. The system shall connect with the wallstations via field bus that carry low voltage control signals.

- 2.3.2. Software configurable wallstations shall provide on/off switching and dimming control for up to six lighting zones/ five lighting scenes per wallstation or more with allowable multi-gang configurations.
- 2.3.3. Shall allow manual dimming of light levels and override of the time schedule.
- 2.3.4. Scenes/zones in the system control software shall be synchronized with the buttons on the wallstation.
- 2.3.5. All wallstations shall be individually addressable & reconfigurable via System Control Software.
- 2.3.6. All wall stations shall feature status LED's
- 2.3.7. All wallstations shall be Class 2 Low Voltage devices.
- 2.3.8. All wallstations power source will be from the communication bus.
- 2.3.9. Communication shall be via NEC/CEC Class 2 communication wire.
- 2.3.10. Wallstation configuration shall be via GUI in a drag and drop format.
- 2.3.11. Custom button cap configuration shall allow combination of scene & zone in one wallstation.
- 2.3.12. Custom commands shall be applied to individual wallstation buttons.
- 2.3.13. Wall station shall display its current status (zone/scene under system control or OFF) when motion is detected in the close proximity of the wallstation
- 2.3.14. The following User Interface and custom labelling options shall be available:
 - 2.3.14.1. Up to five (5) scene switching & dimming
 - 2.3.14.2. Up to six (6) zone switching
 - 2.3.14.3. One (1) zone switching
- 2.3.15. Shall allow vacancy sensor configuration.
- 2.3.16. Dimensions shall meet NEMA WD-6 spec.
- 2.3.17. The following mounting options shall be supported:
 - 2.3.17.1. Mount in standard size wall box
 - 2.3.17.2. On mounting brackets for low voltage devices
- 2.3.18. Shall be used with "Decorator" style wall plate.

2.4. SYSTEM FIELD DEVICES

- 2.4.1. Shall provide a common interface to low voltage occupancy sensors and photo sensors via Input Modules. These modules shall automatically detect the type of devices they are connected to (i.e., photo sensor, occupancy sensor). Addresses to the field devices shall be assigned during system start-up. Upon establishing two way communication with the Energy Control Unit (ECU), these individually addressable modules shall enable each lighting component to be independently controlled and configured to best meet the needs of the facility. These modules shall connect directly to the NEC/CEC Class 2 communication bus.
- 2.4.2. System Field Devices shall be individually addressable via System Control Software.
- 2.4.3. System shall automatically address individual nodes during system start-up thus eliminating the need to pre-address devices or record serial numbers during installation.
- 2.4.4. Electrically rated for up to 24 VDC.
- 2.4.5. Shall connect to NEC/CEC Class 2 communication wire.

2.4.6. Shall retain all system settings in non-volatile memory.

2.4.7. Suitable for fixture or junction box mounting in standard 1/2" knockout (7/8" dia.)

2.5. AREA LIGHTING CONTROLLER/ROOM CONTROLLER

2.5.1. Shall provide a common interface (DIM/SWITCH) to a group of 0-10V Dimming, Fixed Output Ballasts and/or 0-10V LED Drivers via field bus that carry low voltage control signals.

2.5.2. Area Lighting Controllers shall be addressable via Control Software.

2.5.3. System shall automatically address individual area lighting controllers during system start-up thus eliminating the need to pre-address devices or record serial numbers during installation.

2.5.4. Electrical Maximum Load Ratings:

2.5.4.1. 20A 120-347 Vac Ballast

2.5.4.2. 20A 120-347 Vac Resistive

2.5.4.3. 20A 120-347 Vac Tungsten

2.5.4.4. 20A 120-347 Vac General Purpose

2.5.4.5. 1.5 HP 120-277 Vac Motor

2.5.5. Communication shall be via NEC/CEC Class 2 communication wire.

2.5.6. Control Options for:

2.5.6.1. ON/OFF Switching

2.5.6.2. Continuous 0-10V dimming

2.5.6.3. Shall be able to communicate with 0-10V ballasts/drivers

2.5.7. Shall be used for general purpose plug load control.

2.5.8. Shall control up to 30 ballast/LED Drivers.

2.5.9. Shall retain all system settings in non-volatile memory.

2.5.10. Mechanically has mounting for standard 1/2" electrical box knockout.

2.5.11. Colour to be selected by Architect/Engineer's Representative.

2.5.12. UL916, UL924 & UL2043 listed.

2.6. DIGITAL DAYLIGHTING SENSORS

2.6.1. Digital daylighting sensors shall work to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type.

2.6.2. Daylighting sensors shall be interchangeable without the need for rewiring.

2.6.3. The indoor sensor range shall be between 0 and 750 FC.

2.6.4. The outdoor sensor range shall be between 0 and 750 FC.

2.6.5. Atrium sensor range shall be from 2 to 2,500 FC.

2.6.6. Skylight sensor range shall be between 10 and 7,500 FC.

2.6.7. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).

2.6.8. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.

- 2.6.9. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
- 2.6.10. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
- 2.6.11. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.

2.7. DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- 2.7.1. Wall or ceiling mounted (refer to drawings) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.
- 2.7.2. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 - 2.7.2.1. Digital calibration and pushbutton configuration for the following variables:
 - 2.7.2.1.1. Sensitivity – 0-100% in 10% increments
 - 2.7.2.1.2. Time delay – 1-30 minutes in 1 minute increments
 - 2.7.2.1.3. Test mode – Five second time delay
 - 2.7.2.1.4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - 2.7.2.1.5. Walk-through mode
 - 2.7.2.2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - 2.7.2.3. Programmable control functionality including:
 - 2.7.2.3.1. Each sensor may be programmed to control specific loads within a local network.
 - 2.7.2.3.2. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - 2.7.2.3.3. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
 - 2.7.2.3.4. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 2.7.2.3.5. Ultrasonic and Passive Infrared
 - 2.7.2.3.6. Ultrasonic or Passive Infrared
 - 2.7.2.3.7. Ultrasonic only
 - 2.7.2.3.8. Passive Infrared only
 - 2.7.2.3.9. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - 2.7.2.4. Communication shall be via Class 2 communication bus.
 - 2.7.2.5. Manual override of controlled loads.
 - 2.7.2.6. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

- 2.7.2.7. Units shall not have any dip switches or potentiometers for field settings.
- 2.7.3. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology local network. No additional configuration will be required.

2.8. COMMUNICATION WIRE

- 2.8.1. The system shall have the capability to use both NEC/CEC Class 1 and Class 2 wiring to integrate peripheral devices such as ballasts/LED drivers, occupancy sensors, photo sensors, relay-based controls, area lighting controllers, and wallstations into a complete, networked programmable lighting control system.
- 2.8.2. Electrically uses NEC/CEC Class 2 Communication bus.
- 2.8.3. Multi-conductor cable with stranded-copper conductors.
- 2.8.4. Shall power photo sensors, PIR and dual-technology occupancy sensors.
- 2.8.5. Shall allow random devices connection without the need for special network channel termination.
- 2.8.6. Flame rated jacket for plenum use NFPA 262 (UL: FT6, CSA: CMP).

2.9. ENERGY CONTROL UNIT (ECU)

- 2.9.1. The Energy Control Unit (ECU) shall collect, process and distribute lighting control information to the system field devices and wall stations over NEC/CEC Class 2 communication bus. Each CU shall feature multiple NEC/CEC Class 2 communication channels that can control a large quantity of nodes (sensors, wall stations, 0-10V Dimming, Fixed Output Ballasts, 0-10V LED Drivers, etc.) per channel, per the manufacturers recommended maximum.
- 2.9.2. The ECU shall be the central intelligence point for the area it controls collecting signal information from sensors, wallstations and personal control software and determining appropriate brightness levels or on/off status for each luminaire or zone. The CU shall connect with a facility's or tenant's Local Area Network (LAN) via Ethernet to enable desktop personal control.
- 2.9.3. Ethernet communication ports that employ TCP/IP protocol shall be provided to simultaneously enable the following connections:
 - 2.9.3.1. Lighting Control Network
 - 2.9.3.2. Tenant LAN Access Point
- 2.9.4. Shall have 8 ports that accept 18 AWG, pre-fabricated, polarity independent quick connecting NEC/CEC Class 2 communication bus.
- 2.9.5. Each CU channel shall support up to 100 nodes or 800 nodes in total.
- 2.9.6. Shall have status LEDs for the following:
 - 2.9.6.1. Network activity on CU's Ethernet port/s
 - 2.9.6.2. CU channel status
 - 2.9.6.3. CU status
- 2.9.7. Shall enable the following functionalities:
 - 2.9.7.1. Backup to and Restore from USB flash drives
 - 2.9.7.2. Cycle lights through 100%, 25% & 0% steps
 - 2.9.7.3. Disable/enable all controller functionalities
 - 2.9.7.4. IP Address Reset
 - 2.9.7.5. Electronically deactivate individual channels

- 2.9.8. Shall have configuration stored in non-volatile flash memory.
- 2.9.9. Shall mount in a standard 19" rack (1U width), or alternatively where no rack is shown, via an individual wall mount.

- 2.9.10. UL916 and UL924 listed.

2.10. SYSTEM SERVER (SSU)

- 2.10.1. The System Server shall host the lighting control system database for all the lighting control devices. In addition, it shall provide remote accessing capability to change system settings and/or parameters.
- 2.10.2. Server shall have the ability to:
 - 2.10.2.1. Analyze system performance or energy data or generate system report;
 - 2.10.2.2. Record energy consumption with average sampling every 5 minutes for unlimited duration;
 - 2.10.2.3. Host the web interface required for the web enabled Personal Control Software or web based Central Control Software;
 - 2.10.2.4. Reside on a client server (virtual server);
 - 2.10.2.5. Interconnect with Control Units over standard Ethernet connection that employs TCP/IP protocol;
- 2.10.3. Each System Server shall have two Ethernet 10/100Base - Tx Cat 5 RJ45 ports that employ TCP/IP protocol.
- 2.10.4. Shall mount in a standard 19" rack (1U width), or alternatively where no rack is shown, via an individual wall mount.

2.11. EMERGENCY LIGHTING CONTROL DEVICES

- 2.11.1. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
 - 2.11.1.1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
 - 2.11.1.2. Push to test button
 - 2.11.1.3. Auxiliary contact for remote test or fire alarm system interface

2.12. MANUFACTURERS

- 2.12.1. The following are acceptable manufacturers:
 - 2.12.1.1. Wattstopper – Encelium

PART 3 EXECUTION

3.1. PRE-INSTALLATION MEETING

- 3.1.1. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
 - 3.1.1.1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
 - 3.1.1.2. Review the specifications for low voltage control wiring and termination.

3.1.1.3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

3.1.1.4. Discuss requirements for integration with other trades.

3.2. INSTALLATION AND SERVICES

3.2.1. Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.2.2. Install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.

3.2.3. Install all room/area devices using manufacturer's factory-tested cable with pre-terminated connectors. If pre-terminated cable is not used for room/area wiring, test each field-terminated cable following installation and supply the lighting controls manufacturer with test results. Contractor to install any room to room network devices using manufacturer-supplied network wire. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

3.2.4. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.

3.2.5. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

3.2.5.1. Adjust time delay so that controlled area remains lighted while occupied.

3.2.6. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

3.2.6.1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

3.2.6.2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3.2.6.3. Load Parameters (e.g. blink warning, etc.)

3.2.7. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Consultant/Owner of post start-up activity.

3.3. FACTORY SERVICES

3.3.1. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

3.3.2. The Electrical Contractor shall provide both the manufacturer and the Consultant with three weeks written notice of the system start up and adjustment date.

3.3.3. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.4. SYSTEM START UP AND COMMISSIONING

- 3.4.1. If applicable, a commissioning agent will verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.
- 3.4.2. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

3.5. TESTING

- 3.5.1. Upon completion of all line, load and interconnection wiring, and after all luminaire are installed and lamped, a qualified factory representative shall completely configure and test the system.
- 3.5.2. At the time of checkout and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

3.6. TRAINING

- 3.6.1. Provide four half days of training for the Owner and the Owner's maintenance staff on the operation and maintenance of the system.
- 3.6.2. Training to be recorded for use by Owner in the future.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 53 – IDENTIFICATION.

1.2. REFERENCE

- 1.2.1. CSA C22.2 No. 47, Air-Cooled Transformers (Dry-Type), latest edition.
- 1.2.2. CSA C802.2, Minimum Efficiency Values for Dry Type Transformers, latest edition.
- 1.2.3. U.S. Department of Energy (DOE) “DOE 2016 Efficiency”, latest edition.
- 1.2.4. Natural Resource Canada Regulation SOR/2018-201 (NRCAN 2019), latest edition.
- 1.2.4.1. Electricity Act, 1998 Regulation 509/18 Energy and Water Efficiency – Appliances and Products, latest edition.
- 1.2.5. CSA C9, Dry-Type Transformers, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.4. STORAGE

- 1.4.1. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in the transformer housing and if necessary, apply temporary heat where required to obtain suitable storage or service conditions.
- 1.4.2. Handle transformer using proper equipment for lifting and handling, use necessary lifting eye and/or brackets provided for that purpose.

1.5. WARRANTY

- 1.5.1. The transformer shall carry a 10 year warranty from the time of substantial completion.

PART 2 PRODUCTS

2.1. TRANSFORMERS

- 2.1.1. Use transformers of one manufacturer throughout project.
- 2.1.2. Design
 - 2.1.2.1. Type: ANN. All transformers to be delta-wye configuration unless otherwise noted on the drawings. Scott T constructed transformers will not be accepted.
 - 2.1.2.2. 3 phase, kVA and voltages as indicated on the plans, 60 Hz.
 - 2.1.2.3. Provide voltage taps of $2 \pm 2 \frac{1}{2}\%$ FCAN (full capacity above normal) & FCBN (full capacity below normal).
 - 2.1.2.4. Insulation: Class 220 deg. C (former designation: Class H), 150 deg. C. or less temperature rise. All windings are to be copper unless stated otherwise on the contract documents.
 - 2.1.2.5. Basic Impulse Level (BIL): standard.

- 2.1.2.6. Hipot: standard.
- 2.1.2.7. Average sound level to comply with the latest edition of CSA C9 for the appropriate voltage class.
- 2.1.2.8. Impedance at 60 Hz: minimum impedance as shown in the table below.

| Transformer size | Minimum impedance (%Z) |
|-----------------------|------------------------|
| Up to 75 kVA | 2.5 % |
| 112.5 to 150 kVA | 4 % |
| 151 to 300 kVA | 4 % |
| 301 to 600 kVA | 5 % |
| 601 to 2500 kVA | 6 % |
| Greater than 2500 kVA | Per CSA C9 |

- 2.1.2.9. Provide minimum K-13, K-rated transformers unless otherwise indicated on the drawings.
- 2.1.2.10. Enclosure: CSA Type 3R, removable metal front panel.
- 2.1.2.11. Mounting: floor or wall, as indicated.
- 2.1.2.12. Transformer to meet energy efficiency requirements of the energy efficiency standards referenced in this specification, whichever is more stringent, at 35% of rated load unless shown otherwise on drawings.
- 2.1.2.13. Finish: in accordance with Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.2. ACCESSORIES

- 2.2.1. Provide analogue type winding temperature indicator with 2 sequence contacts for transformers of 225 kVA and larger. Provide sensor in the centre winding to monitor the temperature.
- 2.2.2. Grounding terminal: inside enclosure.
- 2.2.3. External vibration pads equal to Mason Super 'W'.
- 2.2.4. Nameplate shall be stainless steel.

2.3. EQUIPMENT IDENTIFICATION

- 2.3.1. Provide equipment identification in accordance with Section 26 05 53 – IDENTIFICATION.
- 2.3.2. Label size: 6 mm letters.

2.4. FINISH

- 2.4.1. Finish enclosure exterior in accordance with Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 2.4.2. Transformer to be painted ANSI-61 grey.

2.5. MANUFACTURERS

- 2.5.1. The following are acceptable manufacturers:
- 2.5.1.1. Hammond Power Solutions
- 2.5.1.2. Delta Transformers
- 2.5.1.3. Schneider-Electric
- 2.5.1.4. Eaton Cutler-Hammer

- 2.5.1.5. Rex Power Magnetics
- 2.5.1.6. STI Power
- 2.5.1.7. Siemens

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Mount dry type transformers as indicated. Transformers larger than 75kVA are to be floor mounted unless identified otherwise. Where a transformer larger than 75kVA is shown as mounted off the floor, the Contractor is to provide an engineered structure from the floor and wall to support the transformer. Structure to be stamped and signed by a professional engineer and submitted as a shop drawing. Design of structure to take into account the building structure within the respective room.
- 3.1.2. Provide external vibration isolation pads under transformer.
- 3.1.3. Ensure adequate clearance around transformer for ventilation. Install transformer to meet ventilation clearance requirements given by transformer manufacturer. Where transformer manufacturer does not have requirements, follow clearances required by the local electrical code.
- 3.1.4. Install transformers in level upright position.
- 3.1.5. Remove shipping supports only after transformer is installed and just before putting into service.
- 3.1.6. Loosen isolation pad bolts until no compression is visible.
- 3.1.7. Make primary and secondary connections with flexible conduit and in accordance with wiring diagram.
- 3.1.8. Energize transformers after installation is complete.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 53 – IDENTIFICATION.

Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

- 1.1.4. Section 26 28 21 – MOULDED CASE CIRCUIT BREAKERS.
- 1.1.5. Section 26 28 14 – FUSES LOW VOLTAGE.

1.2. REFERENCE

- 1.2.1. CAN/CSA C22.2 No. 31 – Switchgear Assemblies, latest edition.
- 1.2.2. Seismic compliance: International Building Code (IBC) and California Building Code (CBC), latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.3.2. Indicate on Shop Drawings:
 - 1.3.2.1. Floor or wall anchoring method and foundation template.
 - 1.3.2.2. Dimensioned cable entry and exit locations.
 - 1.3.2.3. Dimensioned position and size of bus.
 - 1.3.2.4. Overall length, height and depth.
 - 1.3.2.5. Dimensioned layout of internal and front panel mounted components.
- 1.3.3. Include time-current characteristic curves for circuit breakers and fuses.
- 1.3.4. Provide certificates of compliance with the requirements as stated within the IBC and CBC and demonstrated the ability to function after the test.
- 1.3.5. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

1.4. MAINTENANCE DATA

- 1.4.1. Submit 3 copies of the maintenance data for the complete assembly including components, and include in the project operating and maintenance manuals.

1.5. MAINTENANCE MATERIALS

- 1.5.1. Include:
 - 1.5.1.1. Fuse or breaker types.

1.6. SOURCE QUALITY CONTROL

- 1.6.1. Submit 3 copies of certified test results, and include in the project operating and maintenance manuals.

PART 2 PRODUCTS

2.1. SWITCHBOARD

- 2.1.1. Ratings as identified on the drawings and/or schedules.
- 2.1.2. Switchboard breakers to have a minimum short circuit current rating of 22 kA at 600 V. Fused sections to have a minimum short circuit current rating of 100 kA at 600 V. Switchboard busing to be rated at a minimum of 65 kA.
- 2.1.3. Enclosures to be dead-front, CSA Type 1 with drip hood, sprinkler proof enclosure, size as indicated.
- 2.1.4. Hinged access panels with captive knurled thumb screws.
- Bus bars and main connections: copper.
- 2.1.5. Bus from load terminals of main breaker via metering section to main lugs of distribution section.
- 2.1.6. Identify phases with colour coding.
- 2.1.7. Provide two-hole long barrel compression lugs with lug inspection / viewing window for the main feeder terminations. All lugs to be dual rated for Copper/Aluminum (Cu/Al). Size as per the drawings.
- 2.1.8. Breakers and/or fuse sections shall be bolt-on.
- 2.1.9. Make provisions to extend the main bus to future cubicles on each end of the switchboard.
- 2.1.10. For Service Entrance Switchboards with secondary utility metering, provision for installation of power supply authority metering transformers in barriered section of switchboard, conforming to power supply authority requirements. Provide 1220 mm x 1220 mm x 305 mm (48 in. x 48 in. x 12 in.) wall mounted metering cabinet with plywood backboard for power authority use. Interconnect cabinet and instrument transformer compartment with 38 mm (1-1/2 in.) empty conduit.

2.2. CIRCUIT BREAKERS

- 2.2.1. Circuit breakers to be supplied as per Section 26 28 21 – MOULDED CASE CIRCUIT BREAKERS.
- 2.2.2. All breakers to be factory installed and tested.
- 2.2.3. Circuit breaker conductor terminations to be dual rated for Copper/Aluminum (Cu/Al).

2.3. FUSIBLE DISCONNECTS AND FUSES

- 2.3.1. Fusible horsepower rated disconnect switch sized as indicated.
- 2.3.2. Provision for padlocking in on-off position by three padlocks.
- 2.3.3. Mechanically interlocked door to prevent opening when handle is in the ON position.
- 2.3.4. Fuse: size as indicated, class J, current limiting in fuse holders without adapters. Fuses to be supplied as per Section 26 28 14 – FUSES LOW VOLTAGE.
- 2.3.5. Quick-make, quick-break action.
- 2.3.6. ON-OFF switch position indication on switch enclosure cover.
- 2.3.7. Fused Switch conductor terminations to be dual rated for Copper/Aluminum (Cu/Al).

2.4. GROUNDING

- 2.4.1. Copper ground bus extending full width of cubicles and located at bottom.
- 2.4.2. Provide two-hole long barrel compression lugs with lug inspection / viewing window for the ground cable terminations. Size as per the drawings.

2.5. INFRARED WINDOWS

Provide infrared windows in the switchboard main incoming section in sufficient sizes and quantities, to provide view of the main feeder terminations.

The window lens shall be compatible with most popular IR cameras, fusion capable and shall transmit electromagnetic radiation in:

Short, Mid and Long Wave Infrared

Visual

UVA and UVB Ultraviolet

Label each window to provide the thermographer with full information necessary to properly set, and aim the infrared camera and correctly interpret readings. The information shall include but not be limited to:

IR window location and number:

Lens material, range and the effective wavelength:

Lens Transmission Rate and proper compensation values:

Target(s): name, location (in respect to window) and target(s) emissivity.

Infrared windows shall be CSA approved to C22.2 No. 14 latest edition, UL/cUL listed, comply with IEEE Std. C37.20.2. Range, size, NEMA/IP and voltage rating suitable for the application. Infrared windows with plastic or polymer components shall also comply with UL746C.

Acceptable manufacturers;

Hawk IR International Limited / Fluke,

FLIR,

Lumasense Technologies Inc.

IRISS Inc.

2.6. FINISHES

- 2.6.1. Apply finishes in accordance with Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 2.6.2. Switchboard to be painted: baked grey enamel.

2.7. EQUIPMENT IDENTIFICATION

- 2.7.1. Provide equipment identification in accordance with Section 26 05 53 – IDENTIFICATION.
- 2.7.2. Label all branch feeders with names as indicated on drawings.

2.8. FACTORY TESTING

Testing shall be witnessed by the Technical Services Division Startup Service Contractor.

- 2.8.1. Include in your bid for the complete cost of two people to attend the factory witness testing for the equipment. Cost to include but not limited to all travel, food and lodging costs.

2.9. MANUFACTURERS

- 2.9.1. The switchboards shall be manufactured by:
 - 2.9.1.1. Schneider Electric.
 - 2.9.1.2. Eaton Cutler-Hammer.
 - 2.9.1.3. Siemens.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Locate switchboard and secure in position. Install floor mounted switchboards on a 100 mm concrete housekeeping pad.
- 3.1.2. Connect main incoming feeder to line terminals of main breaker, if applicable.
- 3.1.3. Connect load terminals of distribution switches or breakers to feeders.
- 3.1.4. Check factory made connections for mechanical security and electrical continuity.
- 3.1.5. Check trip unit settings and fuse sizes against co-ordination study to ensure proper working and protection of components.
- 3.1.6. For Service Entrance Switchboards only where a grounded conductor is installed from the exterior utility transformer (i.e. 4 wires only), provide system bonding jumper between neutral bus and ground bus.

3.2. TESTING

- 3.2.1. Contractor to review and test that all wiring has been connected as per the manufacturer drawings.

Switchboard to be tested on site as defined in Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE. Contractor to oversee all testing and correct any deficiencies noted.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 05 – MOUNTING HEIGHTS.
- 1.1.4. Section 26 05 53 – IDENTIFICATION.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 29 – Panelboards and Enclosed Panelboards, latest edition.
- 1.2.2. CSA C22.2 No. 5 – Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.3.2. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- 1.3.3. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

PART 2 PRODUCTS

2.1. PANELBOARDS

- 2.1.1. Panelboards: product of one manufacturer.
- 2.1.2. Install circuit breakers in panelboards before shipment.
- 2.1.3. In addition to CSA requirements manufacturer's nameplate must show fault current that the panel including all breakers have been built to withstand.
- 2.1.4. Panelboards to have the following minimum ratings for interrupting capacity or as indicated on the drawings or panel schedules.
 - 2.1.4.1. 120/208 V panelboards – 10 kA
 - 2.1.4.2. 347/600 V panelboards – 22 kA
- 2.1.5. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated. Provide an additional 20% of space within each panelboard in addition to what is shown on the drawings when a separate panel schedule is not provided for a specific panelboard.

- 2.1.6. Two keys for each panelboard and key panelboards alike.

Panelboards to be copper bus unless identified otherwise.

- 2.1.7. Where identified on the drawings or schedules, provide a copper neutral bus sized to 200% of the mains rating for panels.

- 2.1.8. Mains: suitable for bolt-on breakers.
- 2.1.9. Trim with concealed front bolts and hinges, for all panelboards other than those used in residential suites.
- 2.1.10. Trim and door finish: baked grey enamel.
- 2.1.11. Enclosure to be CSA Type 1 with drip hood with the exception of recessed panel enclosures which are to be CSA Type 1.
- 2.1.12. Provide Surge Protection Device where shown on Drawings.
- 2.1.13. Series ratings may be acceptable. Panels to be labeled as such. Manufacturing to supply supporting data.
- 2.1.14. All lugs to be dual rated for Copper/Aluminum (Cu/Al).

2.2. MOULDED CASE CIRCUIT BREAKERS

- 2.2.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.
- 2.2.2. Common-trip breakers: with single handle for multi-pole applications.
- 2.2.3. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- 2.2.4. Main breaker, where indicated: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- 2.2.5. Lock-on devices for 10 % of 15 to 30 A breakers installed. Turn over unused lock-on devices to Owner.
- 2.2.6. Where breakers are identified to feed high intensity discharge (HID) lighting, provide breakers that are rated and designed for use with HID lighting.
- 2.2.7. Provide one breaker per designated breaker space. Multiple breakers contained in one housing or twin breakers are not acceptable.
- 2.2.8. Breaker terminals to be dual rated for Copper/Aluminum (Cu/Al).

2.3. EQUIPMENT IDENTIFICATION

- 2.3.1. Provide equipment identification in accordance with Section 26 05 53 – IDENTIFICATION.
- 2.3.2. Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4. MANUFACTURERS

- 2.4.1. The following are acceptable manufacturers:
 - 2.4.1.1. Schneider Electric
 - 2.4.1.2. Eaton Cutler-Hammer
 - 2.4.1.3. Siemens

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

- 3.1.2. Install surface mounted panelboards on galvanized unistrut stand-offs or on fire rated plywood backboards. The plywood backboards are to be as per Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 3.1.3. Mount panelboards at height specified in Section 26 05 05 – MOUNTING HEIGHTS.
- 3.1.4. Connect loads to circuits.
- 3.1.5. Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. STANDARDS

- 1.2.1. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:
 - 1.2.1.1. Institute of Electrical and Electronic Engineers (ANSI/IEEE), latest edition
 - 1.2.1.1.1. C62.11 Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV), C62.41.1 Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits, latest edition.
 - 1.2.1.1.2. C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits, latest edition.
 - 1.2.1.1.3. C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits, latest edition.
 - 1.2.1.2. Federal Information Processing Standards Publication 94 (FIPS PUB 94) – Guideline on Electrical Power for ADP Installations, latest edition.
 - 1.2.1.3. National Fire Protection Association, latest edition:
 - 1.2.1.3.1. 75 Standard for The Protection of Information Technology Equipment, latest edition.
 - 1.2.1.3.2. 780 Standard for the Installation of Lightning Protection Systems, latest edition.
 - 1.2.1.4. MIL Standard 220B Method of Insertion Loss Measurement, latest edition.
 - 1.2.1.5. Underwriters Laboratories UL 1283 – Standard for Electromagnetic Interference Filters and UL 1449 – Standard for Surge Protective Devices, latest edition.
 - 1.2.1.6. CSA C22.2 No. 269 Series – Surge protective devices, latest editions.
 - 1.2.1.7. cUL.

1.3. OVERVIEW

- 1.3.1. The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy Surge Protective Devices (SPD) formerly called Transient Voltage Surge Suppressors (TVSS). The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C environments.
- 1.3.2. SPDs are designed for repeated limiting of transient voltage surges on 60 Hz Power circuits not exceeding 1000 V and designated as follows:
 - 1.3.2.1. Type 2 – SPDs hard-wired to distribution equipment after the load side of the service equipment overcurrent device.
 - 1.3.2.2. Type 3 – Plug-in SPDs.
 - 1.3.2.3. Type 4 – Component SPDs and component assemblies.

1.4. ENVIRONMENTAL REQUIREMENTS

- 1.4.1. The operating temperature range shall be -25 deg. C. to 60 deg. C.
- 1.4.2. The unit shall be capable of operation up to 3,960 m above sea level.

1.4.3. No appreciable magnetic fields shall be generated.

1.5. SHOP DRAWINGS AND PRODUCT DATA

1.5.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.5.2. Product Data: Provide catalogue sheets and supporting documentation showing:

1.5.2.1. System voltage.

1.5.2.2. UL1449 listing.

1.5.2.3. UL 1449 Voltage Protection Ratings.

1.5.2.4. UL 1449 I-n rating.

1.5.2.5. Dimensions showing construction, lifting and support points, and enclosure details.

1.5.2.6. Per mode and per phase peak surge current ratings.

1.5.2.7. Modes of discrete suppression circuitry.

1.5.2.8. Warranty period and replacement terms.

1.5.2.9. Conductor size, conductor type, and recommended lead length.

1.5.2.10. SPD is suitable for the application including system grounding configuration.

1.5.3. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.

1.5.4. List and detail all protection systems such as fuses, disconnecting means and protective features.

1.5.5. Provide verification that the SPD device complies with the required UL1449 latest edition, latest revision, and CSA or cUL approvals.

1.5.6. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -40 dB at 100 kHz.

1.5.7. For retrofit and side-mounting applications, provide electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

1.5.8. Operation and maintenance manuals shall include details for each SPD shipped.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Equipment shall be handled and stored in accordance with manufacturer's written instructions. One (1) copy of manufacturer's written instructions shall be included with the equipment at time of shipment.

1.7. QUALITY ASSURANCE AND WARRANTY

1.7.1. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

PART 2 PRODUCT

2.1. GENERAL

2.1.1. The SPD shall be listed by CSA or cUL to UL's 1283 and UL's 1449 standards, and not merely the components or modules. Listing must be verified by a third party approved laboratory.

- 2.1.2. The SPD shall be CSA or cUL/UL 1449 labelled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD.
- 2.1.3. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnect do not meet the intent of this specification.
- 2.1.4. Obtain all surge suppression devices from a single manufacturer.
- 2.1.5. The maximum continuous operating voltage (MCOV) of all components for solidly grounded systems shall not be less than 125 % for a 120 V system and 120 % for 220 and 240 V systems, and 125 % for 347 and 600 V systems. All components for resistance grounded systems shall have an MCOV not less than 125 % of the line-to-line voltage.
- 2.1.6. Provide delta connected SPDs where a resistance grounded system is shown on the Drawings.
- 2.1.7. All SPD's shall be equipped with a comprehensive monitoring system which shall include a visual panel display providing information on unit status and phase loss/protection loss.
- 2.1.8. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
- 2.1.9. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
- 2.1.10. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

| | Protection Modes | | | |
|--------------------|------------------|-----|-----|-----|
| Configuration | L-N | L-G | L-L | N-G |
| Wye | • | • | • | • |
| Delta | N/A | • | • | N/A |
| Single Split Phase | • | • | • | • |
| High Leg Delta | • | • | • | • |

- 2.1.11. The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.
- 2.1.12. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20 kA In rating regardless of their SPD Type (includes Types 2 and 4) or operating voltage. SPD shall be UL 1449 labelled with this kA I-nominal (I-n) rating.
- 2.1.13. ANSI/UL 1449 Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 VPR for the device shall not exceed the following:

| Modes | 208Y/120 | 480Y/277 | 600Y/347 |
|---------------|----------|----------|----------|
| L-N; L-G; N-G | 700 | 1200 | 1500 |
| L-L | 1200 | 2000 | 2500 |

- 2.1.14. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

| Minimum surge current capacity based on ANSI / IEEE C62.41 location category | | | |
|--|-------------|-----------|----------|
| Category | Application | Per Phase | Per Mode |

| | | | |
|---|---|--------|--------|
| C | Service Entrance Locations or distribution equipment rated at 1,000 Amps or more. | 300 kA | 150 kA |
| B | Distribution equipment rated less than 1,000 Amps but greater than 400 Amps | 200 kA | 100 kA |
| A | Branch Location Panelboards, MCCs, Busway rated at 400 Amps or less | 100 kA | 50 kA |

2.1.15. Internal Fusing - Overcurrent Protection

2.1.15.1. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnect do not meet the intent of this specification.

2.1.16. SPD shall be separate from or integral to the electrical equipment. Where an Integral SPD is supplied, unit shall be UL 1449 labelled as Type 1 intended for Type 2 applications without need for external or supplemental overcurrent controls.

2.1.17. The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability.

2.1.18. SPD lugs and terminals shall be dual rated for Copper/Aluminum (Cu/Al).

2.2. CATEGORY C LOCATIONS

2.2.1. Provide SPD on the service entrance equipment or distribution equipment rated at 1,000 Amps or more.

2.2.2. The SPD shall have an internal audible alarm with mute on front cover.

2.2.3. SPD's for service entrance locations shall have a transient event counter with LCD panel display and reset button on the front cover.

2.3. CATEGORY B LOCATIONS

2.3.1. SPDs for distribution equipment rated less than 1,000 Amps but greater than 400 Amps shall be as indicated on project Drawings.

2.3.2. The SPD shall have an internal audible alarm.

2.4. CATEGORY A LOCATIONS

2.4.1. SPDs for the branch location panelboards, MCCs, busway rated at 400 Amps or less shall be as indicated on project drawings and panel schedules.

2.4.2. The SPD shall have an internal audible alarm.

2.5. DATA & SIGNAL LINE PROTECTION (FOR 24 V APPLICATIONS)

2.5.1. The unit shall have a data transmission rate up to 10.0 Mbps.

2.5.2. Each conductor shall have less than 2.4 ohm of internal series resistance per wire, and each pair of conductors shall have a peak surge current of no less than 10,000 amps per wire (20,000 amps per pair), 8 x 20 μ s waveform.

2.5.3. SPD Voltage Protection level shall be less than < 46 V.

2.5.4. The response time of the components of the unit shall be less than one nanosecond.

2.6. PHONE LINE PROTECTION

2.6.1. The unit shall be listed under UL 497A, Standard for Secondary Protectors for Communications Circuits.

2.6.2. The unit shall have a data transmission rate up to 16.0Mbps.

- 2.6.3. Each conductor shall have less than 1 ohm of internal series resistance per wire.
- 2.6.4. Each pair of conductors shall have a peak surge current of no less than 200 amps, 8 x 20 μ s waveform.
- 2.6.5. The maximum let-through voltage on an IEC 10 x 700 μ s impulse (2kV/80A) shall be 260 volts tip-ring, 260 volts tip to ground, and 260 volts ring to ground.
- 2.6.6. The response time of the components of the unit shall be less than one nanosecond.

2.7. ENCLOSURES

- 2.7.1. All enclosed equipment shall have CSA Type 1 with drip hood, sprinkler proof enclosure, unless otherwise noted.
- 2.7.2. For integral mounted SPD unit, it should be mounted in separate compartment with separate removable cover. For remote mounted SPD unit provide separate enclosure mounted as near to the electrical equipment as possible.

2.8. MANUFACTURERS

- 2.8.1. Approved Vendors:
 - 2.8.1.1. Advanced Protection Technologies
 - 2.8.1.2. Eaton Cutler-Hammer
 - 2.8.1.3. Innosys Power Inc.
 - 2.8.1.4. Schneider Electric
 - 2.8.1.5. Siemens
 - 2.8.1.6. Surge-Pure

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install the SPD with the conductors as short and straight as practically possible. Gently twist conductors together. SPD performance is drastically reduced with increased conductor length.
- 3.1.2. Installer shall reasonably rearrange breaker locations to minimize the lead length to SPDs.
- 3.1.3. Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. The Electrical Contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.
- 3.1.4. Main service entrance units shall be installed on a breaker, or, where indicated, shall be installed on a fused disconnect switch that meets or exceeds the fault current rating of the switchgear. Size of breaker to be confirmed by manufacturer and coordinated with distribution equipment supplier.
- 3.1.5. Distribution, branch panel, and motor control center units shall be installed on dedicated circuit breakers. Size of breaker to be confirmed by manufacturer and coordinated with distribution equipment supplier. A 3-pole breaker position shall be provided for connection of SPD.
- 3.1.6. The installing contractor shall comply with all applicable codes.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 34 – CONDUITS, CONDUIT FASTENERS AND FITTINGS.
- 1.1.4. Section 26 05 21 – WIRES AND CABLES UNDER 2000 V.
- 1.1.5. Section 26 09 13.01 – POWER MONITORING SYSTEM – WEB BASED

1.2. STANDARDS

- 1.2.1. Except as noted by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the Canadian Electrical Manufacturer's Association, CSA and Measurement Canada.
- 1.2.2. The system shall be bench certified/approved by Measurement Canada for legal trade under the "Electricity and Gas Act" of Canada.
- 1.2.3. At the completion of installation, the system shall be field reviewed to verify compliance with Measurement Canada Specifications.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.3.2. Submit shop drawings and manufacturers data for the component items shown and specified under this section of the specification. This shall include, but not limited to:
 - 1.3.2.1. System riser, one line and installation diagrams.
 - 1.3.2.2. Manufacturer's system and communications connection diagram.
 - 1.3.2.3. Information on selected reporting software.
 - 1.3.2.4. All electrical and mechanical meters.
 - 1.3.2.5. All final verification and acceptance forms/letters.
- 1.3.3. Do not supply any equipment to this project prior to shop drawing review by the Engineer's Representative.
- 1.3.4. Shop drawings will be stamped and signed by the Electrical Contractor prior to submittal, allow a minimum of one week for review of the shop drawings submitted.
- 1.3.5. At the completion of the Project, As-Built Drawings will be submitted by the Submetering Supplier/Manufacturer and Electrical Contractor, who will prepare a complete manufacturer's manual including but not limited to all as-built wiring diagrams and all required Measurement Canada certifications and test results.

1.4. DESCRIPTION OF SYSTEM

- 1.4.1. Work under this section is subject to the requirements of Section 26 05 01 - GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.4.2. Provide a fully digital utility (i.e. electricity, water, gas, heating and cooling energy) measurement system for multi-tenant buildings incorporating complete metering. The mechanical meters and electrical metering panel(s) must have its own local display for reading the meters connected to it.

- 1.4.3. All utility consumption metering on site shall be supplied and coordinated through the Submetering Supplier and Electrical Contractor. Consumption metering for all utilities on site must be coordinated through the Submetering Supplier and Electrical Contractor to:
 - 1.4.3.1. Ensure metering infrastructure meets all applicable regulatory requirements.
 - 1.4.3.2. Is capable of seamlessly integrating to the chosen end user platform.
 - 1.4.3.3. Allow for necessary tenant billing data criteria.
 - 1.4.3.4. Ensure non-proprietary data protocols.
 - 1.4.3.5. Allow for one point of contact for all stakeholders.
- 1.4.4. Submetering System to collect data on Electricity, Gas, Water and Heating and Cooling energy consumption. Meters to communicate data to central point(s) and be remotely accessible by operations team, accounting, etc., using a web-based data collection and reporting software.
- 1.4.5. System to include:
 - 1.4.5.1. Meter Hardware - Electrical
 - 1.4.5.2. Meter Hardware - Heating Energy Meters
 - 1.4.5.3. Meter Hardware - Cooling Energy Meters
 - 1.4.5.4. Meter Hardware - Water
 - 1.4.5.5. Meter Hardware - Gas
 - 1.4.5.6. Communications Infrastructure
 - 1.4.5.7. Data Collection and Reporting
 - 1.4.5.8. Execution and Verification
- 1.4.6. The submetering system shall be scalable to include other utility metering, including the power metering system on the Main 600 V Switchboard. System shall be used for tenant billing, and/or energy management.
- 1.4.7. Provide computerized metering in accordance with the Contract Documents. The system to come complete with all parts necessary to operate this system.
- 1.4.8. Remote sub-metering panels shall be used for electricity consumption and display in a digital format and in real numbers.
- 1.4.9. All electricity submetering units to be mounted in a CSA Type 1 with drip hood, sprinkler proof enclosure either located next to the electrical panel(s).
- 1.4.10. Metering panels communicate over their own network, which can report to remote computers using telephone or Ethernet/WAN/Internet communications.

1.5. WARRANTY

- 1.5.1. All meters shall have a manufacturer's warranty of 3 years.
- 1.5.2. All other equipment shall be free from defect in materials and workpersonship under normal use and service for the period of twenty four (24) months from the date of acceptance.

PART 2 PRODUCTS

2.1. ELECTRICAL METERS/METERING AND SUBMETERING EQUIPMENT

- 2.1.1. The electricity meter system will be used to monitor key house electrical loads and riser disconnects on each tenant floor and optional metering for select tenant 120/208 plug loads fed within the building.

- 2.1.2. All meters to be Measurement Canada approved and their installation to be verified and commissioned as per Measurement Canada S-E-04 standards.
- 2.1.3. Meters to have Ethernet interface for direct connection to building's central fibre communications network.
- 2.1.4. Each multi-meter includes current transformers, potential transformers (if applicable), cable connections and Ethernet and BACNet IP capabilities. Meters must have BTL listing (BACNet Testing Laboratories).
- 2.1.5. All electrical meters must be tested, sealed and verified to Measurement Canada standards (no exceptions). Verification of meter installation on-site to comply with Measurement Canada S-E-04 inspection procedures.
- 2.1.6. Meters must be capable of directly metering North American 120/208 V, 120/240 V, 240/416 V, and 277/480 V and 347/600 V wye services. Meters may use manufacturer specified and supplied Potential Transformers for the higher voltages, if required.
 - 2.1.6.1. The Potential transformers, if required, shall be mounted in a separate enclosure rated for the size and capacity necessary to feed the number of meters shown as per the drawings and rated by the manufacturer. Potential transformers must be Measurement Canada approved for revenue metering (independently or as part of system approval).
 - 2.1.6.2. Potential transformers shall be factory assembled and come complete with electrical disconnects and fuses mounted in a separate enclosure.
- 2.1.7. Metering Units must have the capability of a single incoming cable with associated current transformers (CT's).
- 2.1.8. Must meet all ISO 9001 standards for quality control where all meters test to a minimum of +/- 0.5% accuracy.
- 2.1.9. Operating Frequency: 50/60 Hz.
- 2.1.10. Power Factor Range: 0.5 to 1.0 lead/lag.
- 2.1.11. Operating Temperature Range: -40 degrees to +55 degrees C.
- 2.1.12. Current Ranges: 100/200/400 Amps or 5/10 Amp interface (services over 400 A or critical loads)
- 2.1.13. Metering unit(s) must be able to meter a minimum of 24 single-pole circuits, 12 single phase/Network meters and 8 three phase type meters.
- 2.1.14. Meter communications options: Ethernet, Modbus TCP, BACNet or modem:
 - 2.1.14.1. Ethernet interface at each metering device
 - 2.1.14.2. Meters must be a push IP based communication
 - 2.1.14.3. There cannot be any modifications to customer's existing firewall
 - 2.1.14.4. Modbus TCP or BACnet communications for interface to client systems
- 2.1.15. Meters and their elements must conform to the Measurement Canada "Standard Drawings for Electrical Metering Installations" to ensure accurate metering. All configurations shall come with current transformers/transducers required in the "Standard Drawings".
- 2.1.16. Approved Electrical Submeter Manufacturers:
 - 2.1.16.1. Triacta Powerhawk 6X12 Series multi-meter.
 - 2.1.16.2. Carma Industries.

2.2. HEATING AND COOLING ENERGY (BTU) SUB-METERING EQUIPMENT

- 2.2.1. Meter must be EN1434 Certified.

- 2.2.2. Components: each thermal meter system includes ultra-sonic flow meter, two pocket-type temperature sensors, sensor wells and thermal energy calculator.
- 2.2.3. Temperature sensors: pocket-type thermal sensors are required; direct immersion sensors will not be accepted. One of the temperature sensors and its well shall be located in the ultrasonic flow meter housing. Temperature sensors must be PT500 or better.
- 2.2.4. Flow Meter: Ultrasonic flow meter to have R value of 200 or better. Flow meter must be able to operate in up to 50% glycol composition and up to 120 Degrees C. Base meter size on nominal flow rate.
- 2.2.5. Combined heating/cooling: the heating thermal meter must also be capable of measuring cooling energy if the meter is used in a combined heating and cooling two-pipe system. And vice versa, the cooling thermal meter must also be capable of measuring heating energy if the meter is used in a combined heating and cooling two-pipe system.
- 2.2.6. Accuracy: thermal meter system to meet or exceed Accuracy standard EN 1434 for energy metering. Refer to Measuring Instrument Directive (MID) MI-004
- 2.2.7. Communications: The meters must be capable of M-BUS or equal remote communications and will be connected to the M-Bus or equal network in the property.
- 2.2.8. Power: The thermal meters will be powered by the M-Bus network or equal and contain a minimum 10 year back-up battery. Primary power through a battery or separate electrical connection will not be accepted.
- 2.2.9. Display: Meters to be complete with a Liquid Crystal Display (LCD) to access all measurements (flow, temperatures, energy, system status). Meters without displays will not be accepted
- 2.2.10. Calculator Location: thermal calculator can be mounted on top or side of meter or be wall mounted
- 2.2.11. Labeling: meter labeling to include meter name, Q3 (Qn) flow value, type examination certification number, Metrology Identification (serial #), manufactured year, temperature class, maximum pressure, pulse ratio, and indication of vertical or horizontal installation
- 2.2.12. Data Logging: calculator to store at least 1000 events, up to 18 monthly end KWH values, and peak flow, temperature, and KWh values
- 2.2.13. Pulse Inputs: thermal meter to be capable of receiving at least two pulse inputs from other utility meters
- 2.2.14. Pulse Outputs: thermal meter must be capable of providing two pulse outputs for energy and volume
- 2.2.15. Alarming: meter system to log and report via M-Bus system or equal failures or alerts. Meter must include alarming for temperature sensor failure, maximum/minimum temperature exceeded, maximum flow exceeded, air in line
- 2.2.16. Security: at the completion of commissioning, the meter's protective devices shall be sealed by representatives of the competent authority. For any subsequent adjustment of the meter or for replacement of sub-assemblies, batteries etc., it will thus be necessary to break one or more seals. Seals shall be renewed in accordance with appropriate regulations.
- 2.2.17. Approved Thermal (BTU) Meter Manufacturers:
 - 2.2.17.1. GWF UltraMaxxV series
 - 2.2.17.2. GWF CF5X series
 - 2.2.17.3. Or approved equal

2.3. DOMESTIC WATER SUBMETERING EQUIPMENT (COLD AND HOT WATER)

- 2.3.1. Components: each water meter includes single jet meter, 8 digit register, GWF M-Bus register encoder or equal and two NPSM to NPT connectors.
- 2.3.2. Accuracy: consumption meter to meet or exceed Accuracy standard EN 14154 or AWWA standard C712-02, ANSI/NSF 61 and NIST 44-2006 Section 3.36 for water metering and have a minimum R value of 80. Refer to Measuring Instrument Directive (MID) MI-001.
- 2.3.3. Communications: The meters must be capable of M-BUS or equal remote communications and will be connected to the M-Bus or equal network in the property.
- 2.3.4. Power: The water meters shall not require external power or will be powered by the M-Bus network or equal.
- 2.3.5. Display: Meters to be complete with 8 digit register, showing measurement down to 1 litre resolution.
- 2.3.6. Labeling: meter labeling to include meter name, Q3 (Qn) flow value, type examination certification number, Metrology Identification (serial #), manufactured year, temperature class, maximum pressure, pulse ratio, and indication of vertical or horizontal installation. Meter to also be colour-coded to reflect cold (blue), warm (orange) or hot (red) water applications.
- 2.3.7. Security: at the completion of commissioning, the meter's protective devices shall be sealed by representatives of the competent authority. For any subsequent adjustment of the meter or for replacement of sub-assemblies, batteries etc., it will thus be necessary to break one or more seals. Seals shall be renewed in accordance with appropriate regulations.
- 2.3.8. Approved Water Meter Manufacturers:
 - 2.3.8.1. GWF Unicocoder MP single jet meters with M-Bus communications. For installations over 1", use GWF MTKcoder or Woltman Delta meters.
 - 2.3.8.2. Or approved equal.

2.4. NATURAL GAS SUBMETERING EQUIPMENT

- 2.4.1. Each meter includes rotary or diaphragm meter and pulse output communications module
- 2.4.2. The meters must include pulse output for connection to Data Collector, M-Bus network or electricity meter.
- 2.4.3. All gas meters used for metering tenant loads must be tested, sealed and verified to Measurement Canada standards (no exceptions).
- 2.4.4. Approved Gas Meter Manufacturers:
 - 2.4.4.1. Roots Dresser natural gas meters
 - 2.4.4.2. Elster natural gas meters
 - 2.4.4.3. Or approved equal

2.5. M-BUS COMMUNICATIONS INFRASTRUCTURE – MECHANICAL METERS

- 2.5.1. All mechanical meters (water, gas and thermal) shall communicate M-Bus or equal to a central collection point(s) using:
 - 2.5.1.1. M-Bus meter bus communications system, consisting of an M-Bus Master and meters with M-Bus Interface. Meters and Master connected by network of twisted pair copper cables.
 - 2.5.1.2. Master: M-Bus Master is a Level Converter CMe3100 with capacity extension modules available; up to 250 slave meters can be read from each CMe3100 master

- 2.5.1.3. External Communications: CMe3100 is Ethernet enabled and will require a static IP with internet access
- 2.5.1.4. Power: 120VAC power source is required for the CMe3100 and extension modules
- 2.5.1.5. Baud Rate: standard set at 2400
- 2.5.1.6. Protocol: slave protocol to include 'header' information (primary address, secondary address [serial 3], meter type, manufacturer, etc.) and 'read' information (consumption values), as per standard EN 1454-3
- 2.5.1.7. Configuration Software: M-Bus system to be configured with non-proprietary M-Bus software, such as MBConf
- 2.5.2. The Basis of Design for the mechanical meters communications system is M-Bus. If the Submetering Supplier does not offer M-Bus communication for their mechanical meters, an alternate communications system may be considered by the Engineer's Representative/Owner upon written approval and the following:
 - 2.5.2.1. Must be a bus based network compatible with daisy-chain or 'star' topology and transmitting absolute encoded register reading.
 - 2.5.2.2. Shall submit all information pertaining to the alternate system to the Engineer's Representative/Owner for review/approval. The Submetering Supplier and Electrical Contractor may be required to submit additional information of the alternate communication system upon request by the Engineer's Representative/Owner if the original submission is considered insufficient or inadequate for proper review.
 - 2.5.2.3. The Submetering Supplier and Electrical Contractor shall be responsible for any and all labor and material costs associated with changes using the alternate communications system. This shall include, but not limited to, additional power connections, metering panels, conduit, wiring, cabling, terminations, etc. to suit the requirements of the alternate communications system. No additional costs shall be considered by the Owner arising from miscoordination related to acceptance of this alternate system.
- 2.6. DATA COLLECTION, REPORTING, BILLING AND SYSTEM SOFTWARE**
 - 2.6.1. All meter data must be collected via the communication infrastructure and reported through one or more of the following software options. At a minimum, 15 minute interval KWh data must be available for download into a CSV, Excel file.
 - 2.6.2. The following capabilities and services must be provided:
 - 2.6.2.1. Web-hosted Energy Reporting Software:
 - 2.6.2.1.1. Provide QMC MeterConnex web-based reporting software or approved equal. Graphing and exportation of meter data shall be available on-line. Tenant interface shall also be available, provided as a Software as a Service with no upfront costs
 - 2.6.2.2. BAS and Power Quality Meter Integration:
 - 2.6.2.2.1. Seamlessly integrate meter register data for meters pertaining to building operations and/or maintenance. This shall include communicating and fully integrating the Submetering System with information from the Power Quality Meters installed on the Main 600V Switchboard of the building. Electrical Contractor to coordinate communications protocol with Power Quality Meters supplied as specified in section 26 09 13.01 - Power Quality Metering System.
 - 2.6.2.3. The Submetering Supplier must have the following capabilities as an option for their system:
 - 2.6.2.3.1. Tenant Billing Services:

- 2.6.2.3.1.1. Read all meter data on a monthly basis and produce tenant invoices for electricity, heating and cooling energy and domestic water use. Billing summary shall be capable of being sent to property or tenant directly.
- 2.6.2.3.1.2. Shall provide menu driven generation of energy bills in a format similar to the format provided by the local Utility Supplier. Shall permit energy cost calculations that utilizes information from account bill received from the local Utility Supplier, allowing for the incorporation of co-incident demand charges and time of use rates allocated to each tenant.
- 2.6.2.3.1.3. Shall permit multiple metering points to be allocated to a single tenant file in order to totalize a number of metering points and energy costs to a single tenant account.
- 2.6.2.3.1.4. Shall permit reconfiguration of tenant accounts through menu selection.
- 2.6.2.3.1.5. Shall list all tenant accounts including the tenant history file.
- 2.6.2.3.1.6. Shall access the actual metering measurements used in deriving each Tenant's invoice.
- 2.6.2.3.1.7. Provide billing data within a format compatible with standard accounting packages.
- 2.6.2.3.2. This service shall be provided on an ongoing basis and negotiated with the Owner/Property Manager at completion of system installation.
- 2.6.2.4. The Submetering System Software shall meet the following requirements:
 - 2.6.2.4.1. Must be accessible by any user via standard web-browser, such as IE, Chrome, etc.
 - 2.6.2.4.2. Also provide a Windows™ based simplified user interface for system operation.
 - 2.6.2.4.3. Tiered access so users can only access meter data and reports selected by system owner.
 - 2.6.2.4.4. Up to 100 user accounts available.
 - 2.6.2.4.5. Multiple utilities must be presented, including electricity, water, gas and thermal energy.
 - 2.6.2.4.6. Environment Canada weather data must be collected (Heating and Cooling Degree Days, Average Temperature).
 - 2.6.2.4.7. Metering data must be available to other software parties via API (Application Program Interface).
 - 2.6.2.4.8. All data must be exportable in CSV or Excel format.
 - 2.6.2.4.9. Mandatory Functionality:
 - 2.6.2.4.9.1. Bill Generation, including utility consumption and rates.
 - 2.6.2.4.9.2. Visual Reports, including 15 minute energy profiles, load comparisons.
 - 2.6.2.4.9.3. Heat Mapping Tool.
 - 2.6.2.4.9.4. Weather Regression modelling based on HDD/CDD or average temperature.
 - 2.6.2.4.9.5. Alarming tools: demand or consumption min and max thresholds and automated email or text alarm to selected users.
 - 2.6.2.4.9.6. Automated reporting tool: automated PDF report sent to selected users showing energy-related KPIs (Key Performance Indicators) of property.
 - 2.6.2.4.9.7. Revenue legal metering measurements shall be received from all sub-metering sensors and stored in a central Data Collection Unit (DCU).
 - 2.6.2.4.9.8. To monitor, acknowledge and control communications with the remote metering points and to log any disruption of the communication link or unauthorized system access or tampering.
 - 2.6.2.4.9.9. To permit the user to view instantaneous readings of voltage, current, power, phase angle, present and peak demand for any electricity meter.

- 2.6.2.4.9.10. To permit the user to view instantaneous readings present usage (totalized) or demand (last 15 minute interval) for any mechanical meter.
- 2.6.2.4.9.11. Provide the ability to export data into Reporting Applications (e.g. Web and Excel VBA).
- 2.6.2.4.9.12. To include service menus for diagnostic monitoring of the metering equipment and through either a modem and telephone link or Internet access to permit remote diagnostics by the manufacturer's service technicians. Security access control shall permit remote diagnosis to be locked out.

2.7. WIRING

- 2.7.1. Provide all wiring in conduit as required to operate the entire system. Wiring to be provided as per manufacturer's instructions. All power wiring to be in conformance with the electrical code.

PART 3 EXECUTION

3.1. DRAWING REVIEW

- 3.1.1. Submetering Supplier and Electrical Contractor to review tenant electrical, gas, heating, cooling and domestic water distribution using construction contract drawings to coordinate and budget all meters and M-Bus communications system according to site-specific distribution and property needs. This includes both the Electrical and Mechanical Contract Drawings.

3.2. MECHANICAL METER INSTALLATION

- 3.2.1. The Electrical Contractor shall supply and turn over all mechanical meters to the Mechanical Contractor for installation in the piping system. All meters to include two isolation shutoff valves.
- 3.2.2. Wiring of mechanical meters to connect to the Submetering System to be supplied and installed by the Electrical Contractor. Coordinate exact locations and installation on site with the Mechanical Contractor.

3.3. ELECTRICAL METER INSTALLATION

- 3.3.1. All metering equipment shall be installed in electrical or mechanical rooms, as indicated on the drawings.
- 3.3.2. Remove electrical panel cover.
- 3.3.3. Wire bending space should be in compliance with Canadian Electrical Code Section 12. Verify that Current Transformers, Power Taps, and wiring can be installed without crowding the electrical panel.
- 3.3.4. Verify that the Current Transformers can be installed with a minimum 1/2 inch clearance to uninsulated live parts in panel, and without bearing against dead metal parts.
- 3.3.5. Verify that power is 120V, 120/280V, 120/240V, 240/416V or 416V, 277/480V, 480V, 347/600V or 600V. Verify that neutral is available if applicable.
- 3.3.6. Provide a dedicated 15A, 120VAC circuit for each panel and equipment from the nearest available panel. Provide a new breaker in the respective panel.
- 3.3.7. Verify that the meter is the right size and voltage for the installation.
- 3.3.8. Secure metal conduit to panel. Use insulating bushing. Reliable grounding is required. Locknuts must be tightened enough to pierce paint in cabinet.
- 3.3.9. Secure meter enclosure in or on wall, according to location, and connect conduit using locknut. Attach the enclosure to a wall stud using screws to provide equivalent support.
- 3.3.10. Install CT's and PT's per manufacturer's recommendations.

- 3.3.11. Interconnect all metering panels with wiring in conduit as per manufacturer's instructions. Provide connection of Metering Panels to remote accesses connection: telephone, Ethernet connection, etc.
- 3.3.12. Replace electrical panel covers.
- 3.3.13. Contact Electrical Safety representatives for verification of compliance to governing electrical codes.
- 3.3.14. All electrical multi-meters must be verified according to Measurement Canada S-E-04 inspection procedures.
- 3.3.15. Contact Measurement Canada or accredited service provider for installation verification. Installation verification shall include a tenant-to-breaker check. Electrical Contractor must be available for verification support.

3.4. CALIBRATION AND MAINTENANCE SERVICE

- 3.4.1. All meters shall be Measurement Canada bench verified, and Submetering Supplier will provide all Inspection/Verification Certificates within as-built documentation in order to provide a complete operational system.
- 3.4.2. Submetering Supplier will include all required Measurement Canada installation inspections in pricing. All appropriate equipment is to be labelled with the respective certification labels.
- 3.4.3. Electrical Contractor to provide "AS BUILT" – marked up by Submetering Supplier; "Record of Metering Installation" sheet(s) indicating each meter, serial no., address, cross reference, metered tenant(s) and other applicable information. Information to be forwarded to software or reporting vender.
- 3.4.4. The Submetering Supplier shall verify, adjust and test the system. Verification to be carried out with the assistance of the Electrical and Mechanical Contractor. Upon completion, Submetering Supplier to issue a "CERTIFICATE OF ACCEPTANCE" to the Engineer's Representative/Owner, and Electrical Contractor. This shall be submitted as a Shop Drawing to the Consultants and incorporated into the final O&M Manuals.
- 3.4.5. Submetering Supplier shall demonstrate operation of the system as follows:
 - 3.4.5.1. Meter readings at the meter
 - 3.4.5.2. Diagnostics
 - 3.4.5.3. Provide manual of installed system.
- 3.4.6. The Submetering Supplier shall provide pricing for billing services, on a per meter price, for collection of tenant sub-metered energy for return to building management or local distribution company (LCD) to apply against facility energy costs.
- 3.4.7. The Submetering Supplier shall detail remote connectivity requirements (telephone, High-Speed Internet, etc.). Building owner/property manager shall provide necessary remote connectivity to allow for remote billing services, if required.
- 3.4.8. Submetering Supplier to register the system with Measurement Canada and work with the Owner to obtain all required information to do so.
- 3.4.9. After the specified Measurement Canada approval period (seal period typically 6 years), the Submetering Supplier shall provide options for maintaining Measurement Canada Approval. This may include, but not limited to: Onsite Re-verification or removal of existing equipment and replacement with Measurement Canada verified equipment.
- 3.4.10. The Submetering Supplier shall provide pricing to the Owner for system maintenance, repair and/or replacement service to the extent that is covered by the warranty.

3.5. COMMUNICATIONS

- 3.5.1. Provide a dedicated IP connection at point of central data collection for remote meter reading and diagnostics of the system.

3.6. TRAINING

- 3.6.1. Submetering Supplier to provide 4 hour training and software manual for Owner's staff of selected reporting system.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 27 26 – WIRING DEVICES.
- 1.1.4. Section 26 05 21 – WIRES AND CABLES UNDER 2000 V.

1.2. REFERENCE

- 1.2.1. CSA C22.2 No. 62 – Surface Metal Raceways, latest edition.
- 1.2.2. ANSI/TIA 569-C – Commercial Building Standard for Telecommunications Pathways and Spaces, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.3.2. If variations from the reviewed shop drawings occur during the installation of the system, final as built drawings shall be submitted for each floor that has been altered.

PART 2 PRODUCTS

2.1. SURFACE RACEWAY FOR WIRING DEVICES

- 2.1.1. The raceway and all system components must be CSA listed.
- 2.1.2. Raceway to be constructed of galvanized steel unless stainless steel is identified on the drawings. Raceway base shall have a minimum thickness of 1.3 mm (0.050 in.) and the cover shall have a minimum thickness of 1 mm (0.040 in.).
- 2.1.3. Raceways shall be painted with the colour to be determined by the architect at the time of shop drawing stage. Submit available colour selections with the shop drawing submittal.
- 2.1.4. The raceway shall have a minimum of two compartments unless additional compartments are identified on the drawings. Assembled base and cover shall be a 120 mm (4¾ in.) wide for two section raceway and additional 60 mm (2-3/8 in.) for every additional compartment with a minimum depth of 45 mm (1¾ in.) unless specified otherwise on the drawing.
- 2.1.5. The raceway shall be a modular design with separate covers for each compartment divided with fixed barriers. The compartment covers to be snap on design, which snap side by side on a common base. Raceway covers shall be enhanced tamper resistant form, where screws are only necessary on access plates and the covers of certain fittings, but not on standard cover lengths. A tool shall be provided to form the shape in the cover flange necessary to maintain enhanced tamper resistance when the cover is field cut. Another tool shall be provided for cutting covers to ensure square field cuts.
- 2.1.6. Provide all required fittings including, but not limited to flat, internal and external elbows, couplings for joining raceway sections, wire clips, blank end fittings, entrance fittings, and a full complement of device mounting brackets and plates. All fittings shall be an enhanced tamper resistant form and shall be divided with barriers and made to match the size of the accompanying raceway base.
- 2.1.7. Provide full capacity corner elbows and tee fittings to maintain a controlled 50 mm (2 in.) cable bend radius, which meets the specifications for Fiber Optic cabling and exceeds the TIA 569 requirements for communications pathways.

- 2.1.8. Device brackets shall be provided in sizes to match the width of the raceway and with mounting-holes appropriately located to ensure proper mounting of devices in all compartments.
- 2.1.9. Device plates shall be made in any length from 152.4 mm (6 in.) to 1.5 m (60 in.) with cut outs to accommodate various combinations of power and/or communication devices in all compartments. Device plates shall be 152.4 mm (6 in.) and 304.8 mm (12 in.) long with a flange to overlap the joint of the adjacent cover. Provide 5% additional device plates for future additions or modifications for all types of devices installed.

2.2. MANUFACTURERS

- 2.2.1. The following are approved manufacturers:
 - 2.2.1.1. CER - Canadian Electric Raceways.
 - 2.2.1.2. Legrand – Wiremold.
 - 2.2.1.3. Hubbell.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Prior to and during installation, refer to system layout or approval drawings containing all elements of the system. Installer shall comply with detailed manufacturer's instruction sheets, which accompany system components, as well as complete system instruction sheets, whichever is applicable.
- 3.1.2. All raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, also in accordance with manufacturer's installation sheets.
- 3.1.3. All metal raceway shall be electrically continuous and bonded in accordance with the respective electrical code for proper grounding.
- 3.1.4. Provide a separate insulated bonding conductor in the entire length of the raceway.
- 3.1.5. Raceway shall be securely supported at intervals not exceeding 1500 mm (5 ft.) or in accordance with manufacturer's installation sheets.
- 3.1.6. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer's installation sheets. All unused raceway openings shall be closed.
- 3.1.7. Locate wireway and wiring devices as shown.
- 3.1.8. Install supports, elbows, tees, connectors and fittings. Keep the number of elbows, offsets and connections to a minimum.
- 3.1.9. Install wiring and wiring devices as indicated.
- 3.1.10. Install barriers to separate different wiring systems.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 05 – MOUNTING HEIGHTS.
- 1.1.4. Section 26 05 53 – IDENTIFICATION.
- 1.1.5. Section 26 51 13 – LIGHTING EQUIPMENT.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 42, General use receptacles, attachment plugs, and similar wiring devices, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

PART 2 PRODUCTS

2.1. SWITCHES

- 2.1.1. 20 A, single pole, double pole, three-way, or four-way specification grade switches. Voltage rating of the switch to be as per the contract documents.
- 2.1.2. Manually-operated general purpose switches with following features:
 - 2.1.2.1. Terminal-holes approved for No. 10 AWG wire.
 - 2.1.2.2. Silver alloy contacts.
 - 2.1.2.3. Urea or melamine moulding for parts subject to carbon tracking.
 - 2.1.2.4. Suitable for back and side wiring.
 - 2.1.2.5. Decora Style specification grade Rocker switch.
 - 2.1.2.6. Colour to be selected by Architect/Engineer's Representative.
- 2.1.3. Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2. RECEPTACLES

- 2.2.1. All receptacles to be specification grade.
- 2.2.2. Duplex receptacles, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
 - 2.2.2.1. Thermoplastic with impact-resistant nylon face moulded housing.
 - 2.2.2.2. Suitable for No. 10 AWG for back and side wiring.
 - 2.2.2.3. Eight back wired entrances, four side wiring screws.
 - 2.2.2.4. Triple wipe contacts and riveted grounding contacts.
- 2.2.3. Duplex receptacles with USB charging outlets, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
 - 2.2.3.1. Thermoplastic with impact-resistant nylon face moulded housing.

- 2.2.3.2. Suitable for No. 10 AWG for back and side wiring.
- 2.2.3.3. Six back wired entrances, four side wiring screws.
- 2.2.3.4. Triple wipe contacts and riveted grounding contacts.
- 2.2.3.5. One USB A charging outlet and one USB C charging outlet, 5 V DC, 6 A shared between the two ports.
- 2.2.4. Hospital grade receptacles: As indicated in Section 26 05 21.01 – PATIENT CARE WIRING.
- 2.2.5. Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - 2.2.5.1. Thermoplastic moulded housing.
 - 2.2.5.2. Suitable for No. 10 AWG for back and side wiring.
 - 2.2.5.3. Four back wired entrances, 2 side wiring screws.
- 2.2.6. Other receptacles with ampacity and voltage as indicated.
- 2.2.7. Receptacles to be coloured as follows:
 - 2.2.7.1. Normal Power – Colour to be selected by Architect/Engineer's Representative.
 - 2.2.7.2. Emergency/Essential Power – Red.
 - 2.2.7.3. Isolated Ground – Orange.
 - 2.2.7.4. Switched – Gray.
 - 2.2.7.5. UPS – Blue.
- 2.2.8. All dwelling receptacles of CSA configuration 5-15R and 5-20R shall be tamper resistant receptacles and shall be so marked; receptacles dedicated for microwaves, refrigerators, freezers or those receptacles located in an attic or crawl space shall not be required to be tamper-resistant.
- 2.2.9. All dwelling receptacles rated 125V, 20A or less shall be provided with arc-fault protection, except for the following:
 - 2.2.9.1. Bathroom and washroom basin receptacles.
 - 2.2.9.2. Kitchen counter receptacles
 - 2.2.9.3. Refrigerator receptacles
- 2.2.10. Arc-fault protection for dwelling unit receptacles shall be provided by:
 - 2.2.10.1. A combination-type arc-fault circuit interrupter
 - 2.2.10.2. An outlet branch-circuit interrupter installed at the first outlet on the branch circuit, where the wiring method for the portion of branch circuit between the branch circuit overcurrent device and the first outlet consists of metal raceway, armoured cable, or non-metallic conduit or tubing.
- 2.2.11. Electrical Contractor shall coordinate with furniture supplier to identify switched circuits prior to installation.

2.3. MANUFACTURERS

- 2.3.1. The switches and wiring devices shall be of one manufacturer throughout the project.
- 2.3.2. The following are acceptable manufacturers:
 - 2.3.2.1. Legrand.
 - 2.3.2.2. Hubbell.
 - 2.3.2.3. Cooper.

2.3.2.4. Leviton.

2.4. DIMMERS

2.4.1. Dimmers shall be 600 W, 1500 W, 2000 W.

2.4.1.1. Full range, continuously variable control of light intensity.

2.4.1.2. Vertical slider allowing the light level to be set by the user.

Slide to Off.

2.4.1.3. Capable of operating at rated capacity.

2.4.1.4. Power failure memory.

2.4.1.5. Dimmers shall be available for direct control of incandescent, magnetic low voltage, electronic low voltage, fluorescent, and LED.

2.4.2. Electronic (solid-state) Low Voltage (ELV) transformer dimmers (incandescent).

2.4.2.1. Circuitry designed to control the input of Electronic (solid state) Low Voltage transformers.

2.4.2.2. Control up to 600 W of Electronic Low Voltage load.

2.4.2.3. Reset-able overload protection when capacity is exceeded.

2.4.3. LED dimmers.

Slide to Off only. Must match driver and LED requirements.

2.4.4. Manufacturers

2.4.4.1. Lutron Maestro Series.

2.4.4.2. Leviton True Touch Series.

2.5. SPECIAL WIRING DEVICES

2.5.1. Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type.

2.6. COVER PLATES

2.6.1. Cover plates for wiring devices.

2.6.2. Cover plates from one manufacturer throughout project.

2.6.3. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

2.6.4. Provide stainless steel cover plates, suitable for the respective device, for all devices mounted in flush-mounted outlet boxes located in finished areas.

2.6.5. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.6.6. Weatherproof rain tight while-in-use metal cover, complete with gaskets for duplex receptacles located outside or as indicated.

2.6.7. Weatherproof rain tight while-in-use metal cover, complete with gaskets for single receptacles or switches located outside or as indicated.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Switches:

3.1.1.1. Install single throw switches with handle in "UP" position when switch closed.

- 3.1.1.2. Install switches in gang type outlet box when more than one switch is required in one location.
- 3.1.1.3. Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.
- 3.1.1.4. Mount toggle switches at height specified in Section 26 05 05 – MOUNTING HEIGHTS or as indicated.
- 3.1.2. Receptacles:
 - 3.1.2.1. Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - 3.1.2.2. Mount receptacles at height specified in Section 26 05 05 – MOUNTING HEIGHTS or as indicated.
 - 3.1.2.3. Where split receptacle has one portion switched, mount vertically and switch upper portion.
- 3.1.3. Dimmers:
 - 3.1.3.1. Install dimmers as indicated. Provide suitable clearances in multi-gang boxes as recommended by the manufacturer to maintain the dimmer rating.
 - 3.1.3.2. Coordinate the dimmer selection with the ballast/driver to be controlled, to ensure compatibility.
 - 3.1.3.3. Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.
- 3.1.4. Cover plates:

Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

 - 3.1.4.1. Install suitable common cover plates where wiring devices are grouped.
 - 3.1.4.2. Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- 3.1.5. Labelling
 - 3.1.5.1. Provide labels with panel name and circuit number on all receptacles in conformance with Section 26 05 53 – IDENTIFICATION.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 248, Low Voltage Fuses, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.3.2. Submit fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics, I²t (for fuse coordination), and peak let-through current.

1.4. MAINTENANCE MATERIALS

- 1.4.1. Three spare fuses of each type and size installed 600 A. and above.
- 1.4.2. Six spare fuses of each type and size installed up to and including 400 A.

1.5. DELIVERY AND STORAGE

- 1.5.1. Ship fuses in original containers.
- 1.5.2. Do not ship fuses installed in switchboard.
- 1.5.3. Store fuses in original containers in moisture free location.

PART 2 PRODUCTS

2.1. FUSES GENERAL Fuses: product of one manufacturer.

- 2.1.2. Fuses to have an indicating window to identify when the fuse has been blown.

2.2. FUSE TYPES

- 2.2.1. Class L fuses.
 - 2.2.1.1. Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - 2.2.1.2. Type L2, fast acting.
- 2.2.2. Class J fuses.
 - 2.2.2.1. Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - 2.2.2.2. Type J2, fast acting.
- 2.2.3. Class R fuses. For UL Class RK1 fuses, peak let-through current and I²t values not to exceed limits of CSA C22.2 No. 248.
 - 2.2.3.1. Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
 - 2.2.3.2. Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - 2.2.3.3. Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

- 2.2.4. Class C fuses.
- 2.2.5. Fuses for Motors:
- 2.2.5.1. All fuses for motor loads are to be time-delay type.

2.3. FUSE STORAGE CABINET

- 2.3.1. Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door, B-LINE model 243012 + 2 shelves FCS2412, finished in accordance with Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.4. FUSE PULLER

- 2.4.1. Provide a fuse puller for each size of fuse to be located in the fuse storage cabinet. Fuse puller to be clearly labelled for the appropriate building and fuse cabinet. Fuse puller to be equal to the Ideal Safe-T-Grip Fuse Puller.

2.5. MANUFACTURERS

- 2.5.1. The following are acceptable manufacturers:
 - 2.5.1.1. Mersen
 - 2.5.1.2. Cooper-Bussman
 - 2.5.1.3. Littelfuse

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install fuses in mounting devices immediately before energizing circuit.
- 3.1.2. Ensure correct fuses fitted to physically match mounting devices.
 - 3.1.2.1. Install Class R rejection clips for Class R fuses.
- 3.1.3. Ensure correct fuses fitted to assigned electrical circuit.
- 3.1.4. Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 5 – Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS
- 1.3.2. Include time-current characteristic curves for breakers with ampacity of 400 A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.
- 1.3.3. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

PART 2 PRODUCTS

2.1. BREAKERS GENERAL

- 2.1.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.
- 2.1.2. Common-trip breakers: with single handle for multi-pole applications.
- 2.1.3. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- 2.1.4. Circuit breakers with interchangeable trips as indicated.

2.2. THERMAL MAGNETIC BREAKERS

- 2.2.1. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3. MAGNETIC BREAKERS

- 2.3.1. Moulded case circuit breakers to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4. FUSED THERMAL MAGNETIC BREAKERS

- 2.4.1. Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit breaker. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. The removal of fuse cover, blowing of a fuse or removal of a fuse, shall trip the breaker.

2.5. SOLID STATE TRIP BREAKERS

- 2.5.1. Circuit breaker to operate by means of an adjustable solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition.
- 2.5.2. Electronic trip with true RMS sensing.
- 2.5.3. Use current transformers to ensure accurate measurement from low current up to high currents.
- 2.5.4. Electronic trip with thermal memory/imaging.
- 2.5.5. Adjustable solid state trip unit complete with:
 - 2.5.5.1. Adjustable long time pick-up
 - 2.5.5.2. Adjustable long time delay
 - 2.5.5.3. Adjustable short time pick-up (where S indicated on Drawings)
 - 2.5.5.4. Adjustable short time delay (where S indicated on Drawings)
 - 2.5.5.5. Adjustable instantaneous pick-up (where I indicated on Drawings)
 - 2.5.5.6. Adjustable ground fault pick-up (where G indicated on Drawings)
 - 2.5.5.7. Adjustable ground fault delay (where G indicated on Drawings)
 - 2.5.5.8. Long time, short time, instantaneous tripping for phase and ground fault short circuit protection as noted above.
- 2.5.6. Trip unit consisting of adjustable protection settings set by rotating switch or digital keypad, and rating plug.

Provide features listed below:

- 2.5.6.1. Provide instantaneous maintenance mode (arc flash reduction maintenance system) including settings as low as 2.5 times breaker rating plug with switch built into respective switchboard. Provide LED light that confirms that maintenance mode is engaged.
- 2.5.6.2. Provide instantaneous maintenance mode (arc flash reduction maintenance system) including settings as low as 2.5 times breaker rating plug, enabled remotely through 24 V DC circuit and remote switch. Provide LED light that confirms that maintenance mode is engaged.
- 2.5.6.3. Provide trip unit with local trip indication and ability to locally and remotely indicate reason for trip (e.g. overload, short circuit, or ground fault).

2.6. INSULATED CASE CIRCUIT BREAKERS GENERAL

- 2.6.1. Use insulated case circuit breakers where shown on the Drawings.
- 2.6.2. Provide draw out type electrically operated circuit breaker with remote open/close key switch.
- 2.6.3. Provide circuit breaker operating mechanisms that are two-step, fully-stored energy devices for quick-make, quick-break operation with a maximum of a five-cycle closing time. Open-close-open (O-C-O) cycle possible without recharging. Provide motor operator that automatically charges when circuit breaker is closed. Charge the closing springs (step one) upon actuation of the operating handle or an operation cycle of the circuit breaker motor and close the circuit breaker contact (step two) upon operation of a local "close" button. Automatically charge the opening springs when closing the circuit breaker contacts.
- 2.6.4. Provide breaker that is 100 % continuous current rated in its enclosure.
- 2.6.5. Provide kirk keys where indicated on the Drawings.

- 2.6.6. Completely isolate current-carrying components from the accessory mounting area and double insulate current-carrying components from the operator with accessory cover in place.
- 2.6.7. Provide padlocking provisions furnished to receive up to three padlocks when circuit breaker is in the open position, positively preventing unauthorized closing of the circuit breaker contacts.
- 2.6.8. Provide provisions for up to two key locks allowing locking in the disconnected position. Provide provisions for locking in the connected, test and disconnected positions by padlock or key lock.
- 2.6.9. Provide buttons, with lockable clear cover, located on the face of the circuit breaker, to open and close the circuit breaker and indicators to show the position of the circuit breaker contacts, status of the closing springs, and circuit breaker position in the cell. Provide an indicator that shows "charged-not OK to close" if closing springs are charged but circuit breaker is not ready to close. Provide circuit breaker racking system that has positive stops at the connected, test, disconnected and withdrawn positions.
- 2.6.10. Equip circuit breaker with an interlock to discharge the stored energy spring before the circuit breaker can be withdrawn from its cell. Provide circuit breaker that provides a positive ground contact check between the circuit breaker and cell when the accessory cover is removed while the circuit breaker is in the connected, test or disconnected positions.
- 2.6.11. Provide interlocks to prevent circuit breaker draw out when in closed position and to prevent closing unless fully engaged or in test position. Provide breaker that is trip free during racking operation.
- 2.6.12. Provide as an option, primary connectors that can be rotated to provide flexible vertical or horizontal connections. Ensure front connections are available as an option for shallow depth equipment designs.
- 2.6.13. Provide ready-to-close contact that indicates remotely that the circuit breaker is "ready to close." The circuit breaker is ready to close when it is open, spring mechanism is charged, a maintained closing order is not present, a maintained opening order is not present, and the circuit breaker is in an operational position.
- 2.6.14. Provide secondary control wiring that is front accessible and available in cage clamp or ring terminal connections. Provide secondary wiring that is inaccessible when switchboard door is closed.
- 2.6.15. Provide long service life circuit breaker. Provide circuit breakers certified to perform a minimum of 10,000 operations without maintenance where circuit breaker frames are 3000 A and below.
- 2.6.16. Equip circuit breaker with a visual contact wear indicator.
- 2.6.17. Provide circuit breaker arc chutes that don't contain asbestos.
- 2.6.18. Trip Unit
- 2.6.18.1. Comply with the requirements noted above in the Solid State Trip Breakers section.
- 2.6.18.2. Provide trip units that are removable to allow for field upgrades.
- 2.6.18.3. Provide trip units that are capable of the following types of ground-fault protection: residual, zero sequence, source ground return, and modified differential. Ground-fault sensing systems may be changed in the field.
- 2.6.18.4. Ensure neutral current transformers are available for four-wire systems.
- 2.6.18.5. Provide trip units that have real time metering and metering functions that include current, voltage, power and frequency. Provide metering accuracy of 1.5 % current, 0.5 % voltage, and 2 % power. Accuracies listed are total system including CT and meter and are of reading, not full scale, in a range of 5 – 500 %.

2.6.18.6. Provide trip unit with provisions for communications on a network.

2.7. ACCESSORIES

2.7.1. Include:

2.7.1.1. shunt trip, when electrically operated or when indicated.

2.7.1.2. auxiliary switches, when electrically operated or when indicated.

2.7.1.3. motor-operated mechanism, when electrical operation indicated.

2.7.1.4. on-off locking device.

2.7.1.5. handle mechanism.

2.7.1.6. Where a breaker serves a fire pump, the breaker is to come complete with auxiliary contacts that are to be monitored by the fire alarm system.

2.8. MANUFACTURERS

2.8.1. The following are acceptable manufacturers:

2.8.1.1. Schneider Electric

2.8.1.2. Eaton Cutler-Hammer

2.8.1.3. Siemens

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Install circuit breakers as indicated.

3.1.2. Contractor to wire any neutral CT's to the breaker trip unit where required by the breaker ground fault detection system or as otherwise required by the manufacturers instructions.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 53 – IDENTIFICATION.

1.2. REFERENCE

- 1.2.1. CSA C22.2 No. 4 – Enclosed Switches, latest edition.
- 1.2.2. CSA C22.2 No. 39 – Fuse-holder Assemblies, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.3.2. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

PART 2 PRODUCTS

2.1. DISCONNECT SWITCHES

- 2.1.1. Fusible, horsepower rated disconnect switch in CSA Type 3R enclosure, size as indicated.
- 2.1.2. Non-fusible, horsepower rated disconnect switch in CSA Type 3R enclosure, with minimum 10 kA Short Circuit Current Rating (SCCR), with manufacturer listed series rating with upstream breaker / fuse where available fault current exceeds 10 kA and with UL series rating label on disconnect switch, size as indicated.
- 2.1.3. Provision for padlocking in on-off switch position by three locks.
- 2.1.4. Mechanically interlocked door to prevent opening when handle in ON position.
- 2.1.5. Fuses: size as indicated, class J, current limiting, in accordance with Section 26 28 14 – FUSES - LOW VOLTAGE.
- 2.1.6. Fuse-holders: suitable without adaptors, for type and size of fuse indicated.
- 2.1.7. Quick-make, quick-break action.
- 2.1.8. ON-OFF switch position indication on switch enclosure cover.

2.2. EQUIPMENT IDENTIFICATION

- 2.2.1. Provide equipment identification in accordance with Section 26 05 53 – IDENTIFICATION.
- 2.2.2. Indicate name of load controlled on nameplate.
- 2.2.3. Provide a Lamacoid nameplate that indicates the replacement fuse size as well as the maximum allowable fuse size for that disconnect based upon the sizing of the feeder.

2.3. MANUFACTURERS

- 2.3.1. The following are acceptable manufacturers:

- 2.3.1.1. Schneider Electric.
- 2.3.1.2. Eaton Cutler-Hammer.
- 2.3.1.3. Siemens.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install disconnect switches complete with fuses if applicable.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 53 – IDENTIFICATION.

Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

1.2. REFERENCES

- 1.2.1. IEC 947-4-1, Part 4: Contactors and motor-starters, latest edition. Select IEC or NEMA rated devices depending on the project requirements
- 1.2.2. CSA C22.2 No. 60947-4-1 – Low-voltage switchgear and control gear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters, latest edition.
- 1.2.3. Attachment A – Loose Starter Schedule
- 1.2.4. Attachment B – MCC Schedule.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
 - 1.3.1.1. Indicate:
 - 1.3.1.1.1. Mounting method and dimensions.
 - 1.3.1.1.2. Starter size and type.
 - 1.3.1.1.3. Layout of identified internal and front panel components.
 - 1.3.1.1.4. Enclosure types.
 - 1.3.1.1.5. Wiring diagram for each type of starter.
 - 1.3.1.1.6. Interconnection diagrams.
 - 1.3.2. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

1.4. OPERATION AND MAINTENANCE DATA

- 1.4.1. Provide operation and maintenance data for motor starters for incorporation into manual.
- 1.4.2. Include operation and maintenance data for each type and style of starter.

1.5. MAINTENANCE MATERIALS

- 1.5.1. Provide listed spare parts for each different size and type of starter:
 - 1.5.1.1. Stationary contacts.
 - 1.5.1.2. Movable contacts.
 - 1.5.1.3. Auxiliary contacts.
 - 1.5.1.4. Control transformer.

- 1.5.1.5. Operating coil.
- 1.5.1.6. Fuses.
- 1.5.1.7. Indicating lamp bulbs used.

PART 2 PRODUCTS

2.1. MATERIALS

- 2.1.1. Starters: to IEC 947-4 with AC4 utilization category.

2.2. EQUIPMENT

- 2.2.1. All starters (with the exception of manual motor starters) are to be combination starters with fusible disconnect switches.
 - 2.2.1.1. All fusible disconnects are:
 - 2.2.1.1.1. To be of the quick make and quick break type.
 - 2.2.1.1.2. To have an operating handle on the outside of the enclosure.
 - 2.2.1.1.3. To have fuse clips suitable for HRC type J fuses.
 - 2.2.1.2. The operating handle of the fusible disconnect switch must be:
 - 2.2.1.2.1. Capable of being locked in the "OFF" position.
 - 2.2.1.2.2. Have provisions of accepting 3 pad locks.
 - 2.2.1.2.3. Have provision for preventing switching to "ON" position while enclosure door is open.
- 2.2.2. All starters, with the exception of manual motor starters, are to be provided with a single phase, dry type control circuit transformer with:
 - 2.2.2.1. A fused primary.
 - 2.2.2.2. Primary voltage as indicated.
 - 2.2.2.3. 120 V secondary.
 - 2.2.2.4. Secondary fusing.
- 2.2.3. Size the control transformer for control circuit load plus 20 % spare capacity, minimum capacity 150 VA.
- 2.2.4. All starters shall be equipped with indicating lamps that are long life cluster LED style.
- 2.2.5. All starters shall be provided with 3 phase bimetallic overload relays which are adjustable and are ambient temperature compensated. Manual resets for the overload relays are to be mounted on the enclosure door such that they can be reset from outside of the enclosure and have externally visible trip indication.
- 2.2.6. All starters shall have identification for each wire and terminal for external connection, within starter, with permanent number marking identical to diagram.

MANUAL MOTOR STARTERS

Single or three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

Switching mechanism, quick make and break.

One overload heater per phase, manual reset, trip indicating handle.

Accessories:

Toggle switch: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating light: oil tight type and colour as indicated on the Starter Schedule.

Locking tab to permit padlocking in "ON" or "OFF" position.

2.3. FULL VOLTAGE MAGNETIC STARTERS

2.3.1. Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

2.3.1.1. Contactor solenoid operated rapid action type.

2.3.1.2. Motor overload bimetallic protective relay.

2.3.1.3. Wiring and schematic diagram inside starter enclosure in a visible location.

2.3.2. Accessories:

2.3.2.1. Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

2.3.2.2. Indicating lights: oil tight type and color as indicated on the Starter Schedule.

2.3.2.3. 2-N/C and 2 N/O spare auxiliary contacts unless otherwise indicated on the Starter Schedule.

FULL VOLTAGE REVERSING MAGNETIC STARTERS

Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

Two - 3 pole magnetic contactors mounted on a common base.

Mechanical and electrical interlocks to prevent both contactors from operating at same time.

Motor overload bimetallic protective relay.

Wiring and schematic diagram inside starter enclosure in a visible location.

Accessories

Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating lights: heavy duty oil tight type and color as indicated on the Starter Schedule.

Auxiliary control devices as indicated on the Starter Schedule.

MULTI-SPEED STARTERS

2.3.3. (2) Speed starters of size type, rating and enclosure type as indicated. Starter suitable for variable torque type motor, unless otherwise indicated, and with components as follows:

One 3-pole contactor for each winding for separate winding motors.

One 3-pole and one 5-pole contactor for each re-connectable winding for consequent pole type motors.

Three overload relays.

Accessories:

Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating lights: heavy duty oil tight, type and color as indicated on the Starter Schedule.

Auxiliary control devices as indicated on the Starter Schedule.

Low speed compelling relay and automatic sequence accelerating, decelerating relays for each speed.

MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER

Auto-transformer starter closed circuit transition type, of size, type, rating and enclosure type as indicated and with following components:

Three 3-pole contactors.

Auto-transformer with 50%, 65% and 80% taps.

One adjustable pneumatic timing relay.

One 3-pole manual reset overload device.

Thermal overload protection of auto- transformers.

Accessories:

Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating lights: heavy duty oil tight type and color as indicated on the Starter Schedule.

Auxiliary control devices as indicated on the Starter Schedule.

MAGNETIC STARTER REDUCED VOLTAGE STAR-DELTA

Reduced voltage star-delta open transition starter, of size, type, rating and enclosure type as indicated, with components as follows:

Two 3-pole delta contactors with auxiliary relays and interlocks.

One 3-pole star contactor with auxiliary relays and interlocks.

Mechanical interlock to interlock one delta contactor and the star contactor.

One timing relay.

Three overload relays.

Reduced voltage star-delta closed transition starter, of size, type, rating and enclosure type as indicated, with components as follows:

Two 3-pole delta contactors with auxiliary relays and interlocks.

One 3-pole star contactor with auxiliary relay and interlocks.

One 3-pole transition contactor.

One set of transition resistors.

Mechanical interlock, to interlock one delta contactor and the star contactor.

One timing relay.

Three overload relays.

Accessories:

Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating lights: heavy duty oil tight, type and color as indicated on the Starter Schedule.

Auxiliary control devices as indicated on the Starter Schedule.

MAGNETIC STARTER REDUCED VOLTAGE PART WINDING

Two-step reduced voltage, part winding starter of size, type, rating and enclosure type as indicated, with components as follows:

Two 3-pole contactors.

Adjustable pneumatic timer.

Six Choose an item.reset overload relays.

Three step reduced voltage part winding starter of size, type, rating and enclosure type as indicated, with the following components:

Three 3-pole contactors.

One set starting resistors.

Six overload relays.

Accessories:

Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating lights: heavy duty oil tight type and color as indicated on the Starter Schedule.

Auxiliary control devices as indicated on the Starter Schedule.

THREE PHASE MANUAL REVERSING STARTER

Three phase manual reversing starter of size, type, rating and enclosure type as indicated, with components as follows:

Two 3-pole manual motor starters, quick make and break.

Six overload relays and manual reset.

Mechanical interlock to prevent both switches from closing at same time.

Accessories

Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating lights: heavy duty oil tight type and colour as indicated on the Starter Schedule.

THREE PHASE MANUAL TWO SPEED SEPARATE WINDING STARTERS

Three phase manual two speed separate winding starters of size, type, rating and enclosure type as indicated with components as follows:

Two 3-pole manual motor starters, quick make and break.

Six overload relays and manual reset.

Mechanical interlock to prevent both switches from closing at same time.

Accessories:

Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

Indicating lights: heavy duty oil tight type and colour as indicated on the Starter Schedule.

2.4. ENCLOSURE

2.4.1. Starter to come in a CSA Type 3R enclosure, size as indicated.

2.4.2. Equipment to be painted: baked grey enamel.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Install starters, connect power to starter and control and provide wiring from starter to motor through a manual disconnecting device if required by code.

- 3.1.2. Coordinate with Mechanical Division Contractor to ensure correct fuses and overload devices elements installed.

3.2. FIELD QUALITY CONTROL

Perform tests in accordance with Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE and manufacturer's instructions. Contractor to oversee all testing and correct any deficiencies noted.

- 3.2.1. Operate switches, contactors to verify correct functioning.
- 3.2.2. Perform starting and stopping sequences of contactors and relays.
- 3.2.3. Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 01 00 – OPERATING AND MAINTENANCE INSTRUCTIONS.
- 1.1.2. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.3. Section 26 05 04 – SUBMITTALS – SHOP DRAWINGS.
- 1.1.4. Section 26 05 21 – WIRES AND CABLES UNDER 2000 V.
- 1.1.5. Section 26 06 05.16 – LUMINAIRE SCHEDULE.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 74 – Equipment for Use with Electric Discharge Lamps, latest edition.
- 1.2.2. The Consortium of Energy Efficiency (CEE) guidelines, latest edition.
- 1.2.3. IESNA LM-79 – Approved Method: Electric and Photometric Measurements of Solid-State Lighting Products, latest edition.
- 1.2.4. IESNA LM-80 – Approved Method: Measuring Lumen Maintenance of LED Light Sources, latest edition.
- 1.2.5. The Certified Ballast Manufacturers Association (CBM) standards, latest edition.
- 1.2.6. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts, latest edition.

1.3. SUBSTITUTION

- 1.3.1. The lighting equipment for this project and specified herein has been carefully selected for its ability to meet the project's luminous environment requirements. Manual and computer calculations have been performed to ensure that the lighting equipment that has been specified complies with established criteria. The Engineer's Representative reserves the right not to accept any alternates or substitutions in accordance with the requirements of the Luminaire Schedule. If alternates or substitutions are entertained, then it is the responsibility of the Contractor/Supplier to provide: a comparison table showing the specified and the proposed luminaire performance information, IES files for the proposed luminaires, the information required herein, and detailed layouts and lighting calculations demonstrating that the performance of the alternate luminaire meets or exceeds the original lighting design while not consuming any additional energy. An extra review fee, per luminaire submitted, will be charged to the Contractor (with no additional costs to the Project Owner). Reviewed alternates may be rejected, regardless of the payment fee received, when alternates do not meet the project requirements. Invoices must be paid prior to Consultant's review starting or changes in the design documents to incorporate the proposed alternates after their review. The Contractor/Supplier is responsible to ensure the light levels provided in the alternate submittal package will achieve the design light levels. Where the light levels are not achieved, the Contractor is responsible to replace the luminaire with a luminaire that will meet the required levels with no increase in energy use at no cost to the Owner. Rather than replacing the luminaires, the Engineer's Representative may accept the installation of additional luminaires by the Contractor at no cost to the Owner in order to achieve the required light levels.
- 1.3.2. Accompanying the request for a luminaire or lamp substitution, the contractor shall submit a complete lighting calculation report with photometric modeling of the space showing light levels including average, maximum, minimum and max to min values.

1.4. SHOP DRAWING AND PRODUCT DATA

- 1.4.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.4.2. Submit a shop drawing for each luminaire specified, including lamp.
- 1.4.3. Luminaire submittals are to consist of a physical description, manufacturer's specification sheets, dimensioned drawings, and complete photometric data from an independent test laboratory in the form of IES computer files of the equipment being submitted and hard copy of the photometric report. Coordinate ceiling types to ensure proper supports and luminaire framing.
- 1.4.4. Lamp submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, rated life, colour temperature, base type, lamp shape, CRI, and voltage.
- 1.4.5. LED submittals are to consist of manufacturer's technical data for diodes and drivers with respective luminaire shop drawing. Submittal to include operating wattage, voltage, maximum distance from drivers, wiring diagrams and lumen output at time of delivery.
- 1.4.6. Ballast submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, input voltage, ballast efficiency, maximum distance for remote ballasts, power factor, and operating temperature.
- 1.4.7. Where samples are indicated on the luminaire schedule, they are to be provided with shop drawings at time of shop drawing submittals unless noted otherwise.
- 1.4.8. Where luminaires consist of multiple field assembled components, include manufacturer supplied installation manual detailing the assembly procedure.

1.5. OPERATION AND MAINTENANCE DATA

- 1.5.1. Provide operation and maintenance data for lighting equipment in accordance with Section 26 01 00 – OPERATING AND MAINTENANCE INSTRUCTIONS for incorporation into the manual.
- 1.5.2. Operation and maintenance instructions shall include documentation related to warranty claim process.

1.6. FIXED PER UNIT COST LUMINAIRES

- 1.6.1. Listed in the luminaire schedule are a fixed per unit cost for certain luminaire types. Electrical Contractor is responsible for completing a take-off of the drawings to determine quantity of each luminaire type and use the listed fixed unit price to calculate the total cost per luminaire type. The total cost for all luminaires shall be carried in the bid for the electrical contract. Provide a breakdown of the total cost, per luminaire type, that is carried under the electrical contract. All luminaires are to be included in the electrical contract including all luminaires identified with fixed unit costs. The Electrical Contractor is to include fixed per unit cost luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.6.2. The fixed per unit cost excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost luminaires. Show the applicable taxes as a separate line item.

1.7. CASH ALLOWANCE LUMINAIRES

- 1.7.1. Listed in the luminaire schedule are 'cash allowance' fixtures for certain luminaire types. A complete take-off of the drawings has been done to determine the quantity of each 'cash allowance' luminaire type and the total cost has been carried in the Div-0/1 cash allowance value. The total cost for all 'cash allowance' luminaires are NOT to be carried in the bid for the electrical contract.

- 1.7.2. After tender award to the successful Electrical Contractor, the Consultant shall provide the Electrical Contractor the exact manufacturer/model number(s) of all 'cash allowance' luminaires and the Electrical Contractor shall be responsible for purchasing the fixtures through the monies from the cash allowance.
- 1.7.3. Provide a breakdown of the total cost, per luminaire type, that is carried under the base electrical contract. All luminaires are to be included in the base electrical contract excluding all luminaires identified as 'cash allowance' luminaires. However the Electrical Contractor is to include 'cash allowance' luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS once the Consultant provides the Electrical Contractor with the exact manufacturer/model number(s).
- 1.7.4. The cash allowance value carried excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all 'cash allowance' luminaires. Show the applicable taxes as a separate line item.

1.8. WARRANTY

- 1.8.1. The manufacturer shall provide a warranty against defects in material and workpersonship, starting at substantial completion. Parts warranty shall be 5 years and labour warranty shall be 1 year.
- 1.8.2. LED's, Drivers, Lamps and ballasts showing signs of premature failure shall be replaced at no cost to the owner.
- 1.8.3. LED Drivers must have a 5 year warranty.

PART 2 PRODUCT

2.1. GENERAL

- 2.1.1. All products must be CSA or CUL approved.

2.2. LAMPS AND LEDS

- 2.2.1. All Lamps are to meet the standards of the Consortium of Energy Efficiency (CEE) guidelines.
- 2.2.2. Refer to luminaire schedule for project specific details, and lamps required.
- 2.2.3. Lamps are to be in accordance with the lamp specifications detailed in the Luminaire Schedule and as noted below. Luminaire schedule shall take precedence where differences occur.
- 2.2.4. All lamps are to be new and are to be from the same manufacturing batch to avoid colour differences. Replace all lamps that exhibit colour shift, or exhibit premature lumen intensity decline, at no cost to the owner.
- 2.2.5. Light Emitting Diodes (LED)
- 2.2.5.1. LEDs shall meet the standards of IESNA LM-79 and LM-80.
- 2.2.5.2. All LED drivers shall be tested and comply with the maximum in-rush current limits as stated in NEMA 410.
- 2.2.5.3. LED's shall be manufactured by Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, or Samsung. Colour temperature shall be as indicated on the luminaire schedule. Lamps are to be binned with no visible colour variance (+/- 100K from specified colour temperature). Rated life for 1 watt white LED shall be 50,000 hours. Lumen output to be maximum based on latest technology at time of delivery.
- 2.2.5.4. All LED luminaires that present signs of failure on site, within the warranty period, must be replaced at no cost to the owner. If temporary luminaires are required to replace any failed LED luminaires, during the waiting time for parts (i.e. drivers, boards, heat sinks, etc.), the labour cost

including installation, temporary luminaire supply, temporary luminaire removal and reinstallation of the LED luminaire must be provided at no cost of the owner. Additional electrical costs, associated with higher Wattage temporary luminaires, must be reimbursed with interest to the owner by the manufacturer.

- 2.2.5.5. In case of failure of an LED luminaire, complete or part thereof, an independent third party testing Laboratory (approved by Smith + Andersen) shall be commissioned by the manufacturer or vendor to perform tests on samples taken from the failed luminaires installed on corresponding site. All reporting including the test results must be submitted to Smith + Andersen for evaluation and final approval.
- 2.2.5.6. Any additional time involved by Smith + Andersen will be billed at our hourly rates to the manufacturer or vendor.

2.3. DRIVERS

- 2.3.1. All drivers are to be tested and comply with maximum in-rush current limits within NEMA 410 standards. This is to be clearly indicated on shop drawing submittal.
- 2.3.2. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
- 2.3.3. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
- 2.3.4. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
- 2.3.5. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
- 2.3.6. Total Harmonic Distortion less than 20 % percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
- 2.3.7. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
 - 2.3.7.1. Adjustment of forward LED voltage, supporting 3 V through 55 V.
 - 2.3.7.2. Adjustment of LED current from 200 mA to 1.05 A at the 100 percent control input point in increments of 1 mA.
 - 2.3.7.3. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
- 2.3.8. Driver must be able to operate for a (+/- 10%) supply voltage of 120 V through 277 VAC at 60 Hz.
- 2.3.9. Driver must be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
- 2.3.10. Driver shall include ability to provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts or less in this standby. Control deadband between 0.5 V and 0.65 V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

- 2.3.11. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 % relative light output, or 100 – 1 % light output and step to 0 % where indicated. Driver shall respond similarly when raising from 0 % to 100 %
- 2.3.11.1. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
- 2.3.12. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels
- 2.3.13. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
- 2.3.14. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:
 - 2.3.14.1. LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
 - 2.3.14.2. Base specification: Flicker index shall less than 5% at all frequencies below 1000 Hz.
 - 2.3.14.3. Preferred specification: Flicker index shall be equal to incandescent, less than 1% at all frequencies below 1000 Hz.
- 2.3.15. Control Input
 - 2.3.15.1. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
 - 2.3.15.1.1. Must meet IEC 60929 Annex E for General White Lighting LED drivers
 - 2.3.15.1.2. Connect to devices compatible with 0 to 10 V Analog Control Protocol, Class 2, capable of sinking 0.6 mA per driver at a low end of 0.3 V. Limit the number of drivers on each 0-10 V control output based on voltage drop and control capacity.
- 2.3.16. Must meet ESTA E1.3 for RGBW LED drivers
- 2.3.17. Provide drivers manufactured by Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, Samsung, or Edoleds.

2.4. BALLASTS

- 2.4.1. All Ballasts shall comply with CSA C22.2 No. 74 and are to meet or exceed the standards of the Certified Ballast Manufacturers Association (CBM).
- 2.4.2. All ballasts shall be tested and comply with maximum in-rush current limits as stated in NEMA 410.
- 2.4.3. Not all ballasts could be used, refer to luminaire schedule for project specific details.
- 2.4.4. All ballasts shall be manufactured by Osram/Sylvania, Philips, Advance, GE, Lutron or Magnetek unless indicated otherwise. Ballasts shall operate at voltage and control lamps as noted in the Luminaire Schedule.
- 2.4.5. Ballasts shall contain no PCB's and audible rating will be class A or better.
- 2.4.6. Racks are to be provided for remote ballasts.
- 2.4.7. Ballasts with unacceptable noise levels are to be replaced at no cost to the owner.

2.5. LUMINAIRES

- 2.5.1. All luminaires are to be complete with mounting brackets, transformers, supports, trims, louvers, lenses and other accessories as required to make luminaire operational and allow it to be installed in the respective location.
- 2.5.2. Luminaires shall be suitable for the environment where installed, include seals and gaskets, and corrosion resistant baked-on finish as required and as specified.
- 2.5.3. Louvers, lenses and diffusers must be of suitable thickness to prevent sagging.
- 2.5.4. Where drawings show luminaires mounted end-to-end, luminaires shall be suitable for continuous, seamless and tandem mounting.
- 2.5.5. All poles are to come complete with internal vibration dampeners to accommodate wind conditions to avoid damage due to wind-induced vibrations.
- 2.5.6. All concrete bases for poles and bollards shall be designed to accommodate the height, weight, etc. of the pole/bollard and its accessories for the soil conditions for which it is installed. Engineered shop drawings shall be provided that is signed by a structural engineer registered in the local jurisdiction.
- 2.5.7. Where cameras are shown to be installed on poles, the poles shall be stiffened to reduce vibration and sway, and shall be rated for video recording cameras.
- 2.5.8. The supply and installation of fixed per unit cost and 'cash allowance' luminaires shall comply with all standards set forth in Electrical Specifications. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost and 'cash allowance' luminaires.
- 2.5.9. The following is a list of generic type designation for luminaires. The project specific luminaire schedule is to be referenced for the specific types and designations and the respective specifications.
 - 2.5.9.1. Designations beginning with the letter 'L' denote LED type.
 - 2.5.9.2. Designations beginning with the letter 'X' denote exit sign.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. It is the responsibility of the contractor to obtain the information related to the luminaire and luminaire trim finishes/colours from the Interior Designer or Architects prior to the fabrication of luminaires. The Contractor shall provide adequate time for the design team to review and comment on luminaire and luminaire trim finishes.
- 3.1.2. The contractor will provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and other related lighting equipment as specified herein. Lamps for all equipment will be provided and installed by the contractor according to equipment manufacturer's instructions.
- 3.1.3. The Electrical Contractor shall be responsible for the supply and installation of all concrete bases for poles and bollards. Unless otherwise shown on the drawings, concrete bases to be ArtForm style or Approved Equal and shall extend a minimum 900 mm above grade in parking lots and a minimum 150 mm above grade in pedestrian walkways.
- 3.1.4. Poles and bollards are to be installed on independent concrete bases unless indicated otherwise on the drawings or schedules. Coordinate brackets for cameras and supports for banners with pole manufacturer.
- 3.1.5. Install remote ballasts in racks and wire luminaires to ballasts in conduit. Provide wiring as per manufacturer's recommendations.

- 3.1.6. Locate luminaires in accordance with the Architect's Drawings. Coordinate exact locations on site. Refer to Architect's drawings for dimensions of coves and valences.
- 3.1.7. Install in accordance with Manufacturer's Instructions, Local Codes, Electrical Division Drawings and Specifications.
- 3.1.8. All suspended luminaires shall have cables and support stems vertically aligned.
- 3.1.9. Suspend luminaires in mechanical rooms after all the mechanical equipment and ductwork are installed. Luminaires are not to be suspended from mechanical pipes, ductwork or other building services.
- 3.1.10. All luminaires shall be installed underneath other services located within ceiling space. Contractor is responsible for interference drawings to ensure all services in ceiling are coordinated.
- 3.1.11. Any dimensions provided in the drawings or schedules are intended as general guidelines. For exact dimensioning refer to the Architectural drawings. The detailed information shall be cross referenced with the electrical specifications and the Luminaire Schedule applying the most stringent requirement.
- 3.1.12. It is the responsibility of the Electrical Contractor to coordinate luminaire trims and mounting system with ceiling finishes. Luminaires delivered on site with the wrong ceiling mounting system shall be replaced without additional costs for the owner. Restocking fees will not be accepted.
- 3.1.13. For suspended ceiling installations support luminaires from structural slab in accordance with local inspection requirements.
- 3.1.14. Where luminaires are mounted in tandem, align luminaires mounted in continuous rows to form straight uninterrupted line.
- 3.1.15. Align luminaires mounted individually parallel or perpendicular to building grid lines.
- 3.1.16. Ensure light leakage does not occur from openings and trim rings. Contractor is responsible to repair the ceiling at no cost to the Owner if cut-out is too large.
- 3.1.17. Connect luminaires to lighting circuits.
- 3.1.18. Provide all wiring in conduit with junction boxes on a grid pattern to limit the run of flexible armoured cable drops from the ceiling mounted junction box to each luminaire to a maximum of 3 m in length unless approved otherwise in writing from the Engineer's Representative.
- 3.1.19. Modular wiring systems shall be employed only where indicated or with approval of the Engineer's Representative.
- 3.1.20. Luminaires are not to be used as temporary construction lighting. After being tested to ensure acceptable operation, luminaires will not be used until substantial completion unless permission is received from the owner, architect or Engineer's Representative.
- 3.1.21. Lamps are to be installed after luminaire is cleaned.
- 3.1.22. Clean all luminaires, inside and out at time of substantial completion. Replace all scratched or damaged luminaires, lenses, louvers and diffusers at no cost to the owner.
- 3.1.23. Installation of exit signs
- 3.1.23.1. Rough-in and installation of exit signs shall be carefully coordinated on site such that after installation of all equipment/services, including equipment/services from other trades (i.e. sprinkler lines, plumbing pipes, way-finding signs, etc.), shall not interfere with the line-of-sight visibility of the exit sign(s) from approach of the intended egress pathway(s).
- 3.1.23.2. If exit sign(s) have been installed and do not meet the satisfaction of the Engineer's Representative/Architect, the Contractor shall lower, raise or relocate the exit sign(s) such that proper and adequate visibility of the exit sign(s) is achieved at no additional cost to the Owner.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCE

- 1.2.1. UL Standard 508A, latest edition.
- 1.2.2. CSA Standard C22.2 NO. 14 – Industrial Control Equipment, latest edition.

1.3. SCOPE

- 1.3.1. Furnish and install a CSA Certified snow-melting system complete with specified heating cable, termination components, junction boxes, contactors, and controls for snow melting.

1.4. SEQUENCE OF OPERATION

- 1.4.1. The Snow Melting System shall be automatically controlled through a contactor, to turn on whenever it snows outside, as detected by a pole- or roof-mounted snow sensor.
- 1.4.2. The Snow Melting System shall have a Manual/Off/Automatic control switch to allow manual control of the heating circuit. Manual control would be used whenever it is desired to turn on the heating system when it is not snowing, such as for melting ice caused by water runoff.
- 1.4.3. Manual operation of the Snow Melting System shall be over-ridden by an Ambient Sensing Thermostat, detecting outside temperature, such that the heating circuit cannot turn on if the ambient temperature is above 8 deg. C. The purpose of this ambient temperature shutdown is to minimize electricity costs by ensuring that the heating system does not remain energized if inadvertently left in "Manual" mode during warmer temperatures.

1.5. SHOP DRAWINGS AND PRODUCT DATA

- 1.5.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.6. WARRANTY

- 1.6.1. Manufacturer shall offer a warranty that can be extended to 10 years.

PART 2 PRODUCTS

2.1. HEATING CABLE AND ACCESSORIES

- 2.1.1. The heating cable shall be self-regulating heating cable for concrete snow-melting and anti-icing applications, or approved equal. Power output shall vary in response to temperature all along its length.
- 2.1.2. The heating cable and termination components shall be CSA Certified as Designation 1B, 2B.
- 2.1.3. The heating cable shall be magnesium oxide insulated, with a copper or resistance alloy conductor and a seamless copper sheath. The heating cable shall be constructed in such a manner that no combustible materials are allowed between the resistance alloy conductor and outer metal sheath. All heating cable core materials shall be inorganic and will not deteriorate with age.
- 2.1.4. The heating cable shall be jacketed with high density polyethylene (HDPE) to resist corrosion.

- 2.1.5. Each heating cable shall be factory-fabricated to the length required and shall not be altered on site. The heated section shall be joined to a polymeric jacketed copper sheath cold lead section by a factory-made joint. Cold lead shall be 4.6 m long unless otherwise specified.
- 2.1.6. The heating cable shall operate on 600 volts without the use of transformers, and shall be supplied from a 40A, 3 pole circuit breaker.
- 2.1.7. The heating cable shall come complete with power connection and end-seal termination accessories as supplied by the heating cable manufacturer.
- 2.1.8. Each circuit shall be protected by a 30-35 mA ground fault protection device.

2.2. POWER DISTRIBUTION AND CONTROL PANEL

- 2.2.1. Furnish and install a complete pre-wired power distribution and control panel for snow melting.
- 2.2.2. Tyco Thermal Controls DigiTrace SMPG3 snow melting panel or approved equal.
- 2.2.3. The panel shall be cUL Listed to UL Standard 508A and CSA Standard C22.2 NO. 14.
- 2.2.4. The panel shall be available with a CSA Type 1 with drip hood, sprinkler proof enclosure (for indoor installations), or CSA Type 3R/4 enclosure (for outdoor installations) with space heater and thermostat.
- 2.2.5. The panel shall incorporate a microprocessor based snow melting controller with adjustable hold-on timer and a temperature sensor.
- 2.2.6. The sensor shall be capable of being located up to 150 m from the panel. The panel shall have two indicators for "Supply" and "Relay".
- 2.2.7. The panel shall incorporate 3-pole shunt trip circuit breakers with external ground fault sensors (30 mA trip level).
- 2.2.8. Panels shall be designed for operation on 600 volts.
- 2.2.9. The power distribution and control panel shall initiate heating cable operation when precipitation is present at temperatures below 3.3 deg. C. The hold-on timer pushbutton shall initiate a melt cycle through the snow controller for drifted or tracked snow and ice. For embedded snow melting applications, the included temperature sensor shall be used as a slab temperature sensor to regulate slab temperature.
- 2.2.10. All lugs and terminals to be dual rated for Copper/Aluminum (Cu/Al).

2.3. SENSORS

- 2.3.1. Tyco Thermal Controls SIT-6E pavement-mounted sensor or approved equal.
- 2.3.2. Tyco Thermal Controls CIT-1 aerial snow sensor or approved equal.
- 2.3.3. The thermostat shall respond to air temperature changes detected by a stainless steel sensing probe. The thermostat shall be used to control a contactor coil. The weatherproof enclosure shall be a polyurethane-coated cast aluminum housing with stainless steel hardware.
- 2.3.4. The thermostat shall have a temperature-setting adjustment knob.

2.4. JUNCTION BOX

- 2.4.1. The heating cable power connection and end-seal terminations shall be made in a rugged, CSA certified weatherproof junction box, which has a minimum of 7400 mL of volume per 600V, 1-phase heating circuit, to a maximum of three 600V, 1-phase heating circuits per box.

- 2.4.2. The junction box shall be rugged, outdoor weatherproof, hot-compression-molded fibreglass reinforced grey polyester, and corrosion-resistant, such as Vynckier VJ Series, dimensions 410 mm H x 355 mm W x 170 mm D, or equivalent. The box shall have a minimum internal volume of 23000 mL so as to accommodate up to three heating circuits. The box shall include a non-metallic back plate suitable for mounting a neutral terminal.
- 2.4.3. Mount a neutral terminal inside the box to accommodate four (4) AWG #8 neutral cables. The purpose of the neutral terminal is to split the incoming neutral three ways to provide for connecting up to three 600V, 1-phase heating circuits.

2.5. CONTACTOR

- 2.5.1. Each contactor shall be an EEMAC Size 2, 45A, 600V, 3-pole, EEMAC 1 enclosed, complete with single-phase control transformer 600/120V fused with two primary fuses and one secondary fuse, a neutral feed-thru terminal, and control terminal block to accommodate two #14 external contactor control wires.
- 2.5.2. The contactor shall be used to control up to three 40A, 600V heating circuits.

2.6. CUSTOM CONTROL PANEL

- 2.6.1. Provide a custom-built control panel with hinged door to house the control components. The control panel shall house the Automatic Snow Controller, interposing control relay, control fuses, and terminal blocks for control power and input/output connections. The control panel shall be pre-wired at the factory.
- 2.6.2. The interposing relay shall be industrial grade, heavy duty, complete with six auxiliary Type A (normally open) contacts, rated 10A at 240Vac, capable of continually energizing and de-energizing the EEMAC Size 2 contactors above.
- 2.6.3. The custom control panel will receive the following inputs: a) snow sensor control wires, and b) ambient sensing thermostat control wires.

2.7. GROUND FAULT PROTECTION

- 2.7.1. The ground fault protection panel shall be rated 600/347V, 3-phase, 4-wire, with a 30-ma ground fault trip setting, complete with a 40A 3-pole automatic circuit breaker.
- 2.7.2. The ground fault protection panel shall be used to provide ground fault protection and overcurrent/overload protection for up to three 600V 40A heating circuits.

2.8. MANUFACTURERS

- 2.8.1. Acceptable snow melting system manufacturer shall be :
- 2.8.1.1. Tyco Thermal Controls - SMPG3 series
- 2.8.1.2. Watts Water Technologies – HeatWeave ProMelt.
- 2.8.1.3. TRM Heating Cables – APS-4C series
- 2.8.1.4.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. The heating cable shall be installed according to electrical code, manufacturer's recommendations, the instructions supplied with the heating cable and components, and the instructions in the manufacturer's Installation and Operation Manual.

- 3.1.2. Cable sheaths shall not touch or cross one another nor shall cables cross expansion joints. Concrete crack control joints must be crossed in accordance with manufacturer's recommendations.
- 3.1.3. Heating cables shall be laid out at the specified spacing. Spacing must not be greater than 250 mm in concrete, 150 mm in asphalt and for pavers, to ensure reasonably uniform distribution of heat.
- 3.1.4. The heating cable shall be installed only in concrete pavement designed for long-term structural integrity. The pavement (supplied by others) shall be reinforced with rebar or wire mesh and the reinforcing supported such that the location of the reinforcing and the attached heating cable is not disturbed during the concrete placement. The rebar shall be placed at the heating cable depth whenever possible.
- 3.1.5. The heating cable shall be protected from where it leaves the pavement to the junction box by installing the cable in 27 mm rigid metal conduit. Use one conduit for each heating cable.
- 3.1.6. All junction boxes shall be located in accessible areas. Junction boxes shall not be located in the heated slab, but shall be located above grade level. Covers shall be kept on boxes at all times when not working therein.
- 3.1.7. All terminations shall be protected from the weather and from physical damage. All conduits should enter at or near the bottom of the box. The gland assembly shall be bonded to the system ground.
- 3.1.8. Heating cable repairs and splices shall be made using a splice kit provided by the manufacturer and specifically approved for the purpose. They shall pass the Megger test after installation.
- 3.1.9. Any field alterations or deviations shall proceed only after authorization has been issued by the engineer. All changes shall be accurately recorded by the contractor and shall be turned over to the engineer upon completion of that phase of work.
- 3.1.10. A representative from the heating cable manufacturer is to meet with the electrical and general contractors prior to installation, to advise on the recommended installation procedure, and to visit the site again just prior to concrete pouring, to review the layout and installation of the heating cable.

3.2. TESTING

- 3.2.1. The heating cable shall be tested for continuity with a multi-meter (or ohmmeter), and for insulation resistance with a 2500 Vdc Megger, when received on the job site, after installation, during and after the concrete pour, and annually thereafter according to the manufacturer's recommendations.
- 3.2.2. Insulation resistance shall be consistently not less than 20 mega-ohms.
- 3.2.3. A complete system test of controls shall be conducted to verify cable operation.
- 3.2.4. Copies of all such testing shall be delivered to the Engineer and included in the Operation and Maintenance (O&M) manuals.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCE

- 1.2.1. UL Standard 508A, latest edition.
- 1.2.2. CSA Standard C22.2 NO. 14 – Industrial Control Equipment, latest edition.

1.3. SCOPE

- 1.3.1. Furnish and install a CSA Certified Roof and Gutter De-icing System complete with heating cable, termination components, junction boxes, contactors, hanger, tee and splice kits and sensor/controls for snow melting.

1.4. SEQUENCE OF OPERATION

- 1.4.1. The Roof and Gutter De-icing System shall be automatically controlled through a contactor to turn on as detected by a roof/gutter mounted moisture sensor. The sensor shall monitor both moisture and temperature such that the heating cables will only turn on if the ambient air temperature is below an adjustable trigger temperature (34°F to 44°F).
- 1.4.2. The Roof and Gutter De-icing System shall have a Manual/Off/Automatic control switch to allow manual control of the heating circuit. Manual control would be used whenever it is desired to turn on the heating system when it is not snowing.
- 1.4.3. Automatic and manual operation of the Roof and Gutter De-icing System shall be over-ridden by an Ambient Sensing Thermostat, detecting outside temperature, such that the heating circuit cannot turn on if the ambient temperature is above 44°F. The purpose of this ambient temperature shutdown is to minimize electricity costs by ensuring that the heating system does not remain energized if inadvertently left in "Manual" mode during warmer temperatures.

1.5. SHOP DRAWINGS AND PRODUCT DATA

- 1.5.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.

1.6. WARRANTY

- 1.6.1. The heating cables for the Roof and Gutter De-icing system shall come with a 10 year warranty against any defects or failures and 1 year for the controllers.

PART 2 PRODUCTS

2.1. HEATING CABLE AND ACCESSORIES

- 2.1.1. Heating cable shall be a self-regulating heating cable suitable for roof and gutter de-icing applications.
- 2.1.2. The heating cable shall consist of a continuous core of conductive polymer that is radiation cross-linked, extruded between two tin or nickel-plated copper bus wires that varies its power output in response to temperature changes.
- 2.1.3. The heating cable shall have a modified polyolefin inner jacket and a tinned-copper braid to provide a ground path and enhance the cables ruggedness.

- 2.1.4. The heating cable shall have a fluoropolymer (XT) outer jacket for enhanced mechanical and chemical protection.
- 2.1.5. The heating cable shall have an inherently UV-resistant outer jacket (fluoropolymer).
- 2.1.6. The heating cable shall operate on line voltages of 120 or 208 volts (refer to drawings for exact voltage) without the use of transformers.
- 2.1.7. The heating cable power output shall be a maximum 12 W/ft at 32°F in ice or snow.
- 2.1.8. The heating cable shall be part of a UL Listed, CSA Certified and FM Approved system.
- 2.1.9. Manufacturer shall provide power connection, splice/tee and end seal kits compatible with selected heating cable.
- 2.1.10. The heating cable shall come complete with power connection and end-seal termination accessories as supplied by the heating cable manufacturer.
- 2.1.11. Connection kits shall be rated CSA Type 4X to prevent water ingress and corrosion. All components shall be UV stabilized.
- 2.1.12. Connection kits shall be UL Listed and CSA Certified.
- 2.1.13. Each circuit shall be protected by a 30-35 mA ground fault protection device.

2.2. CONTROL AND DISPLAY PANEL

- 2.2.1. Furnish and install a complete pre-wired control and display panel ("Panel") to remotely monitor and control the Roof and Gutter De-icing System.
- 2.2.2. The Panel shall display when the heating system is in either Manual/Off/Automatic mode.
- 2.2.3. The Panel shall fit within a standard single gang or multi gang electrical box and be compatible with a standard Decora type cover plate. Otherwise the Panel shall come from the factory in a pre-fabricated stainless steel enclosure.

2.3. CONTROLLER AND SENSORS

- 2.3.1. The controller shall have automatic activation based on precipitation and temperature readings from the sensor.
- 2.3.2. Controller shall be designed for operation on 208 volts, single phase.
- 2.3.3. The sensor shall be capable of being located up to 150 m (500 ft.) from the Panel.
- 2.3.4. The controller shall have a replaceable remote sensor.
- 2.3.5. The controller shall have a CSA Type 3R enclosure rating and shall be cUL and UL listed for its intended application.
- 2.3.6. The sensor shall respond to air temperature changes. The thermostat shall be used to control a contactor coil. The weatherproof enclosure shall be a polyurethane-coated cast aluminum housing with stainless steel hardware.
- 2.3.7. The thermostat trigger temperature set point shall be adjustable between 34°F to 44°F.
- 2.3.8. The controller shall initiate heating cable operation when precipitation is present at temperatures below that specified by the adjustable trigger temperature set point.
- 2.3.9. The controller shall be rated at a minimum 30A @ 208VAC.

2.4. MANUFACTURERS

- 2.4.1. Acceptable Roof and Gutter De-icing System manufacturer shall be :
 - 2.4.1.1. Pentair – Raychem IceStop

- 2.4.1.2. Britech – Roof and Gutter De-icing
- 2.4.1.3. TRM Heating

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. The heating cable shall be installed according to electrical code, manufacturer's recommendations, the instructions supplied with the heating cable and components, and the instructions in the manufacturer's Installation and Operation Manual.
- 3.1.2. Cable sheaths shall not touch or cross one another nor shall cables cross expansion joints. Concrete crack control joints must be crossed in accordance with manufacturer's recommendations.
- 3.1.3. Heating cables shall be laid out at the manufacturer's specified spacing.
- 3.1.4. The heating cable shall be installed only on roof and gutters designed for its intended application.
- 3.1.5. The sensor(s) shall be installed within the roof/gutter and orientated as per the manufacturer's installation recommendation and manual.
- 3.1.6. All junction boxes, if required, shall be located in accessible areas. Coordinate exact locations with the Architect/Consultant prior to installation. Covers shall be kept on boxes at all times when not working therein.
- 3.1.7. All terminations shall be protected from the weather and from physical damage. All conduits should enter at or near the bottom of the box. The gland assembly shall be bonded to the system ground.
- 3.1.8. Heating cable repairs and splices shall be made using a splice kit provided by the manufacturer and specifically approved for the purpose. They shall pass the Megger test after installation.
- 3.1.9. Any field alterations or deviations shall proceed only after authorization has been issued by the engineer. All changes shall be accurately recorded by the contractor and shall be turned over to the engineer upon completion of that phase of work.
- 3.1.10. A representative from the Roof and Gutter De-icing System manufacturer is to meet with the electrical and general contractors prior to installation, to advise on the recommended installation procedure, and to visit the site again to inspect the layout and installation of the heating cable. The representative shall visit at the completion of the installation to commission the system to ensure proper installation and operation.

3.2. TESTING

- 3.2.1. The heating cable shall be tested for continuity with a multi-meter (or ohmmeter), and for insulation resistance with a 2500 Vdc Megger, when received on the job site, after installation, during and after the concrete pour, and annually thereafter according to the manufacturer's recommendations.
- 3.2.2. Insulation resistance shall be consistently not less than 20 mega-ohms.
- 3.2.3. A complete system test of controls shall be conducted to verify cable operation.
- 3.2.4. Copies of all such testing shall be delivered to the Engineer and included in the Operation and Maintenance (O&M) manuals.

END OF SECTION

PART 1 GENERAL

1.1. OVERVIEW

- 1.1.1. Read and comply with all sections of this document.
- 1.1.2. Provide all labour, materials, tools, and equipment required for the complete scope of the Work specified in all sections of the Contract Documents.
- 1.1.3. Test results for cables that fall under the Pass* and Fail categories shall be submitted to the Owners' Engineering Representative for review and action immediately upon discovery. Submit all Pass cables prior to the IT room being turned over to the owner. See Section 27 08 00 – COMMISSIONING FOR TELECOMMUNICATIONS SECTIONS for testing parameters.

1.2. SECTIONS AFFECTED

- 1.2.1. These instructions apply to and form a part of all Telecommunications Sections.

1.3. INTENT

- 1.3.1. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.
- 1.3.2. Be completely responsible for the acceptable condition and operation of all systems, equipment, and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment, and repair related damages. The replacement of equipment and repair to damages shall be coordinated with other trades completed in a timely fashion so as not to affect the complete construction of the Telecommunications Systems and/or work by others.

1.4. WORK INCLUDED

- 1.4.1. Provide a new Telecommunications Structured Cabling system for the area included in the scope of this Contract. The Structured Cabling Systems shall be as follows:
 - 1.4.1.1. Horizontal Structured Cabling System consisting of 4-pair Copper Cabling for data applications.
 - 1.4.1.2. Intra-building Backbone Structured Cabling system consisting Fibre Optic Cabling
 - 1.4.1.3. Horizontal CATV Cabling System consisting of Coaxial Cabling for CATV applications.
- 1.4.2. All horizontal cabling shall be serviced from the nearest logical Telecommunications Room, either existing or new as shown on floor plans.
- 1.4.3. The Telecommunications Structured Cabling system is based on a physical star wiring topology (unless otherwise specified) that is designed in accordance with and supported by a manufacturer backed certification and warranty as specified herein. This cabling infrastructure solution shall encompass, and not be limited to, all telecommunication outlets, cable, cable terminating hardware, equipment cabinets/racks, and selected connectivity devices.
- 1.4.4. Provide CMP (FT6) rated components of the Telecommunications Cabling System that is to be located within mechanical spaces deemed a Return Air Plenum. CMR (FT4) rated components may be used in mechanical spaces upon approval by all Authorities Having Jurisdiction (AHJ) and/or the Telecommunications Engineer's Representative. For this project, all components shall have a CMP (FT6) rating unless otherwise specified in this document. All CMP (FT6) rated products must be CSA/ULC.
- 1.4.5. While every attempt has been made to ensure all information is correct at the time of publication, the products specified are available and that any part numbers identified are correct, it is the responsibility of the Telecommunications Contractor to verify all part numbers and to report any errors and/or omissions in the Drawings and/or Specification during the procurement process.

- 1.4.6. Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurements.
- 1.4.7. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the Work.
- 1.4.8. Include all labour, materials, plant, transportation, storage costs, training, equipment, insurance, temporary protection, permits, inspections, bonding, taxes, and all necessary and related items required to provide complete and operational systems shown and described.

1.5. BIDDER INQUIRIES

- 1.5.1. Bidders who find discrepancies or omissions in this RFQ, or who have any doubt as to the technical meaning or intent of any part of this RFQ, shall direct their questions or other inquiries in writing to the Telecommunication's Engineer's Representative as defined in Section 27 00 05.20 – DEFINITIONS AND ABBREVIATIONS
- 1.5.2. In fairness to all bidders, all questions will be answered and distributed to all. Oral questions will not be answered. No questions will be answered within 48 hours of the closing date / hour of the bid. Refer to Division 0 for question period close time and date.

1.6. TENDER FORMS AND SUBMISSION OF TENDERS

- 1.6.1. Submit all information called for on the Telecommunications Tender and Supplementary Tender Forms. Tenders not completed in full may, at the discretion of the Owner, be rejected.
- 1.6.2. Show separate, identified, alternate and unit prices for optional components or items called for as additions to or deductions from the Tender amount.
- 1.6.3. The Owner reserves the right to accept or reject any substitution without question.
- 1.6.4. Include incidental fees and other fees for items required to successfully install the Structured Cabling Solution that may or may not be indicated in this document. Meet all requirements of this document and all telecommunications (and related) standards, municipal, local, Provincial and Federal building, safety, fire and electrical codes.

1.7. HOLDBACK

- 1.7.1. The value for testing and documentation (cable test results and as-builts), for payment purposes, shall be set at 10% of the base contract or \$5,000; which ever is greater. This amount will be withheld from the Telecommunications Contractor until testing and correction of deficiencies is 100% complete.

1.8. SCHEDULE

- 1.8.1. By submitting a response to this document and associated Drawings, the Telecommunications Contractor agrees to meet and adhere to all project milestones as indicated in the project schedule(s).
- 1.8.2. Acknowledge that project schedule(s) are subject to change. Verify all project milestones with the Telecommunications Engineer's Representative and/or General Contractor.

1.9. LABOUR

- 1.9.1. Comply with all job-site requirements for the duration of the project.
- 1.9.2. Do not assign or sub-contract any Work without the prior written consent of the Telecommunications Engineer's Representative. In the event of sub-contractor approval, submit a complete list of sub-contractors during the procurement process.
- 1.9.3. Use only workers who are fully trained, qualified, and experienced on the installation, termination, and testing of the Structured Cabling Solution.

- 1.9.4. Third party certification will not be permitted unless the certifying contractor performs the termination and testing for all cabling. If third party certification is necessary, the Telecommunications Contractor shall obtain the consent of the Telecommunications Engineer's Representative prior to submitting a bid response.
- 1.9.5. Make any changes or alterations required by an authorized inspector of the authority having jurisdiction.
- 1.9.6. Obtain consent from the Telecommunications Engineer's Representative before changing the Project Manager and/or Site Supervisor during the Project.

1.10. ACCESS AND PROTECTION

- 1.10.1. Access to the Site shall be limited to location and time of day. Refer to Section 27 00 05.70 – PROJECT SPECIFIC REQUIREMENTS and conform to requirements.
- 1.10.2. Refer to the security and protection requirements in the General Conditions and conform to all requirements.

1.11. DRAWINGS, CHANGES AND INSTALLATION

- 1.11.1. The Drawings are intended to show the general character and scope of the Work and not the exact details of the Work. Complete the Work with all accessories required for a complete and operative installation.
- 1.11.2. The location, arrangement, and connection of equipment and material as shown on the Drawings represent a close approximation to the intent and requirements of the contract. The Telecommunications Engineer's Representative reserves the right to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no extra cost to the Owner.
- 1.11.3. Certain details indicated on the Drawings are general in nature and specific labelled detail references to each occurrence of use is not indicated, however, such details shall be applicable to every occurrence on the Drawings.
- 1.11.4. The location and size of existing services shown on the Drawings are based on the best available information. Verify the actual location of existing services in the field before Work is commenced.
- 1.11.5. Make changes and modifications necessary to ensure co-ordination and to avoid interference and/or conflicts with other trades, or to accommodate existing conditions, at no extra cost to the Owner.
- 1.11.6. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.11.7. Where equipment is shown to be 'roughed in only', obtain accurate information from the Telecommunications Engineer's Representative before proceeding with the Work.
- 1.11.8. Location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers, and all other equipment shown on Drawings (if shown) is diagrammatic.
- 1.11.9. Remedy any Work not installed in correct location (at the sole discretion of the Telecommunications Engineer's Representative). The Telecommunications Contractor is responsible to mark-out their Work and fully co-ordinate with all other trades. Review the Work with Telecommunications Engineer's Representative prior to rough in.

1.12. APPROVED EQUAL

- 1.12.1. Wherever the term "approved equal", "approved equivalent", or another variation is used herein, it is to be understood that reference to the specified trade name, brand name, manufacturer's name, model number, and catalog number has been made solely to indicate the minimum standard of quality required in material, workmanship, and service. Any proposed alternate shall be submitted for review and acceptance before procurement and installation. The review and acceptance shall be at the sole discretion of the Owner and the Telecommunications Engineer's Representatives.

1.13. CONFLICTING REQUIREMENTS

- 1.13.1. In the case of conflict or discrepancy in the requirements indicated in the contract documents the more stringent, onerous, and/or costly requirement shall apply.

1.14. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

- 1.14.1. Materials and equipment provided under this Division shall be new and free from defects.
- 1.14.2. All equipment and material for which there is a listing service shall bear a ULC and/or CSA label.
- 1.14.3. Equipment shall meet all applicable FCC/CRTC Regulations.
- 1.14.4. Materials shall have a flame spread in accordance with local Authorities Having Jurisdiction, and in accordance with the Specifications of this project.

1.15. DOCUMENT FORMAT

- 1.15.1. This document has been constructed based on a 3-part specification for Division 27. The first part 'General' describes general information pertaining to the section. The second part 'Product' describes the products that shall be provided for the project. The third part 'Execution' details the requirements for the installation of the specified products. Reference sections 1 and 3 for the relevant General information and Execution requirements of products that are listed in section 2.

1.16. STATEMENT OF PRICES

- 1.16.1. Submit a statement of their estimated prices for the various portions of the Work including both labour and materials to form a basis of progress payments. The total price of all portions of the Work shall equal the total price of the Work covered under the Telecommunications Division.

1.17. VALUATION OF CHANGES

- 1.17.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:
- 1.17.1.1. Estimate and acceptance in a lump sum, unless the Telecommunications Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.
- 1.17.2. Provide the Telecommunications Engineer's Representative with a detailed cost analysis of the contemplated change indicating:
- 1.17.2.1. Quantity of each material.
- 1.17.2.2. Unit cost of each material.
- 1.17.2.3. Time involved.
- 1.17.2.4. Sub-trade quotations including a complete analysis of costs.
- 1.17.2.5. Mark-ups, if applicable.
- 1.17.2.6. Value of GST or HST, as applicable.

- 1.17.2.7. Proposed change in Contract Time.
- 1.17.3. The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.
- 1.17.4. The following shall not be included in the cost of the Work but are covered by the allowance (mark-ups) for overhead and profit:
- 1.17.4.1. The Contractor's head office and site office expenses, including stationary, postage and other office supplies.
- 1.17.4.2. The costs of the Telecommunications Contractor's Project Manager, clerical and administrative personnel, and executive personnel.
- 1.17.4.3. Use of temporary offices, sheds, small tools, etc., including the cost of telephone, light, power, water and heat used therein,
- 1.17.4.4. Transportation and overnight room expenses for out of town labour, if local labour is unavailable.
- 1.17.4.5. Insurance premiums.
- 1.17.4.6. Licenses and permits, except when these are special for a particular item of Work.
- 1.17.4.7. Printing charges for Proposed Changes, Change Orders and Drawings for the Contractor's and Subcontractors use in the Work. Telecommunications Engineer's Representative will provide one PDF copy of change notice documentation and in the event of re-issue of full size Drawings will provide one print.
- 1.17.4.8. The cost of as-built drawings and Shop Drawings.
- 1.17.4.9. The cost of cleanup and disposal of waste material.
- 1.17.4.10. Parking.
- 1.17.5. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-[latest version] GC 6.2.
- 1.17.6. Inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the Work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.
- 1.17.7. Charge special equipment rental rates at cost. Submit the invoice for special equipment rental with the cost of the Work.
- 1.17.8. Permitted Mark-Ups
- 1.17.8.1. Maximum net overhead and profit mark-ups permitted for extra Work under Change Order or Change Directive:

| Cost of Extra Work, not including GST or HST, as applicable | Contractor's Mark-Up on Work of Own Forces (%) | Contractor's Mark-Up on Subcontracted Work (%) |
|---|--|--|
| \$0 to \$5,000 | 10 | 7 |
| >\$5,000 to \$10,000 | 10 | 7 |
| >\$10,000 to \$50,000 | 7 | 5 |
| >\$50,000 | 5 | 4 |

- 1.17.8.2. Maximum net overhead and profit mark-ups by Subcontractors permitted for extra Work:

| Cost of Extra Work, not including GST or HST, as applicable | Contractor's Mark-Up on Work of Own Forces (%) | Contractor's Mark-Up on Subcontracted Work (%) |
|---|--|--|
| \$0 to \$5,000 | 10 | 7 |
| >\$5,000 to \$10,000 | 10 | 7 |
| >\$10,000 to \$50,000 | 7 | 5 |
| >\$50,000 | 5 | 4 |

- 1.17.8.3. Where a proposed change order includes both credits and extras, overhead and profit mark-ups apply to the net extra or credits, if any, of the entire change.
- 1.17.9. All changes, change notices, revisions to contract, site instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.
- 1.17.10. Labour Rate:
- 1.17.10.1. For the duration of the contract, extra Work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour unit's column 1 (one). No additional factors will be accepted.
- 1.17.10.2. The hourly labour rate for all changes will be based on a Journeyperson rate as listed on the Supplementary Bid Form. The Owner and/or Telecommunications Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be exclusive of overhead and profit. The labour rate will be inclusive of all labour burden charges including: payroll and administrative burdens, all government payroll burdens, variable labour factors and union or association funds.
- 1.17.10.3. The following labour burdens are not part of the hourly labour cost and are covered under overhead and mark-up or under the NECA labour unit rates: all supervision, hand tools, warranties, storage, rentals, parking, clean-up, additional bonding, as-built drawings, material sorting/handling/hoisting, project financing, coffee break/rest periods, safety training including safety briefings, WHMIS and the health and safety committee, non-productivity time and site office and consumables.
- 1.17.10.4. Submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate comprising the proposed hourly rate. The Owner and the Telecommunications Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.

PROPOSED CHANGE ORDER

| | |
|-----------------|-----------------|
| Company Name: | CCN # |
| Address: | Date: |
| City, Prov.: | Project Name: |
| Postal Code: | Project Number: |
| | Quote Number: |
| Telephone: | Change Order #: |
| Fax: | |
| E-Mail address: | |
| Owner Address: | |

Work Description

We reserve the right to correct this quote for errors and omissions.
This quote covers direct costs only.
This price is good for acceptance within 30 days from the date of receipt.

Itemized Breakdown

| Description | Qty. | Net Price U | Total Mat(\$) | Labor U | Total Hours |
|-----------------------|------|-------------|---------------|----------|-------------|
| 4-Pair Category Cable | | \$X.XX C | | \$X.XX C | |
| Termination Module | | \$X.XX C | | \$X.XX C | |
| Patch Cord | | \$X.XX C | | \$X.XX C | |
| Modular Patch Panel | | \$X.XX C | | \$X.XX C | |
| Labelling | | \$X.XX C | | \$X.XX C | |
| Testing | | \$X.XX C | | \$X.XX C | |
| TOTALS | | | | | |

Summary

| Description | Total Hours |
|-----------------------------------|-------------|
| General Materials | \$Y.YY |
| Material Total | |
| JOURNEYPERSON (xx Hrs. @ \$xx.00) | |
| Subtotal | |
| MARK-UP | |
| Overhead/Mark-up (@ 5.000 %) | |
| Profit (@ 5.000%) | |
| Total Mark-up | |
| Final Amount (TNIP) | |

PART 2 PRODUCTS

2.1. SYSTEM PERFORMANCE

2.1.1. 4-Pair Horizontal Copper Cabling – Data System

- 2.1.1.1. All components of the horizontal data channel shall meet the minimum performance characteristics of: Category 6a – 500MHz and a data rate of 10Gb/s, with an outside diameter no greater than 0.27”.

2.2. CERTIFICATION

- 2.2.1. Acceptable manufacturers for the complete 4-pair horizontal voice and data systems:
- 2.2.1.1. Manufacturer / Contractor Certification:
- 2.2.1.1.1. Belden Incorporated / CSV – Certified Systems Vendor
- 2.2.1.1.2. CommScope Incorporated (Systimax) / CPP – CommScope Partner Pro

PART 3 EXECUTION

3.1. TERMINATION REQUIREMENTS

- 3.1.1. UTP Cables
- 3.1.1.1. Terminate cabling using EIA/TIA 568A configuration, unless noted otherwise.

3.2. SITE EXAMINATION

- 3.2.1. Prior to submitting their tender response, perform a site survey (when available) to familiarise their workers with the site and all conditions of the site affected by the proposed Work. No claims for extra payment will be considered because of failure to fulfil this condition.

END OF SECTION

PART 1 GENERAL

1.1. DEFINITIONS

1.1.1. Generally, the following definitions are used in this Division:

| | |
|-------------------------------|---|
| Addendum | - Normative document used to provide additional requirements and recommendations to a published document (e.g., standards, contracts). When published, an addendum effectively becomes part of the document that it supports. |
| Bonding | - The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed. |
| Bonding Conductor (BC) | - A conductor used specifically for the purpose of bonding. |
| Building Entrance Facility | - The room or space inside a building where telecommunications cables enter and leave the building. |
| Telecommunications Contractor | - The successful bidder to this Specification responsible for the supply and installation of the Structured Cabling Solution as detailed in this document and associated Drawings. |
| Category | - A rating that defines the performance of cabling components and systems. Describes mechanical properties and transmission characteristics of balanced twisted-pair cabling and provides a numbered designation. |
| Channel | - Complete end to end connection including patch cords, cable and termination device(s). |
| Cut Over | - The live date(s) when the Owner will occupy the space as indicated by date and/or phasing. |
| Drawings | - Details, diagrams, layouts, schedules, and other information in a design drawing package accompanying this specification. |
| Grounded Conductor | - A system or circuit conductor that is intentionally grounded. |
| Grounding System | - A system of hardware and wiring that provides an electrical path from a specified location to an earth ground point. |
| Modular Copper Patch Panel | - A patch panel that allows each RJ-45 female jack (or port) to be removed individually. |
| Owner | - Person or company that will own the system and components. |
| Project | - Supply and installation of a complete Structured Cabling Solution to support Voice, Data and/or Video applications as described in this document. |

| | | |
|--|---|--|
| Provide | - | Supply, install, test, configure, and document. |
| Shop Drawings | - | Contractor provided construction drawings to facilitate compliance with the plans and specifications. |
| Telecommunications Engineer's Representative | - | Joshua Blizzard Smith + Andersen Choose an item. |
| Workstation | - | Systems Furniture Workstation, Office, Meeting Room, Boardroom, Classroom, etc. Any Voice or Data cable originating in a Telecom, LAN, Computer Room or Consolidation Point that is not terminated on a patch panel / IDC Block at the other end. |

1.2. ABBREVIATIONS

1.2.1. Generally, the following abbreviations are used in this Division:

| | | |
|--------|---|--|
| A | - | Ampere |
| ac | - | Alternating current |
| ACR | - | Attenuation to Cross-Talk Ratio |
| ADC | - | Analog to Digital Converter |
| ADSL | - | Asymmetric Digital Subscriber Line |
| A/E | - | Architect or Engineer |
| AFF | - | Above Finished Floor |
| AHJ | - | Authority Having Jurisdiction |
| ALPETH | - | Aluminum Polyethylene |
| AME | - | Architectural, Mechanical, Electrical |
| AN | - | Access Node |
| ANSI | - | American National Standards Institute |
| AP | - | Access Point |
| ARPAP | - | Resin-coated Aluminum, Polyethylene Aluminum, Polyethylene |
| ASCII | - | American Standard Code for Information Interchange |
| ASP | - | Aluminum Steel Polyethylene |
| ASTM | - | American Society for Testing and Materials |
| ATD | - | Asynchronous Time Division |
| ATDM | - | Asynchronous Time Division Multiplexing |
| ATM | - | Asynchronous Transfer Mode |
| Attn | - | Attenuation |
| AV | - | Audiovisual |
| AWG | - | American Wire Gauge |

| | |
|---------|---|
| BAS | - Building Automation System |
| BC | - Bonding Conductor |
| BCD | - Backbone Conduit |
| BCT | - Bonding Conductor for Telecommunications |
| BEF | - Building Entrance Facility |
| BER | - Bit Error Rate |
| BERT | - Bit Error Rate Test |
| BFOC | - Bayonet Fibre Optic Connector |
| BIC | - Building Industry Consultant |
| BICSI® | - Building Industry Consulting Service International |
| bit | - Binary Digit |
| BOM | - Bill Of Material |
| b/s | - Bit per Second |
| BWA | - Broadband Wireless Access |
| CA | - Cable |
| CACSP | - Coated Aluminum Coated Steel Polyethylene |
| CAD | - Computer Aided Design |
| CATV | - Community Antenna Television (Cable Television) |
| CCIA | - Computer Communications Industry Association |
| CCTV | - Closed Circuit Television |
| CD | - Compact Disc |
| CEC | - Canadian Electrical Code |
| CEF | - Cable Entrance Facility |
| CENELEC | - European Committee for Electrotechnical Standardization |
| cm | - Centimetre |
| CMP | - Communications Plenum |
| CMR | - Communications Riser |
| coax | - Coaxial Cable |
| CO-OSP | - Customer-Owned Outside Equipment |
| CP | - Consolidation Point |
| CPU | - Central Processing Unit |
| CPVC | - Chlorinated Polyvinyl Chloride |
| CRTC | - Canadian Radio-television Telecommunications Commission |
| CSA | - Canadian Standards Institute |
| CSC | - Construction Specifications Canada |

| | |
|-------------|---|
| CSI | - Construction Specifications Institute |
| CT | - Cable Tray |
| Cu | - Copper |
| dB | - Decibel |
| dB/km | - Decibel per Kilometre |
| dBm | - Decibel milliwatt |
| dBmV | - Decibel millivolt |
| demarc | - Demarcation Point |
| D-ring | - Distribution Ring |
| DID | - Direct Inward Dialing |
| DSL | - Digital Subscriber Line |
| EF | - Entrance Facility |
| EIA | - Electronics Industry Alliance |
| ELFEXT | - Equal Level Far-End Crosstalk |
| e-mail | - Electronic Mail |
| EMI | - Electromagnetic Interference |
| EMI/RFI | - Electromagnetic Interference / Radio Frequency Interference |
| ER | - Equipment Room |
| ESD | - Electrostatic Discharge |
| ETL | - Edison Testing Laboratories |
| e/w | - Equipped With |
| FC | - Fibre Connector |
| FCC | - Federal Communications Commission |
| FDDI | - Fibre Distributed Data Interface |
| FEP | - Fluorinated Ethylene Propylene |
| FEXT | - Far-End Crosstalk |
| FOTP | - Fibre Optic Test Procedure |
| ft | - Foot / Feet |
| ft2 | - Square Foot / Feet |
| FTTD | - Fibre To The Desk |
| FT 1 / FT 3 | - Fractional T 1 / Fractional T 3 |
| G | - Giga |
| Gb | - Gigabit |
| GB | - Gigabyte |
| Gb/s | - Gigabit per Second |

| | |
|-------|---|
| GC | - General Contractor |
| GHz | - Gigahertz |
| GWB | - Gypsum Wall Board |
| HC | Horizontal Cross-connect |
| Hz | - Hertz |
| I | - Current |
| IC | - Intermediate Closet |
| IC | - Intermediate Cross-connect |
| ID | - Identification |
| ID | - Inside Diameter |
| IDC | - Insulation Displacement Connection |
| IDC | - Insulation Displacement Connector |
| IDC | - Insulation Displacement Contact |
| IDF | - Intermediate Distribution Frame |
| IEEE® | - Institute of Electrical and Electronics Engineers, Inc. ® |
| IG | - Isolated Ground |
| in | - Inch |
| in2 | - Square Inch |
| I/O | - Input / Output (Device) |
| ICEA | - Insulated Cable Engineers Association |
| IEC | - International Electrotechnical Commission |
| IOR | - Index Of Refraction |
| ISDN | - Integrated Services Digital Network |
| ISO | - International Organization for Standardization |
| IT | - Information Technology |
| kb | - Kilobit |
| kB | - Kilobyte |
| kg | - Kilogram |
| Km | - Kilometre |
| kV | - Kilovolt |
| kVA | - Kilovoltampere |
| kW | - Kilowatt |
| kWh | - Kilowatt hour |
| LAN | - Local Area Network |
| laser | - Light Amplification by Stimulated Emission of Radiation |

| | |
|----------------|---|
| lb | - Pound |
| LED | - Light Emitting Diode |
| LEN | - Local Exchange Node |
| LSZH | - Low Smoke Zero Halogen |
| m | - Metre |
| m ² | - Square Metre |
| mA | - Milliampere |
| MAC | - Move, Add, or Change |
| MAN | - Metropolitan Area Network |
| Mb | - Megabit |
| MB | - Megabyte |
| Mb/s | - Megabit per Second |
| MB/s | - Megabyte per Second |
| MC | - Main Cross-connect |
| MDF | - Main Distribution Frame |
| MGB | - Main Grounding Busbar |
| MHz | - Megahertz |
| mi | - Mile |
| MIMS | - Mineral Insulated Metal Sheathed |
| min | - Minute |
| mm | - Millimetre |
| MM | - Multimode |
| MMF | - Multimode Fibre |
| MPP | - Modular Patch Panel |
| ms | - Millisecond |
| MSDS | - Material Safety Data Sheet |
| MUTO | - Multi-user Telecommunications Outlet |
| MUTOA | - Multi-user Telecommunications Outlet Assembly |
| mW | - Milliwatt |
| MW | - Megawatt |
| NBCC | - National Building Code of Canada |
| NESC | - National Electrical Safety Code |
| NEXT | - Near-end Crosstalk |
| NIC | - Network Interface Card |
| NIR | - Near-end crosstalk-to-Insertion loss Ratio |

| | |
|----------|---|
| NRCC | - National Research Council of Canada |
| OD | - Outside Diameter |
| ODBC | - Open Database Connectivity |
| OEM | - Original Equipment Manufacturer |
| OF | - Optical Fibre |
| OSP | - Outside Plant |
| PBX | - Private Branch Exchange |
| PDU | - Power Distribution Unit |
| PSACR | - Power Sum Attenuation to Crosstalk Ratio |
| PSELFEXT | - Power Sum Equal Level Far-End Crosstalk |
| PSNEXT | - Power Sum Near-End Crosstalk |
| PVC | - Polyvinyl Chloride |
| QA | - Quality Assurance |
| QC | - Quality Control |
| QoS | - Quality of Service |
| RCDD® | - Registered Communications Distribution Designer |
| RF | - Radio Frequency |
| RFI | - Radio Frequency Interference |
| RFQ | Request for Quote |
| RJ | - Registered Jack |
| rms | - Root Mean Square |
| RU | - Rack Unit (1.75") |
| RX | - Receive |
| RX | - Receiver |
| SAN | - Storage Access Network |
| SC | - Single Fibre Coupling Optical Fibre Connector |
| SCC | - Standards Council of Canada |
| SCS | - Structured Cabling System |
| ScTP | - Screened Twisted Pair |
| SFTP | - Screened Foiled Twisted Pair |
| SI | - International System of Units (Le Système International d'Unités) |
| SLA | - Service level Agreement |
| SM | - Singlemode |
| SMF | - Singlemode Fibre |
| SNMP | - Simple Network Management Protocol |

| | |
|----------|---|
| SNR | - Signal-to-Noise Ratio |
| STALPETH | - Steel Aluminum Polyethylene |
| STP | - Shielded Twisted Pair |
| STP-A | - Shielded Twisted Pair A |
| T 1 | - Trunk Level 1 |
| TBB | - Telecommunications Bonding Backbone |
| TBBIBC | - Telecommunications Bonding Backbone Interconnecting Bonding Conductor |
| TC | - Telecommunications Closet |
| TDD | - Telecommunications Device for the Deaf |
| TGB | - Telecommunications Grounding Busbar |
| TGR | - Telecommunications Grounding Rod |
| TIA | - Telecommunications Industry Association |
| TMGB | - Telecommunications Main Grounding Busbar |
| TN | - Telecommunications Node |
| TP | - Twisted Pair |
| TR | - Telecommunications Room |
| TS | - Technical Standard |
| TSB | - Telecommunications Systems Bulletin (formerly Technical Systems Bulletin) |
| TTY | - Teletypewriter / Text Telephone |
| TV | - Television |
| TX | - Transmit |
| TX | - Transmitter |
| UD | - Underfloor Duct |
| UL® | - Underwriters Laboratories Inc.® |
| ULC | - Underwriters Laboratories of Canada |
| UPC | - Universal Product Code |
| UPS | - Uninterruptible Power Supply |
| UTP | - Unshielded Twisted Pair |
| V | - Volt |
| VA | - Volt-Ampere |
| VCSEL | - Vertical Cavity Surface Emitting Laser |
| VLAN | - Virtual Local Area Network |
| VoIP | - Voice over Internet Protocol |
| VPN | - Virtual Private Network |
| W | - Watt |

| | |
|---------|--|
| WAN | - Wide Area Network |
| WAP | - Wireless Application Protocol |
| WiFi | - Wireless Fidelity |
| Wi-Fi | - Wireless Fidelity |
| WLAN | - Wireless Local Area Network |
| WMAN | - Wireless Metropolitan Area Network |
| WWAN | - Wireless Wide Area Network |
| X | - Cross-connect |
| XLPE | - Cross-linked Polyethylene |
| XPE-PVC | - Expanded Polyethylene Polyvinyl Chloride |

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

- 1.1.1. Code, Standard and Regulation Compliances
- 1.1.1.1. The Telecommunications Contractor shall adhere to all Codes, Standards, Regulations and documents listed throughout this document.
- 1.1.1.2. All products installed must meet or exceed all Local, Provincial and Federal Building, Fire, Health, Safety and Electrical Codes.
- 1.1.1.3. The non-plenum/plenum cable shall be ETL or ULC Listed and CSA Certified as type CMR/CMP, in accordance with the Binational Standard for Telecommunications Cable, UL444/C22.2 No. 214-17.
- 1.1.1.4. The equipment, material and installation shall conform to the latest version of the applicable Codes, Standards and Regulations of Authorities Having Jurisdiction as indicated in Table 1. In the case of conflict or discrepancy the more stringent code, standard or regulation shall apply.
- 1.1.1.5. Table 1: Applicable Codes, Standards and Regulations

| STANDARD | TITLE |
|------------|---|
| ANSI/ICEA | |
| S-80-576 | Communication Cables. |
| S-83-596 | Optical Fibre Premises Distribution Cable, latest version |
| S-104-696 | Standard for Indoor-Outdoor Optical Cable, latest version |
| Z136.2 | American Standards for the Safe Operation of Optical Fibre Communication Systems Utilizing Laser Diode and LED Sources. |
| ANSI/TIA | |
| 455 | Standard Test Procedures for Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components – latest version |
| 472CAAA-93 | Detail Specification for All-Dielectric (Construction 1) Optical Fibre Communications Cable for Indoor Plenum Use, Containing Class Ia, 62.5 mm Core Diameter/125 Cladding Diameter Optical Fibre(s). |
| 492CAAA-98 | Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communications Systems. |
| 568.0 | Generic Telecommunications Cabling for Customer Premises, latest version. |
| 568.1 | Commercial Building Telecommunications Infrastructure Standard, latest version. |
| 568.2 | Balanced Twisted Pair Telecommunications Cabling and Component Standard, latest version. |
| 568.3 | Optical Fibre Cabling Components Standard, latest version. |

| | |
|------------------------|--|
| 568.4 | Broadband Coaxial Cabling and Components Standard, latest version. |
| 569 | Commercial Building Standard for Telecommunications Pathways and Spaces including all addenda, latest version |
| 598 | Optical Fibre Cable Colour Coding, latest version |
| 604-5 | FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO, latest version. |
| 606 | Administration Standard for Telecommunications Infrastructure, latest version. |
| 607 | Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, latest version. |
| 862 | Structured cabling infrastructure Standard for Intelligent Building Systems, latest version. |
| CSA | |
| C22.1 | Canadian Electrical Code Part I: Safety Standards for Electrical Installations, latest version. |
| C22.2 No. 41 | Grounding & Bonding Equipment |
| C22.2 No. 182.4-M90 | Plugs, Receptacles, and Connectors for Communication Systems, latest version. |
| C22.2 No. 214-17 | Communications Cables. |
| CAN/CSA-C22.2 No. 0-10 | General Requirements, Canadian Electrical Code, Part II (latest version) |
| OTHER | |
| CAN/ULC-S115 | Standard Method of Fire Tests of Firestop Systems, latest version. |
| CAN/ULC S101 | Standard Method of Fire Endurance Tests of Building Construction and Materials, latest version. |
| CAN/ULC S102 | Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies, latest version. |
| CENELEC EN 50173 | Information Technology – Generic Cabling Systems Part 1: General Requirements, latest version |
| CLC | Canada Labour Code, Part II Occupational Health and Safety, and Provincial and Local Health and Safety regulations |
| IEC 60603-7 | Connectors for electronic equipment - Part 7: Detail specification for 8-way, unshielded, free and fixed connectors, latest version. |
| ISO/IEC IS 11801-1 | Information Technology - Generic Cabling for Customer Premises – Part 1: General Requirements, latest version. |

| | |
|--------------|--|
| NEMA WC 63.1 | Performance Standard for Twisted Pair Premise Voice and Data Communications Cable, latest version. |
| RoHS | Restriction of Hazardous Substances Directive 2011/65/EU, latest version |

- 1.1.1.6. Comply with all Local, Provincial and Federal codes for fire and electrical, as well as all local laws, where applicable and with requirements of the Canadian Standards Association (CSA) when mandatory. Make any changes or alterations required by the authorised inspector of the Authority Having Jurisdiction, at no extra charge to the Owner.
- 1.1.2. General Installation Requirements
 - 1.1.2.1. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment, apparatus and installation of systems cabling solution furnished into premises. Remove these items from premises when no longer required.
- 1.1.3. Metric Conversions
 - 1.1.3.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, equipment, material, and site services in both new and existing installations.
- 1.1.4. Cutting, Patching and Repairing
 - 1.1.4.1. Perform all cutting, patching, repairing, and making good related to the Telecommunications Cabling Work including any penetrations through walls or floors.
 - 1.1.4.2. Allow for all costs associated with cutting, patching, repair, and making good related to the Telecommunications Work including any penetrations through walls or floors.
 - 1.1.4.3. Paint all visible Telecommunications conduit to match existing.
 - 1.1.4.4. Coordinate the colour and location of all conduits, devices, and their housing with architect and architectural drawings on-site before installation.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. CODE, STANDARD AND REGULATION COMPLIANCES

- 3.1.1. Install and terminate all cables and components in accordance with CSA, the latest edition of ANSI/EIA/TIA-568 and its Amendments as well as UL/ULC Guidelines. Maintain the integrity of the pair twists, bend radius and ensuring proper distance is kept from fluorescent light fixtures, electrical cables or any other source of EMI.
- 3.1.2. Comb and bundle all cables in a neat and organised manner. The Telecommunications Engineer's Representative will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at the Telecommunications Contractor's expense. Coordinate with the Telecommunications Engineer's Representative prior to re-dressing cables.
- 3.1.3. The maximum horizontal run length for 4-pair cabling shall not exceed 90-metres. If the 90-metre constraint cannot be met, notify the Telecommunications Engineer's Representative of any cables that exceed 90-metres, prior to installation.

END OF SECTION

PART 1 GENERAL

1.1. CONTRACT DOCUMENTS

- 1.1.1. Read and complete the Telecommunications Tender forms.
- 1.1.2. All Contract Documents, including all General Conditions, Division 1 Specification Sections (if present) and Instructions to Bidders apply to this section and all other Specification sections.
- 1.1.3. Read and comply with all requirements as stated in Divisions 0 and 1. In the event of a conflict between Divisions 0 or Division 1 sections and information contained in Sections 27 00 05.10 - GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS, 27 00 05.60 – ADMINISTRATIVE REQUIREMENTS, and 27 00 05.70 – PROJECT SPECIFIC REQUIREMENTS of this document, the more stringent, onerous, and/or costly requirement shall apply.

1.2. WORK INCLUDED

- 1.2.1. Drawings List
- 1.2.1.1. Refer to the drawing list in the Telecommunications Drawings for a list of drawings that shall be used for preparation of bids and construction.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. COORDINATION

- 3.1.1. Carefully examine Work and Drawings of all related trades and thoroughly plan the Work to avoid conflict or interference with other services. Report defects that would adversely affect Work. Do not commence installation until defects have been corrected. Beginning the Work constitutes acceptance of conditions as satisfactory.
- 3.1.2. Co-ordinate the Work of this Contract such that items will properly interface with the Work of other trades. Prepare installation drawings of critical locations and submit to the Telecommunications Engineer's Representative for review.

END OF SECTION

PART 1 GENERAL

1.1. PROJECT CLOSEOUT SUBMITTALS

1.1.1. Project closeout submittals shall include:

1.1.1.1. Table of contents

1.1.1.2. As-built drawings

1.1.1.3. Cable Test Results

1.1.1.4. Warranty Letters

1.1.1.5. Manufacturer Certification

1.1.1.6. Fibre Optic Safety Letter

1.2. WORK INCLUDED

1.2.1. Closeout Submittal – As-built Drawings

1.2.1.1. Prepare drawing(s) to clearly mark all changes and deviations during the construction process, including the pathway of the cables from the Telecom Room(s) to the Workstations or between Telecom Rooms. Drawing(s) shall be kept up-to-date during construction and in addition to field measurements shall include field instructions and all other changes. Include all additional cables installed during the project in the as-built drawings.

1.2.1.2. The Telecommunications Engineer's Representative has the right to review the status of the as-built drawing(s) from time to time during the construction process. On completion of the project, submit to the Telecommunications Engineer's Representative a soft copy of as-built drawings indicating all such changes and deviations for review within five (5) business days of the completion of the project.

1.2.1.3. Request (in writing) from the Telecommunications Engineer's Representative a soft copy of the Drawings for use by the Telecommunications Contractor in preparation for as-built Drawings. Update the soft copy drawing(s) with correct as-built information (i.e. cable numbers, outlet locations, rack/backboard elevations, etc.) in digital format using the most current version of the Drawings native format (e.g.: AutoCAD or Revit).

1.2.1.4. All changes to drawing(s) shall follow conventional Engineering Draft Standards. All outlet locations shall be identified with proper designation.

1.2.1.5. If the Telecommunications Contractor cannot comply with this requirement, Smith + Andersen will transfer all hand drawn as-builts to the Drawing's native format (AutoCAD or Revit) at a cost to the Telecommunications Contractor. The cost for this service shall be based on per diem rates at time of completion.

1.2.1.6. Print / plot two sets of as-built Drawings at no extra cost. Final as-built print(s)/plot(s) must not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.) and shall be delivered to the Owner.

1.2.1.7. The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) are provided.

1.2.2. Closeout Submittal – Cable Test Results

1.2.2.1. Produce a test report based on the cable schedules. The report shall indicate for each cable, when it was tested successfully and the signature of the technician that performed the test.

- 1.2.2.2. An authorized person for the Telecommunications Contractor must sign the entire report. Supply one (1) soft copy in the tester's native format, along with the appropriate software to read the test results.
- 1.2.2.3. The project will remain incomplete and a holdback will be retained until satisfactory cable test results are provided.
- 1.2.2.4. Provide testing and commissioning documentation for all items and their related components to the Telecommunications Engineer's Representative prior to the completion of the project or at the Telecommunications Engineer's Representatives request. Include maintenance manuals and operating instructions for Owner's staff use.
- 1.2.3. Closeout Submittal – Warranty
 - 1.2.3.1. Provide a minimum of a 2-year unconditional parts and labour Warranty for all equipment and labour provisioned under this contract, from the date of substantial performance of the contract, for each Telecommunications cabling system.
 - 1.2.3.2. Response time for Warranty items shall be 24 hours. Repair deficient Cabling Solution components outside regular working hours. Bidders shall include a statement of Warranty terms and conditions with their contract documents.
- 1.2.4. Closeout Submittal – Manufacturer Certification
 - 1.2.4.1. Arrange for a minimum of 25-year Manufacturer's Warranty and System Performance Guarantee, from the date of substantial performance of the contract, for each Telecommunications cabling system.
 - 1.2.4.2. Provide a manufacturer Warranty that the Structured Cabling Solution is installed and fully operating in accordance with this and the manufacturer Specifications.
 - 1.2.4.3. Upon request and at no additional cost to the Owner the Telecommunications Contractor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.
 - 1.2.4.4. All documentation including the certificate must be in English and French, and shall be submitted to the Telecommunications Engineer's Representative for signed acceptance prior to their production.
- 1.2.5. Closeout Submittal – Fibre Optic Safety Letter
 - 1.2.5.1. Prepare a letter confirming safety labels have been provided at all required locations, and that they will meet performance requirements.
 - 1.2.5.2. Refer to section 27 05 53.00 – IDENTIFICATION FOR COMMUNICATIONS SYSTEMS for location and maintenance requirements.
- 1.2.6. Project Submittal – Shop Drawings
 - 1.2.6.1. Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared.
 - 1.2.6.2. Prepare specifically for this project each Shop Drawing for non-catalogue items. Clearly mark Shop Drawings and brochures for catalogue items to show what is being supplied.
 - 1.2.6.3. Stamp and sign each Shop Drawing or catalogue sheet shall to indicate the drawing has been checked by the Telecommunications Contractor for conformance with all requirements of the Drawings and Specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work

- of other trades. Ensure that co-ordination is complete before submitting Shop Drawings for review.
- 1.2.6.4. Installation of any equipment shall not start until after final review of Shop Drawings by the Engineer's Representative has been obtained.
- 1.2.6.5. When requested, supplement Shop Drawings by data explaining the theory of operation. The Engineer's Representative may also request that this information be added to the maintenance and operating manual.
- 1.2.6.6. Provide space for Shop Drawing review stamps for the Telecommunications Contractor and Telecommunications Engineer's Representative. This space shall be clear of all technical information and shall not be on the back of any sheets.
- 1.2.6.7. One original Shop Drawing will be returned. All copies required for the trades, suppliers or other Consultants will be printed by the Telecommunications Contractor.
- 1.2.7. Project Submittal – Permits, License Reviews and Fees
- 1.2.7.1. Where materials are specified which require special review and approval of CSA and/or local Authorities Having Jurisdiction, obtain such approval for the particular installation with the co-operation of the material supplier. Obtain and pay for permits and reviews required for Work performed.
- 1.2.7.2. Submit required Documents and Shop Drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Drawings and Specifications may be used for this purpose. Prepare any additional information, details and Drawings these authorities may require.
- 1.2.8. Project Submittal – Substitutions and Alternate Products
- 1.2.8.1. This document specifies the use of a complete end-to-end Structured Cabling Solution as manufactured, warranted and certified by a single manufacturer. Alternate materials (from the overall cabling solution) will not be accepted unless specifically noted.
- 1.2.8.2. Where supply of the materials may compromise the schedule, submit a request to use alternate product to the Telecommunications Engineer's Representative. Depending on the circumstance, the Telecommunications Engineer's Representative may provide written authorisation to substitute the Product. Obtain written authorization before providing alternates.
- 1.2.8.3. Where a separate price is requested in this document, prepare quotation(s) to install/provide products and/or systems as outlined. Submit the separate price quotation with the bid response. Instructions and products requested under separate price sections shall not be considered substitutions or alternate products.
- 1.2.8.4. The Telecommunications Engineer's Representative's decision regarding the acceptance or rejection of the proposed substitution is final. Substitutions may be accepted if the delivery of the component or item is such that it will not jeopardise the construction schedule. Otherwise, the substitution may not be approved.
- 1.2.8.5. In order to be assessed, proposed substitutions must include the following:
- 1.2.8.5.1. Description of proposed substitution,
- 1.2.8.5.2. Respective cost of items originally specified and the proposed solution,
- 1.2.8.5.3. Compliance with the applicable Building Codes and the requirements of Authorities Having Jurisdiction,
- 1.2.8.5.4. Compliance with the applicable Telecommunications standards,
- 1.2.8.5.5. Affect concerning compatibility with and interface with adjacent building materials and components,
- 1.2.8.5.6. Compliance with the intent of the Contract Documents, and

- 1.2.8.5.7. Reason(s) for the request.
- 1.2.8.6. Substitution submissions do not relieve the Telecommunications Contractor from the obligation of preparing and submitting a contract documents that is in complete compliance with this specification document and associated Drawings. Any substitution submissions must be clearly outlined in addition to the original specified equipment as detailed in this document and associated Drawings as a separate or alternate price format.
- 1.2.9. Project Submittal – Scheduling
- 1.2.9.1. Within one week of award of the contract, submit a formal project schedule to the Telecommunications Engineer's Representative showing start and finish dates of major tasks as denoted by system such as: demolition, backbone cabling, horizontal cabling, rack and cabinet installation, material order and delivery to site and testing.
- 1.2.9.2. Submit updated schedules as periodically requested by Telecommunications Engineer's Representative.
- 1.2.10. Project Submittal – Review and Testing Requirements
- 1.2.10.1. Develop and submit a test plan indicating the process and types of tests to be performed. The plan must indicate the testing process for each cable.
- 1.2.10.2. The Telecommunications Engineer's Representative must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.
- 1.2.10.3. Invite the Telecommunications Engineer's Representative to witness field testing a minimum of five (5) business days before testing commences.
- 1.2.10.4. Upon completion of the testing the Telecommunications Engineer's Representative may request a random test of up to 10% of the links. The Telecommunications Contractor shall test these randomly selected links and the results shall be stored in accordance with this document. The results obtained shall be compared to the original test data. A penalty of \$50.00 shall be deducted from the Contract amount for each cable that fails to pass the random test. If more than 2% of the sample results differ in terms of the pass/fail determination, repeat 100% testing under the supervision of the Telecommunications Engineer's Representative. The cost of the labour required for the testing as well as the cost for the supervision by the part of Telecommunications Engineer's Representative shall be borne by the Telecommunications Contractor.
- 1.2.11. Keep the site and surrounding area clean, safe and free from debris at all times. Remove all debris from the site on a daily basis. The costs for cleaning are the responsibility of the Telecommunications Contractor.
- 1.2.12. Upon completion of the Work and before acceptance and final payment will be made, clean and remove from the site, all surplus and discarded materials, temporary structures and debris of every kind. Surplus and waste materials removed from the site shall be disposed of in accordance with applicable laws and regulations.
- 1.2.13. Before acceptance by the Telecommunications Engineer's Representative, all the equipment and cabling must be cleaned and tested.

PART 2 PRODUCTS

2.1. NOT USED.

PART 3 EXECUTION

3.1. NOT USED.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Cable Installation
 - 1.1.1.1. The Telecommunications Contractor may assume at their own risk that the entire cable installation will be done during regular hours, except:
 - 1.1.1.1.1. Where noted otherwise in this specification;
 - 1.1.1.1.2. As outlined in the project front end documents.
 - 1.1.2. Floor/Ceiling Tiles
 - 1.1.2.1. Remove and re-install all floor/ceiling tiles in areas affected by the Work. This shall be done on a daily basis for all areas that are occupied during the construction period. Otherwise, remove and re-install the tiles after the Work is complete.
 - 1.1.2.2. Any damage to ceiling tiles during the installation of any Work described in this document is the responsibility of the Telecommunications Contractor. Damages include chipping, breaking and/or soiling. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Owner and/or the Telecommunications Engineer's Representative.
 - 1.1.2.3. The Telecommunications Contractor shall be responsible for storage and protection of floor/ceiling tiles when they have been removed from the floor/ceiling grid.
 - 1.1.3. Cut Over Planning and Management
 - 1.1.3.1. Include for a total of 16 hours cut over support, to be used at the discretion of the Owner/Telecommunications Engineer's Representative. The technician shall be available to provide services to the Owner as required. This may involve additional testing or Move, Add, Change (MAC) activity. Any additional materials used shall be addressed separately.
 - 1.1.3.2. Schedule installers such that the cut over schedule is maintained. Any shift work or overtime premiums that are required to complete the project on schedule shall be included in the Telecommunications Contractor's contract Price.
 - 1.1.4. Safety of Persons and Property
 - 1.1.4.1. Comply with all laws, ordinances, rules, regulations, and policies of the Owner and lawful orders of any public Authority Having Jurisdiction for safety of persons or property or to protect them from damage, injury or loss.
 - 1.1.4.2. Moderate public pedestrian traffic should be expected around all Work locations. Ladders scaffold, installation materials, and all other hazardous conditions shall be fully protected at all times. Warning cones, signs, barricades and warning tapes shall be used to warn and protect persons and property at all times in public corridors.
 - 1.1.4.3. Work shall not interfere with legal fire exits. Corridors, areas of egress, fire protection stand pipes, hydrants and exit stairs shall be maintained at all times.
 - 1.1.4.4. Maintain at all times free access to fire lanes and emergency and utility control facilities such as fire alarm boxes, utility vaults, manholes and junction boxes.
 - 1.1.4.5. No open flames/smoking shall be permitted without prior written approval of the Owner.
 - 1.1.4.6. Set up and remove all signage and safety measures to ensure that other trades and non-trade personnel are safe from work of the Telecommunications Contractor.
 - 1.1.5. Access to Site

- 1.1.5.1. Coordinate site access with the Project Manager and/or Owner as determined during the initial project meeting.
- 1.1.6. Identification
 - 1.1.6.1. All Telecommunications Contractor personnel shall be clearly identified by either uniform or company ID. The Telecommunications Contractor may also be required to wear Owner provided ID for required card access locations or identification. All Owner ID(s) must be returned daily or at the end of the project as determined by the Owner.
- 1.1.7. Emergency Facilities
 - 1.1.7.1. The Telecommunications Contractor shall maintain at all times free access to fire lanes and emergency and utility control facilities such as fire alarm boxes, utility vaults, manholes and junction boxes.
- 1.1.8. Product Delivery Requirements
 - 1.1.8.1. Be responsible for complete delivery, handling, and installation of all materials used in the performance of the Work.
 - 1.1.8.2. Arrange for the delivery of Owner furnished equipment/materials related to the Specifications or Drawings and related items, including unloading of supplier's truck, elevator scheduling, storage, and placement on as indicated on Contract Drawings.
- 1.1.9. Product and Tools Storage Requirements
 - 1.1.9.1. Be responsible for storage and handling of all materials used in the performance of the Work.
 - 1.1.9.2. Job boxes may be allowed to be stored on the site during construction. The tools and the job box shall be the responsibility of the Telecommunications Contractor. The Owner and their representative shall be in no way responsible or liable for any tools of the Telecommunications Contractor.
- 1.1.10. Confined Spaces
 - 1.1.10.1. Where Work is performed in a confined space, comply with all code related and Owner specific safety requirements.
- 1.1.11. Coordination with Occupants
 - 1.1.11.1. Be responsible for co-ordinating all Work with the Owner/tenant of the floor space for their daily work.
- 1.1.12. Project Meetings
 - 1.1.12.1. Attend site meetings when requested by the Telecommunications Engineer's Representative and/or the Project Manager. Regular meetings may occur once per week at the Telecommunications Engineer's Representative's and/or the Project Manager's discretion.
 - 1.1.12.2. Attend scheduled project meetings throughout the duration of the project to review the status of current and planned activities, schedule and conduct other business associated with the project.
- 1.1.13. Progress Reports
 - 1.1.13.1. Prepare and issue a status report at the scheduled project meeting including status of: progress, project completion for phases, material ordering and delays.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. PRODUCT DELIVERY REQUIREMENTS

- 3.1.1. Unload materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2. PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

- 3.2.1. The Telecommunications Contractor shall be responsible for the assembly of above equipment/materials and protection of the above equipment and related items until project cut over. Any damage to equipment shall be the liability of the Telecommunications Contractor. All damage shall be repaired, or at the Owner's request, the equipment shall be replaced at no extra charge to the Owner.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Fire Stopping
 - 1.1.1.1. Provide seals in all Fire Rated Separations and Firewalls to form tight barriers to retard the passage of flame and smoke.
 - 1.1.1.2. The installed seals shall provide and maintain the fire resistance rating of the adjacent floor, wall or other fire separation assembly in accordance with Fire Code and Building Code requirements.
 - 1.1.1.3. Establish/re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed, or that were created by others for use by the Telecommunications Contractor.
 - 1.1.1.4. Provide Fire Stop pillows for existing cable tray penetrations through firewalls.
 - 1.1.1.5. For the purposes of this specification, the only acceptable Fire Stop Systems shall be those that have been tested to the CAN/ULC S115 Standard.
 - 1.1.1.6. Provide non-permanent CSA approved Fire Stop systems that are dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required).
 - 1.1.1.7. All fire stopping shall maintain a minimum one-hour rating and shall meet applicable Federal, Provincial and Local building codes.
 - 1.1.1.8. All Fire Stop Systems shall be listed and tested by an SCC and accredited Third Party Testing Agency in accordance with the Standards.
 - 1.1.1.9. Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire resistance rating of the surrounding Fire Separation or Firewall.
 - 1.1.1.10. All Smoke Seals selected for use shall comply with Fire Code, Building Code, and Building Standards.
 - 1.1.1.11. All Fire Stop Materials and Smoke Seals shall have elastomeric characteristics to allow for building settling and seismic movement. All Fire Stop Materials and Smoke Seals shall be free of asbestos.
- 1.1.2. Water Proofing
 - 1.1.2.1. Seal all foundation penetrating conduits and service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.
 - 1.1.2.2. Seal or reseal all service entrance conduits through building upon cable placement. Plug spare conduits with expandable plugs.
- 1.1.3. Quality Assurance
 - 1.1.3.1. Provide fire stopping systems that comply with the following requirements following:
 - 1.1.3.1.1. Fire stopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for fire stop system acceptable to authorities having jurisdiction.
 - 1.1.3.1.2. Fire stopping products bear the classification marking of qualified testing and inspection agency.
 - 1.1.3.2. Provide the Work of this Section using competent installers, experienced in the application of the materials and systems being used, approved and trained by the material or system manufacturer.
 - 1.1.3.3. Fire Stop Systems shall conform to the fire (F), hose (H) and temperature (T) ratings of Codes.

- 1.1.3.4. Fire Stop Materials and Smoke Seal materials shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class "A").
- 1.1.3.5. For the purposes of this specification the only acceptable Fire Stop Systems are those that have been tested to the CAN/ULC S115 Standard.
- 1.1.4. Performance
 - 1.1.4.1. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.
 - 1.1.4.2. Where non-mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.
 - 1.1.4.3. Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.
 - 1.1.4.4. Seal openings for cable trays using re-enterable fire stopping pillows.
- 1.1.5. Project Conditions
 - 1.1.5.1. Do not install fire stopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer
 - 1.1.5.2. Do not install fire stopping products when substrates are wet due to rain, frost, condensation, or other causes.
 - 1.1.5.3. Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.
 - 1.1.5.4. Do not use materials that contain flammable solvents.
 - 1.1.5.5. Coordinate construction of openings and penetrating items to ensure that through-penetration fire stop systems are installed according to specified requirements.
 - 1.1.5.6. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.
 - 1.1.5.7. Schedule installation of fire stopping after completion of penetrating item installation but prior to covering or concealing of openings.

PART 2 PRODUCTS

2.1. GENERAL

- 2.1.1. Use only fire stopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.2. MANUFACTURERS

- 2.2.1. Products manufactured by Hilti Corporation (or approved equivalent) are acceptable.
- 2.2.2. Obtain fire stop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.3. MATERIALS

- 2.3.1. Firestop Sealants: The following products are acceptable.
 - 2.3.1.1. Hilti FS-ONE MAX high performance Intumescent Firestop Sealant

- 2.3.1.2. Hilti CP 601S Elastomeric Firestop Sealant.
- 2.3.1.3. Hilti CP 606 Flexible Firestop Sealant
- 2.3.1.4. Hilti CP 604 Self-Leveling Firestop Sealant
- 2.3.1.5. Or equivalent
- 2.3.2. Cast-In Firestop Device: A one-step cast-in firestop device for a variety of pipe materials and diameters. The following product is acceptable.
 - 2.3.2.1. Hilti CP 680-M Cast-in Firestop Device or equivalent.
- 2.3.3. Firestop Putty: An intumescent, non-hardening, firestop putty for cable and pipe penetrations. The following product is acceptable:
 - 2.3.3.1. Hilti CP 618 Firestop Putty Stick or equivalent.
- 2.3.4. Firestop Plug: Ready-to-use intumescent and reusable plug for small openings. The following product is acceptable:
 - 2.3.4.1. Hilti CFS-PL Firestop Plug or equivalent.
- 2.3.5. Fire Rated Cable Pathways: Re-penetrable cable management device:
 - 2.3.5.1. Hilti CP 653 Speed Sleeve or equivalent.

PART 3 EXECUTION

3.1. FIRE STOPPING

- 3.1.1. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of fire stopping in accordance with manufacturer's installation instructions and technical information.
- 3.1.2. Examine sizes and conditions of voids to be filled to establish correct thickness and installation of Fire Stop Materials.
- 3.1.3. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- 3.1.4. Prepare surfaces in contact with Fire Stop Systems and Smoke Seals to manufacturer's instructions. Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- 3.1.5. Install/replace sound barrier/fire stopping materials as soon as cables have been pulled through the opening.
- 3.1.6. In all Fire Stop Systems that require mineral wool or ceramic fibre backer or filler materials, these materials shall be dry and free of other contaminants before, during and after installation of sealant Fire Stop Materials. Alkaline water contamination of the backer or filler materials may cause corrosion of metallic penetrating items.
- 3.1.7. Apply Fire Stop Systems and Smoke Seals in strict accordance with manufacturer's instructions to prevent the passage of fire and smoke, and where required and / or specifically designated, the passage of fluids.
- 3.1.8. Provide temporary forming and packing as required. Tool or trowel all exposed surfaces to smooth, neat and tidy finish.
- 3.1.9. Fire Stop and smoke seal gaps and holes in all Fire Separation and Firewall construction through which cables pass as a result of Work in this document.

- 3.1.10. In Combustible Construction (membrane GWB type) where the framing members are wood or where paper faced insulation is incorporated within the separation, a Fire and Temperature rise "FT" rating is required equal to that of the rating of the Fire Separation. Include openings which have been formed and sleeved.

3.2. WATER PROOFING

- 3.2.1. Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or water proof duct seal.

3.3. EXPOSED SERVICE PENETRATIONS IN CEILING OF UNDERGROUND PARKING AREAS

- 3.3.1. Where the bottom of a Fire Stop System is exposed, seal bottom side of the assembly with a fire rated elastomeric Fire Stop sealant.

3.4. CLEAN UP

- 3.4.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of the Telecommunications Engineer's Representative. Remove and or correct staining and discolouring of adjacent surfaces as directed.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in the Contract Documents. Use pathways installed by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangers.
- 1.1.2. Do not use any mechanical or electrical fittings to support the Telecommunications cabling.
- 1.1.3. Independently support the cables above all ceiling tiles in such a manner that the cables do not interfere with the removal of the ceiling tiles. Maintain a minimum of 75 mm 3"(in) of clear vertical space above the ceiling tiles shall .
- 1.1.4. Obtain the Telecommunications Engineer's Representative approval for all deviations from the contract documents and Drawings in relation to cable routing, outlet and equipment locations.

1.2. INDOOR CABLE DISTRIBUTION

- 1.2.1. Utilise all indicated and available cable pathways such as conduits, Telecommunications cable tray, ducts, surface raceways installed by the Electrical Contractor, and furniture system channels except where otherwise noted.
- 1.2.2. Inside buildings minimize any possibilities of interference by maintaining the following minimum clearances from electrical and heat sources when routing cables.

| Item | Minimum Separation Distances | | |
|--|------------------------------|---------------------|---------------------|
| | (<2kVA) | (2-5kVA) | (>5kVA) |
| Unshielded power lines or electrical equipment in proximity to open or non-metallic pathway. | 127 mm (5"(in)) | 305 mm (12"(in)) | 610 mm (24"(in)) |
| Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway. | 64 mm (2.5"(in)) | 152 mm (6"(in)) | 305 mm (12"(in)) |
| Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway. | --- | 76 mm (3"(in)) | 152 mm (6"(in)) |
| | | | |
| Motors | 1.2 m (4'-0") | | |
| Transformers | 1.2 m (4'-0") | | |
| Fluorescent Luminaires | 300 mm (12") | | |
| Pipes (gas, oil, water, etc.) | 120 mm (5") | | |
| HVAC (equipment, ducts, etc.) | 150 mm (6") | | |

PART 2 PRODUCTS

2.1. NON-CONTINUOUS CABLE SUPPORT

- 2.1.1. Supply and install cable support for the distribution of horizontal and backbone cables where conduit or cable tray has not been provided.
- 2.1.2. Use non-continuous cable supports up to the maximum density of cables permitted, as specified by the manufacturer.
- 2.1.3. Provide adequate supports to suit the quantity of cables in runs used for distribution.

- 2.1.4. Include any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal and backbone cabling.
- 2.1.5. Approved Manufacturers:
- 2.1.5.1. Erico,
- 2.1.5.2. Panduit, or
- 2.1.5.3. An equivalent and sized as per manufacturer recommendations.
- 2.1.6. Approved Products
- 2.1.6.1. Panduit J-Pro, J-Mod, or equivalent cable supports shall be used where ceiling space rating dictates.

| Description | Panduit Part# | J-Mod |
|------------------------------------|--|------------|
| Wall Mount | JP2W-L20 | Equivalent |
| Ceiling Mount | JP2CMB-L20 SPEC | Equivalent |
| Drop Wire and Threaded Rod Clip | JP2DW-L20 | Equivalent |
| Screw-On Beam Clamps | JP2SBC50-L20 or JP2SBC50RB-L20 | Equivalent |
| Hammer On Beam Clamps | JP2HBC25RB-L20 or JP2HBC50RB-L20 or JP2HBC75RB-L20 | Equivalent |
| Purlin Clips | JP2ZP-L20 or JP2CP-L20 | Equivalent |
| Under Floor Pedestal Support Clamp | JP2UF100-L20 | Equivalent |

2.2. VELCRO STRAPS

- 2.2.1. Provide only Velcro straps for bundling of cable. Under no circumstance shall plastic tie-wraps be used.
- 2.2.2. Acceptable Manufacturers
- 2.2.2.1. Panduit: HLS/HLM-15R0 (Black), or
- 2.2.2.2. Approved equivalent
- 2.2.3. If plastic tie-wraps are used the Telecommunications Contractor shall remove and replace all affected cables at their own expense.

2.3. SPIRAL WRAP

- 2.3.1. Size Spiral Wrap according to quantity of cables being fed into the system furniture. Spiral Wrap colour shall match system furniture manufacturer's power feed.
- 2.3.2. Approved Manufacturers:
- 2.3.2.1. Panduit part number: T50F-CX, or
- 2.3.2.2. Approved equivalent.

2.4. INNER DUCT

- 2.4.1. For plenum rated spaces, supply and install plenum rated Inner duct. Carlon part numbers are listed below.

- 2.4.2. Acceptable manufacturer:
- 2.4.3. Size Plenum Riser
- | | | |
|----|---------------------------|---------------------------|
| 1" | Carlton Part# CF4X1C XXX | Carlton Part# DF4X1C XXX |
| 2" | Carlton Part # CJ4X1C XXX | Carlton Part # DJ4X1C XXX |
- Where "XXX" refers to appropriate product length
- 2.4.4. Innerduct shall be sized appropriately to maintain the 40% fill ratio and allow for a proper bend radius of the cable(s) within.
- 2.4.5. Where Innerduct is installed for use with OM1 or OM2 Multimode Fibre, it shall be Orange. Where Inner duct is installed for use with OM3/OM4 Multimode Fibre, it shall be Aqua. Where Inner duct is installed for use with Single Mode Fibre, it shall be Yellow. All Inner duct shall be installed with pre-lubricated pull tape.

PART 3 EXECUTION

3.1. CABLE DISTRIBUTION

- 3.1.1. Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- 3.1.2. Install and terminate all cables and components in accordance with applicable Codes, Standards and Regulations.

3.2. CABLE SUPPORT

- 3.2.1. Supply and install supports, hanger supports, and any other miscellaneous hardware required to support Telecommunications cabling where conduit/cable tray has not been provided. Any conduit and cable tray shall be provided by the Electrical Contractor as indicated on Division 27 Drawings, unless otherwise noted. Telecommunications Contractor is responsible for determining these requirements based on Telecommunications and/or Electrical Drawings.
- 3.2.2. Install hangars at 4' intervals (maximum). Do not exceed a cable sag greater than 4". Secure all cables to J-hooks/supports with Velcro straps. Comb and dress cables for all visible portions of the install. Comb and redress any cables that do not meet this criteria at no additional cost.
- 3.2.3. Run all cable support hangers and inner duct parallel to building lines.
- 3.2.4. Cable support hangers or hanger supports must not be drilled into post-tensioned beams under any circumstances.
- 3.2.5. Be responsible for coordinating the best time to install the supports with the General Contractor. After hours Work may be required for this portion of the Work.
- 3.2.6. Size supports to accommodate the number of cables in each run. Provide other hardware such as hammer on clamps, screw on clamps and angled hanger brackets to support the backbone and/or horizontal cabling.
- 3.2.7. In the Cable Support Hanger System, each individual run or pathway shall not contain more than fifty (50) UTP horizontal cables. Provide an additional hanger pathway to divide the cable bundle where the quantity exceeds this.
- 3.2.8. Completely and independently support the hangar system from the structural ceiling or walls (concrete slab/deck). Do not support the cable support hanger system from the suspended ceiling. Do not drill anchors for hangers into post tensioned beams under any circumstances. Do not use pneumatic hammers. All anchors must be drilled into slab.
- 3.2.9. Minimize the disturbance or removal of 'fire spray' insulation during installation of cable supports.

3.3. VELCRO STRAPS

- 3.3.1. Use Velcro straps to neatly dress cables; they shall be placed at a maximum of 4' intervals for horizontal distribution (centre points between cable supports).
- 3.3.2. Use Velcro straps to dress horizontal cables into racks/cabinets. For each row of the patch panel, the maximum spacing of Velcro for horizontal cables into or along vertical cable managers shall be no more than 6", this includes cabling dropped from the ladder tray or ceiling above.

3.4. SPIRAL WRAP

- 3.4.1. Install spiral wrap from system furniture feed points to system furniture entry point. Spiral Wrap shall be butted so that no cables are exposed.

3.5. INNERDUCT

- 3.5.1. Install Fibre Cables in innerduct over the entire length inside the building. Exceptions to this are for:
 - 3.5.1.1. Armoured Fibre cabling; or
 - 3.5.1.2. Where a dedicated fibre conduit is installed that is 1.5" in diameter or less.
- 3.5.2. Under these situations, the fibre cabling may be installed without inner duct.
- 3.5.3. Minimise the number of separate innerducts installed by pulling multiple fibre cables through each innerduct.
- 3.5.4. Inner duct shall be CMR (FT4) or CMP (FT6) rated, as is appropriate for ceiling space classification and local code requirements. Size innerduct to suit installation requirements.
- 3.5.5. Fasten to the backboard, rack, cabinet, or enclosure by utilizing cradle mounts and plastic permanent cable ties.

3.6. CABLE DISTRIBUTION

- 3.6.1. Ensure ANSI/EIA/TIA-568.1, latest edition standard installation practices are followed for indoor cable distribution and ANSI/EIA/TIA-758, latest edition standard installation practices are followed for outdoor cable distribution.
- 3.6.2. Station personnel at each access point (i.e. Handhole, maintenance hole, etc.) to observe the cables being pulled. Submit tension pull calculation for installation of cables to Telecommunications Engineer's Representative.
- 3.6.3. Do not exceed the Copper / Fibre cables maximum tensile rating during installation. Monitor tension of the cable during installation. Use a dynamometer to record installation tension. Use a tension limiting device to prevent the exceeding of maximum pulling tension Specifications during installation. Set the tension limit at or below the manufacturer's limit. The cable shall be taken up at intermediate pulling points with an intermediate take-up device as approved by the Telecommunications Engineer's Representative, to prevent over tension on the cable.
- 3.6.4. Do not exceed the minimum bend radius as per the manufacturer's recommendations.
- 3.6.5. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.
- 3.6.6. Protect exposed cable ends from moisture ingress.
- 3.6.7. Provide sufficient slack for cable passing through maintenance holes for expansion/contraction and install clips to prevent sagging.

3.7. CABLE LUBRICANT

- 3.7.1. The use of pulling lubricants of any kind is strictly prohibited

3.8. DUCT AND CONDUIT

- 3.8.1. Clean out each section of duct or conduit by pulling a steel wire brush and mandrel of the correct size through the duct or conduit before pulling cables. Bush, ream and remove any sharp projections on all conduits prior to installation of Telecommunications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Telecommunications Engineer's Representative of the problems encountered.
- 3.8.2. Pull cables in bottom ducts/conduits first, leaving top ducts/conduits for future use. Cable grip shall be attached to the sheath and its strength members so that no direct force is applied to the conductors / fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Labelling
 - 1.1.1.1. Confirm the cable designations with the Telecommunications Engineer's Representative prior to installation.
 - 1.1.1.2. Adhere to CSA T528-93 (ANSI/EIA/TIA-606-C) colour codes.
 - 1.1.1.3. Confirm labelling schemes with the Telecommunications Engineer's Representative prior to installation. The cable labelling scheme for all cables at both ends shall be as follows:
- 1.1.2. Horizontal Cable Labelling Schema
 - 1.1.2.1. Provide labelling schema for Horizontal Data / Fibre cables and IDC Blocks / Patch Panels as follows:
 - 1.1.2.1. Refer to the latest version of the University of Toronto Communications Infrastructure Specifications, Standards and Practices document.

PART 2 PRODUCTS

2.1. CABLE LABELS

- 2.1.1. All adhesive cable labels shall meet the legibility, defacement, and adhesion requirements specified in ANSI/UL 969 (Ref. D-16). In addition, the labels shall meet the general exposure requirements in ANSI/UL 969 for indoor use.
- 2.1.2. Provide self-laminating vinyl cable labels with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area shall be of sufficient length to wrap around the cable at least one and one-half times.
- 2.1.3. Approved Manufacturers:
 - 2.1.3.1. Panduit: Part# LS8E,
 - 2.1.3.2. Easy-mark labeling software: Part# PROG-EMCD, or
 - 2.1.3.3. Equivalent.

2.2. LAMACOID LABELS

- 2.2.1. Provide black lamacoid plates with white 60 point Arial Narrow, engraved upper case letters enclosed by a white border on black background for racks, cabinets, and enclosures.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. All active and passive equipment shall be labeled.

3.2. LABELLING

- 3.2.1. All labels must be mechanically printed using a laser printer. Hand-written labels are not permitted.
- 3.2.2. Provide 25% spare labels in each telecommunications room.

3.3. LABEL LOCATIONS

- 3.3.1. Cable identification labels shall appear at the following locations with the numbers indicated on the cable schedule and Drawings:
 - 3.3.1.1. 102 mm 4" (in) from each end of the cable after termination,
 - 3.3.1.2. Front of Patch Panels,
 - 3.3.1.3. Front of IDC termination blocks,
 - 3.3.1.4. Front of workstation/Telecommunications outlet faceplates, and
 - 3.3.1.5. Each end of each Telecommunications Conduit.
- 3.3.2. Fibre Optic safety Labels shall appear at the following locations:
 - 3.3.2.1. Along the length of the conduit or inner duct at 3m 10' (ft.) intervals,
 - 3.3.2.2. At all junction boxes,
 - 3.3.2.3. At all pull boxes, and
 - 3.3.2.4. On all Fibre Optic Patch Panels.
- 3.3.3. Labels must be visible during installation and normal maintenance of the infrastructure.
- 3.3.4. Affix lamacoid labels to the front and rear of equipment in racks, cabinets.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. General Testing Requirements
 - 1.1.1.1. Test 100% of the installed cabling links. All cables must pass the requirements of the Standards as defined within this document. Any failing link must be diagnosed and corrected. Re-test to prove that the corrected link meets the performance requirements. Provide the final and passing result of the tests for all links in the test results documentation.
 - 1.1.1.2. Correct all deficiencies before the Telecommunications Engineer's Representative will provide a certificate to release the Holdback on the project.
 - 1.1.1.3. Submit a soft copy of test results in PDF and another ODBC compatible database format.
 - 1.1.1.4. Test Patch Cords for portable tester must be designed for testing by the manufacturer. Field assembled Patch Cords are not acceptable. Field testers must use the appropriate jack/tester adapter specified for use with the cabling jack(s) specified within this document.
 - 1.1.1.5. Submit a test plan to the Telecommunications Engineer's Representative for approval prior to testing.
 - 1.1.1.6. Submit a test report based on the cable schedules. Indicate for each cable, when it was tested successfully and the signature of the technician that performed the test, location, cable type, cable number and tester make and model. An authorised person shall sign the test report at the completion of the project.
- 1.1.2. Copper Cabling Test Requirements
 - 1.1.2.1. Test every cabling link in the installation (as required by the Cabling specified) in accordance with the Telecommunications Industry Association (TIA) Standard ANSI/TIA/EIA-568.1, latest edition.
 - 1.1.2.2. Test installed twisted-pair horizontal links from the Telecommunications Room to the workstation against the "Permanent Link" performance limits Specification as defined in ANSI/TIA/EIA-568.1, latest edition .
 - 1.1.2.3. Only trained technicians who have successfully attended an appropriate training program and have been certified must execute the tests. Appropriate training programs include installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals) and Vendor supplied certifications for their product.
 - 1.1.2.4. Test equipment shall comply with or exceed the accuracy requirements for enhanced level II and/or level III and/or level IIIe field testers (according to Cabling specified) as defined in TIA-568, latest edition ; Annex I: Section I.4. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table I.4 of Annex I of TIA/EIA-568.2, latest edition .
 - 1.1.2.5. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. Provide proof that the interface has been calibrated within the period recommended by the Manufacturer. Ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

- 1.1.2.6. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.
- 1.1.2.7. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. Submit all Pass* categorized cable test results to the Owners' Engineering Representative for review and approval. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568, latest edition ; Annex I: Section I.2.2).
- 1.1.3. Copper Cabling Performance Test Parameters
- 1.1.3.1. The test parameters for Category 6a are defined in TIA Category 6a Standard, which refers to TIA/EIA-568.2, latest edition. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test all measurements (at each frequency in the range from 1 MHz through 500 MHz) must meet or exceed the limit value determined in the above-mentioned Standard.
- 1.1.3.2. Testing of all 4 pairs of the horizontal cable (as specified in this document) shall include but not be limited to the following:
- 1.1.3.2.1. Wire Map including; end to end continuity, open and shorts, pair polarity,
- 1.1.3.2.2. Cable length,
- 1.1.3.2.3. Attenuation,
- 1.1.3.2.4. NEXT/FEXT,
- 1.1.3.2.5. ACR,
- 1.1.3.2.6. Return Loss,
- 1.1.3.2.7. ELFEXT, PSELFEXT,
- 1.1.3.2.8. Propagation Delay, Delay skew, and
- 1.1.3.2.9. PSNEXT, PSACR.
- 1.1.3.3. Permanent link testing of all horizontal and backbone cables shall be completed in accordance with the follow test criteria:
- 1.1.3.3.1. Wire Map including; end to end continuity, open and shorts, pair polarity,
- 1.1.3.3.2. Cable length, and
- 1.1.3.3.3. Basic Link.
- 1.1.3.4. The nominal velocity of propagation (NVP) must be set specific to each cable manufacturer before testing. The portable tester shall be within the calibration period recommended by the manufacturer in order to achieve the manufacturer-specified measurement accuracy. Refer to manufacturer's test procedure.
- 1.1.4. Optical Fibre Cabling Test Requirements
- 1.1.4.1. Every Optical Fibre Cabling link in the installation shall be tested in accordance with the field test Specifications defined by the Telecommunications Industry Association (TIA) Standard ANSI/TIA-568.3, latest edition (or by the appropriate network application Standard(s) whichever is more demanding).
- 1.1.4.2. ANSI/TIA-568.0, latest edition, defines the passive cabling network to include cable, connectors, and splices (if present), between two optical fibre patch panels (connecting hardware). A typical horizontal link segment is from the telecommunications outlet/connector to the horizontal cross-connect. This TIA document describes three typical backbone link segments: (1) main cross-connect to intermediate cross-connect, (2) main cross-connect to horizontal cross-connect,

or (3) intermediate cross-connect to horizontal cross-connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

- 1.1.4.3. Only trained technicians who have successfully attended an appropriate training program and have been certified must execute the tests. These certificates may have been issued by any of the following organisations or an equivalent organisation:
 - 1.1.4.3.1. The manufacturer of the Optical Fibre Cable and/or the Optical Fibre Connectors,
 - 1.1.4.3.2. The manufacturer of the test equipment used for the field certification,
 - 1.1.4.3.3. Training organisations authorised by BICSI (Building Industry Consulting Services International) or by the ACP (Association of Cabling Professionals™), or
 - 1.1.4.3.4. Vendor supplied certifications for their product.
- 1.1.4.4. Field test instruments for Single mode Fibre cabling shall meet the requirements of ANSI/TIA-526-7, latest edition.
- 1.1.4.5. The Optical Fibre launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.
- 1.1.4.6. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests as detailed below.
- 1.1.4.7. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.
- 1.1.5. Optical Fibre Cabling Performance Test Parameters
 - 1.1.5.1. ANSI/TIA Standard 568.3, latest edition prescribes that the single performance parameter for field testing of optical fibre links is link attenuation when installing components compliant with this Standard.
 - 1.1.5.2. Calculate the link attenuation by the following formulas specified in ANSI/TIA/EIA 568, latest edition.
 - 1.1.5.3. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
 - 1.1.5.4. The above link attenuation test limits are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14, latest edition, Method B and ANSI/TIA/EIA-526-7, latest edition, Method A.1. The user shall follow the procedures established by these Standards or application notes to accurately conduct performance testing.
 - 1.1.5.5. Test single mode Backbone Links at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, latest edition, Method A.1, and One Reference Jumper. Certify all Single Mode links with test tools using laser light sources at 1310 nm and 1550 nm (See Note below). Delete this section is Singlemode Fiber is not required for your project
 - 1.1.5.6. Notes:
 - 1.1.5.6.1. Link attenuation has been based upon the use of a light source categorised by a Coupled Power Ratio (CPR) of Category 2, Under filled, per Annex B of ANSI/EIA/TIA-526-14, latest edition. The use of a light source categorised as Category 1, Overfilled, may provide results higher than the 2.0 dB limit. A field test tool based on LED (light emitting diode) light sources is a Category 1 device and typically yields high attenuation results.
 - 1.1.5.6.2. Links destined to be used with network applications that use laser light sources (under filled launch conditions) shall be tested with test equipment based on laser light sources. this rule

- should be followed for Cabling Solutions to support Gigabit Ethernet. Gigabit Ethernet only specifies laser light sources.
- 1.1.5.6.3. For Gigabit Ethernet compliant certification (IEEE STD 802.3z application), use test equipment which uses a VCSEL (Vertical cavity surface emitting laser) at 850 nm (compliant with 1000BASE-SX) and a FP laser at 1310 nm (compliant with 1000BASE-LX).
- 1.1.5.7. Each optical fibre link terminated with an optical adapter system which does not impose a transmission direction because the adapters are not or cannot be ganged should be tested and documented in both directions since the direction of the signal transmission cannot be predicted at the time of installation.
- 1.1.5.8. Test each strand of fibre with an Optical Time Domain Reflectometer for length and attenuation. Performance test must be below the total return loss budget for the cable connectors/balun. Provide comprehensive optical time domain reflectometry (OTDR) testing for all fibre runs. Include a hard copy chart recording with the test documentation.
- 1.1.6. Cable Test Result Documentation
- 1.1.6.1. Record the test result information for each link in the memory of the field tester upon completion of the test.
- 1.1.6.2. The tester must transfer saved test result records into a Windows™-based database utility that allows for the maintenance, review and archiving of these test records. Provide a guarantee that the measurement results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time.
- 1.1.6.3. Provide a PDF copy of the test results that lists all the links that have been tested with the following summary information:
- 1.1.6.3.1. The identification of the link in accordance with the naming convention defined in the overall system documentation,
- 1.1.6.3.2. The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst case margin (margin is defined as the difference between the measured value and the test limit value),
- 1.1.6.3.3. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number, and
- 1.1.6.3.4. The date and time the test results were saved in the memory of the tester.
- 1.1.6.4. Provide general information in the electronic data base containing the test result information for each link:
- 1.1.6.4.1. The identification of the Owner site as specified by the end-user,
- 1.1.6.4.2. The overall Pass/Fail evaluation of the link-under-test,
- 1.1.6.4.3. The name of the Standard selected to execute the stored test results,
- 1.1.6.4.4. The cable type and the value of the 'index of refraction' used for length calculations,
- 1.1.6.4.5. The date and time the test results were saved in the memory of the tester,
- 1.1.6.4.6. The brand name, model and serial number of the tester, and
- 1.1.6.4.7. The revision of the tester software and the revision of the test Standards database in the tester.
- 1.1.6.5. Provide detailed test results data in the electronic database and PDF for each tested Copper Cable including:
- 1.1.6.5.1. The identification of the link in accordance with the naming convention defined in the overall system documentation,
- 1.1.6.5.2. The cable type and the value of NVP used for length calculations,
- 1.1.6.5.3. The identification of the tester interface, and

- 1.1.6.5.4. The test results information must contain information on each of the required test parameters that are listed in this document.
- 1.1.6.6. Provide the detailed test result data in the electronic database and PDF for each tested Optical Fibre Cable including:
 - 1.1.6.6.1. The identification of the link/fibre in accordance with the naming convention defined in the overall system documentation,
 - 1.1.6.6.2. The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength and the margin (difference between the measured attenuation and the test limit value), and
 - 1.1.6.6.3. The link length for each optical fibre for which the test limit was calculated based on the formulas in this document.
- 1.1.7. Coaxial Cable Testing
 - 1.1.7.1. Sweep test all horizontal CATV Coaxial cables to industry standards using a Time Domain Reflectometer (TDR).
 - 1.1.7.2. Sweep test all horizontal CATV Coaxial cables after installation for opens, shorts, and kinks. Replace damaged cables by installing a new cable. Indicate on the floor plans the actual length of each cable section as installed.
 - 1.1.7.3. Provide a soft copy of cable test result for each CATV cable. Cable test results shall identify cable numbers and associated test results.

PART 2 PRODUCTS

2.1. APPROVED MANUFACTURERS

- 2.1.1. Copper Testers
 - 2.1.1.1. HP/Agilent,
 - 2.1.1.2. OMNI Scanner, or
 - 2.1.1.3. Fluke DSP-4000.
- 2.1.2. Fibre Testers
 - 2.1.2.1. EXFO,
 - 2.1.2.2. Fluke OptiFiber® Pro OTDR, or
 - 2.1.2.3. Fotec.

2.2. OPTICAL FIBRE TESTING

- 2.2.1. Provide 850nm and 1300nm \pm 20nm wavelength LED light sources.
- 2.2.2. Spectral width of sources shall be \pm 50nm for 850nm wavelengths and \pm 140nm for 1300nm wavelengths.
- 2.2.3. Provide 1300nm and 1500nm \pm 20nm wavelength Laser light sources.
- 2.2.4. Output stability \pm 0.40 dB from 0 to 50oC. Long term stability shall be \pm 0.10 dB at 25oC.

2.3. WARRANTY AND CERTIFICATION

- 2.3.1. Provide to Owner, one system certification at the end of the project.

PART 3 EXECUTION

3.1. WARRANTY AND CERTIFICATION REQUIREMENTS

- 3.1.1. Submit the Structured Cabling Solution certification and the user manual.
- 3.1.2. Provide letter(s) of Certification within two weeks of the date of substantial performance of the contract of the project to the Telecommunications Engineer's Representative. This document will include the following:
 - 3.1.2.1. Verification of the performance of the installed system,
 - 3.1.2.2. Identification of the installation by location and project number, and
 - 3.1.2.3. A copy of the Warranty.
- 3.1.3. Within 7 days of the award of contract, submit copies of the Structured Cabling Solution certification request for Certification form complete with certification number(s) for the project. Provide a copy of the form with Specification submission.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Equipment Locations
 - 1.1.1.1. Devices, Racks, Cabinets, Brackets and Backboards may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3.05m (10'-0") without adjustment to the Contract price.
- 1.1.2. Telecommunication Racks and Cabinets
 - 1.1.2.1. Provide all wall mount brackets, racks, cabinets and components as indicated in this document and on the Contract drawings.
 - 1.1.2.2. Provide all racks, cabinets, wall mount brackets and components from the same manufacturer and identical style shall be used throughout the project, unless specifically noted in this section.
 - 1.1.2.3. All racks, cabinets, wall mount brackets and components shall meet or exceed requirements as defined by ANSI/EIA-310-E, Cabinets, Racks, Panels and Associated Equipment.
 - 1.1.2.4. All racks, cabinets, wall mount brackets and components required for this project will be reflected on Telecommunications Room Layout & Rack Elevation Detail drawings (If required).
 - 1.1.2.5. At a minimum, provide one (1) new 2U horizontal cable management panel for each new patch panel installed, when no rack elevation drawing is provided. Quantities shown on rack elevation drawing(s) shall supersede this requirement.
 - 1.1.2.6. In all cases wall mount brackets, racks, cabinets and components shall be powder-coated black.
- 1.1.3. Approved Manufacturers:
 - 1.1.3.1. APC by Schneider Electric,
 - 1.1.3.2. Chatsworth Products Canada
 - 1.1.3.3. Belden Incorporated,
 - 1.1.3.4. D.L. Custom,
 - 1.1.3.5. Hammond Manufacturing Company Limited, or
 - 1.1.3.6. International ElectronMetal,
- 1.1.4. Cabling
 - 1.1.4.1. Reference General requirements and the Execution requirements as applicable under Sections 27 13 23.00 TELECOMMUNICATIONS OPTICAL FIBRE BACKBONE CABLING, 27 15 00.19 DATA TELECOMMUNICATIONS HORIZONTAL CABLING.

PART 2 PRODUCTS

2.1. FLOOR MOUNT TELECOMMUNICATIONS RACKS

- 2.1.1. Free standing, 482 mm (19") rack, welded frame constructed of minimum 11 GA (0.120") steel with anchor holes in base.
- 2.1.2. Racks shall have a minimum of 45U standard EIA vertical rack positions with permanently marked U-spacing identification.
- 2.1.3. Mounting holes as per EIA-310-E, size 10-32 tapped double sided.

- 2.1.4. Secured all equipment racks to the floor with properly sized hardware. Install rack on top of the finished floor in all Telecommunications Spaces.
- 2.1.5. Racks shall be complete with one (1) dual bolt ground lug mounting position.
- 2.1.6. Utilize proper fasteners for the vertical cable managers, power bars and all accessories as per the manufacturer's recommendations.

2.2. TELECOMMUNICATIONS RACK & CABINET COMPONENTS

- 2.2.1. Vertical Cable Managers
 - 2.2.1.1. Constructed of minimum 16 GA (0.060") steel with stiffeners riveted/welded inside for additional strength.
 - 2.2.1.2. Management panels shall have a hinged door with nonmagnetic closing mechanism. A fully shielded magnetic closing mechanism shall also be accepted.
 - 2.2.1.3. Openings for cable routing shall have grommets to ensure smooth transition of the cables.
 - 2.2.1.4. Management panels shall have lancets along the back of the cable manager to allow for the fastening of the cable(s) to the outside of the manager itself.
- 2.2.2. Horizontal Cable Management Panel
 - 2.2.2.1. Welded construction, fabricated of a minimum of 16 GA (0.060") steel & shall be a minimum of 2U and 76mm (3")D.
 - 2.2.2.2. Panel shall have hinged cover with nonmagnetic closing mechanism. A fully shielded magnetic closing mechanism shall also be accepted.
 - 2.2.2.3. Openings for cable routing shall have grommets to ensure smooth transition of the cables.
- 2.2.3. Shielded Cord Vertical Power Bar Edit this section to suit your project requirements.
 - 2.2.3.1. Fabricated from 18 GA (0.048") steel & mountable into 19" EIA cabinet frames or network racks.
 - 2.2.3.2. Each power bar shall have a NEMA L5-30 input plug that comes with a minimum of 3m 10'(ft) cord and the following output receptacles:
 - 2.2.3.2.1. 12 NEMA 5-20
 - 2.2.3.3. Shielded Cord features a 300V capacity, 100% coverage aluminum foil - polyester tape shield, 7x28 AWG tinned copper drain wire (20 AWG), and a durable PVC outer coating.
 - 2.2.3.4. The power bar(s) shall be UL/ULC listed and must meet UL/ULC 1363 and 1449 requirements.
 - 2.2.3.5. Features breaker protection with reset button, three-stage surge protection, fused and non-switched with illuminated power switch showing power "ON".

PART 3 EXECUTION

3.1. TELECOMMUNICATIONS WALL MOUNT BRACKETS, RACKS, CABINETS AND COMPONENTS

- 3.1.1. Properly secure the racks on top of the finished floor and wall. Ground all racks and cabinets in accordance with the parameters within this specification document.
- 3.1.2. Refer to detail drawings for location(s) of Telecommunications wall mount brackets, racks and cabinets.
- 3.1.3. Provide all Telecommunications rack and cabinet components as per the detail drawings. Provide (including levelling and ganging) all racks, cabinets and their components for a complete functioning system.

3.1.4. Secure all wall mounted equipment (i.e. rotating rack & wall mount cabinet) backboards.

3.2. TELECOMMUNICATIONS RACK & CABINET COMPONENTS

3.2.1. Vertical Cable Managers

3.2.1.1. Install two (2) vertical cable managers for each floor/wall mount rack, except where racks are ganged together.

3.2.1.2. Where racks are ganged together, provide one (1) vertical cable manager between racks.

3.2.2. Horizontal Cable Management Panel

3.2.2.1. Install one horizontal cable manager per rack plus an additional one for every patch panel and every network switch when no rack elevation is provided, otherwise quantities on rack elevation drawing supersede this requirement. Assume 48 port switches, one port for every horizontal cable installed.

3.2.3. Shielded Cord Vertical Power Bar

3.2.3.1. Unless noted elsewhere on an elevated drawing, provide a minimum of one power bar to each rack/cabinet and mount on the rear right side of the rack with cord end located at the top of the rack/cabinet.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS.

1.2. OPTICAL FIBRE ENCLOSURE

- 1.2.1. The Patch Panel shall support the appropriate applications, and facilitate cross connection and inter-connection using Modular Patch Cords.

PART 2 PRODUCTS

2.1. COPPER PATCH PANELS

- 2.1.1. The Patch Panel shall support the appropriate applications, and facilitate cross connection and inter-connection using Modular Patch Cords.
- 2.1.2. 482 mm (19") rack mountable MDVO or High Density style 1U 24-port or 2U 48 Port Patch Panel. Refer to Rack Elevation Detail(s) for correct style.
- 2.1.3. Minimum 50 microns of hard gold over nickel or copper on outlet contact wires.
- 2.1.4. Patch Panels shall be suitable for rack mounting and shall incorporate integral labeling spaces for port identification. Provide blank labeling strips.
- 2.1.5. Colour: Black

2.2. OPTICAL FIBRE ENCLOSURE

- 2.2.1. The Optical Fibre Patch Panel Tray shall be compatible with standard 19" Racks, must be serviceable from the front by allowing the Fibre Patch Panel to slide or pivot away from the Rack. Mount the panel as indicated on Detail Drawings.
- 2.2.2. Performance shall meet all requirements of ANSI/TIA-568.3 Section 5 – Connecting Hardware.
- 2.2.3. The Fibre Optic Patch Panel(s) shall:
- 2.2.3.1. Be sized to accommodate the termination of all Fibre strands at each cable termination point,
- 2.2.3.2. Be capable of terminating tight buffered and loose tube cable and accept all popular connector types, and
- 2.2.3.3. Have a slide out shelf or swing out drawer for access to the Fibres.
- 2.2.4. An appropriately sized splice tray shall be included as required.
- 2.2.5. The Fibre Optic Patch Panel shall provide for bend radius control and strain relief to accommodate the Fibre Optic Cables.

2.3. OPTICAL FIBRE ADAPTER STRIPS AND CONNECTORS

- 2.3.1. The Optical Fibre Adapter Strips shall:
- 2.3.1.1. Be colour coded to identify performance grade:
- 2.3.1.1.1. OM3 / OM4 – Aqua,
- 2.3.1.1.2. OS2 – Blue, and
- 2.3.1.1.3. OS2 APC – Green;
- 2.3.1.2. Have either phosphor bronze or zirconia ceramic sleeves,

- 2.3.1.3. Accommodate either multimode or single mode optical fibre,
- 2.3.1.4. Be pre-loaded with 6 adapters (single density),
- 2.3.1.5. Be compatible with LC connectors,
- 2.3.1.6. Have an insertion loss of 0.2dB for multimode sleeves and 0.15 dB for single mode sleeves,
- 2.3.1.7. Have a durability of 1000 matings, and
- 2.3.1.8. Have a tensile strength of 50-lbs. (220 N), <0.2 dB change.

PART 3 EXECUTION

3.1. PATCH PANELS

- 3.1.1. Provide Patch Panels in each rack location in sufficient quantities to terminate all horizontal cables specified with no less than 6 spare ports per Patch Panel to be left vacant for future use.

3.2. OPTICAL FIBRE ENCLOSURE

- 3.2.1. Provide all necessary accessories for a complete Fibre enclosure for all strands of Fibre, including but not limited to; clear cover plates, mounting brackets and hardware, duplex fibre bulkheads (adapter sleeves-plates/couplers), fibre connectors and fibre cable management. The Telecommunications Contractor is responsible for supplying blank mounting plates for all unused openings.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in the Contract Documents. Use pathways installed by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangers.
- 1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.
- 1.1.3. Install backbone cables in accordance with manufacturer's specifications ensuring that proper installation techniques are used and that the cable's maximum pull-force and maximum bend radii specifications are adhered to.
- 1.1.4. Backbone cable/cable bundles shall be secured properly when fastened to backboards or termination cabinets/racks.
- 1.1.5. Fibre optic cables shall be completely protected with corrugated inner duct for the entire length of the cable run. Refer to section 27 05 28.00 for situations where inner duct is not required.
- 1.1.6. Verify all backbone cable run lengths on site prior to ordering.
- 1.1.7. Fibre Backbone cabling requirements for this project will be reflected on Telecommunications backbone riser diagram(s).

1.2. CABLE ROUTING

- 1.2.1. Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Telecommunications Engineer's Representative prior to installation.
- 1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Telecommunications Engineer's Representative and documented on as-built drawings.

1.3. BACKBONE LOCATIONS

- 1.3.1. Backbone cabling locations may be relocated, prior to installation, from the location shown on the Drawings, to a maximum distance of 3.05m (10'-0") without adjustment to the Contract price.

1.4. FIBRE OPTIC CABLES

- 1.4.1. All fibre optic cables shall meet or exceed the latest requirements of TIA-568.3, latest version.
- 1.4.2. The cables shall have:
 - 1.4.2.1. Sequential length markings printed on the cable jacket,
 - 1.4.2.2. A Crush Resistance of 2000 N/cm as per TIA-455-41, latest edition,
 - 1.4.2.3. An Impact Resistance of 1000 impacts with 1.6 N-m as per TIA-455-25, latest edition, and
 - 1.4.2.4. A minimum Flexure rating of 2000 cycles as per TIA-455-104, latest edition.

1.5. DISTRIBUTION / BREAKOUT SERIES CABLE

- 1.5.1. Distribution / Breakout Series cable shall have 900-micron tight buffered fibre individually placed in a 2mm coded sub-unit with aramid strength members.

1.5.2. The cable shall have a minimum bending radius of 15x cable diameter and 10x cable diameter (long term no-load and short term load, respectively).

1.5.3. The cable shall be fully dielectric with no metallic elements in the cable.

1.6. CABLE RATINGS

1.6.1. The non-plenum/plenum cable shall be ETL or UL/ULC Listed and CSA Certified as type ONFR / ONFP, in accordance with the Binational Standard for Communications Cable, UL444/C22.2 No. 214-latest version.

1.7. CABLE CONNECTORS AND CLAMPS

1.7.1. All connectors and clamps must be listed and rated for outside use and properly sized to accept the wire and strand size involved.

PART 2 PRODUCTS

2.1. SINGLEMODE (DISTRIBUTION SERIES) OPTICAL FIBRE CABLE

2.1.1. Cable to be formed into groups of 6 or 12 fibres each. Groups and individual fibres to be identified in accordance with current standards.

2.1.2. Groups assembled to form a single compact core and covered by a protective sheath.

2.1.3. Sheath consisting of an overall jacket and one or more layers of dielectric material applied over the core.

2.1.4. All tests to be performed at 23°C ± 5°C.

2.1.5. Fibre cables to be tight buffer distribution type design with an OFNP Plenum / OFNR Non-Plenum rated jacket as required by local codes. The cable shall be CSA certified and stamped accordingly.

2.2. SYSTEM PERFORMANCE

2.2.1. Singlemode Fibre Optic Backbone System

2.2.1.1. All components of the Fibre Optic Backbone channel shall meet the minimum performance characteristics of: OS2 – 8/125um to 9/125um with minimum bandwidth stipulated by the cable manufacturer at 1310nm and 1550nm. Cable and patch cord components shall be Zero Water Peak design allowing use of entire spectrum from 1260nm to 1620nm.

2.3. CERTIFICATION

2.3.1. Acceptable manufacturers for the complete Structure Cabling Solution:

2.3.2. Manufacturer / Contractor Certification

2.3.3. Belden Incorporated / CSV – Certified Systems Vendor

2.3.4. CommScope Incorporated (Systimax) CPP / CommScope Partner Pro

2.3.5. Corning Incorporated / NPI – Network of Preferred Installers

2.4. VERTICAL CABLE SUPPORT

2.4.1. Closed mesh type, galvanized finish metal vertical cable support system

2.4.2. Double eye attachment system

2.4.3. Size support(s) to accommodate size & quantity of vertical cabling.

2.4.4. Approved Products:

- 2.4.4.1. Pass & Seymour Flexcor Wire Mesh Grip system, and
- 2.4.4.2. Kellem Closed Mesh Support Grip system.

2.5. CABLE LUBRICANT

- 2.5.1. The use of pulling lubricants of any kind is strictly prohibited.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Replace damaged cables without any additional compensation.

3.2. BACKBONE CABLE DISTRIBUTION

- 3.2.1. Provide appropriately sized fibre optic cable(s) as depicted on the Telecommunications Riser Diagram(s). Refer to backboard and rack elevation Drawings for mounting type & locations. Coordinate mounting location with Owner prior to termination for terminations made in an existing Telecommunications Room.
- 3.2.2. Provide appropriate & size of optical fibre cable(s) as depicted on the Telecommunications Riser Diagram(s). At each cable end, terminate cable in a new fibre patch panel. See rack elevations for details. Coordinate mounting location with Owner prior to termination for terminations to be made in an existing Telecommunications room.
- 3.2.3. Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- 3.2.4. Install and terminate all cables and components in accordance with applicable Codes, Standards and Regulations.
- 3.2.5. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available cable supports shall be used in the ceiling space to coil slack.
- 3.2.6. Neatly bundle all cables using Velcro straps. Separate Data and Fibre cables into separate distinct bundles for identification purposes.
- 3.2.7. Pull all cables in a continuous run. Do not splice any cables for any reason, unless prior consent is given by the Engineer's Representative.
- 3.2.8. Provide vertical cable support system(s) for cabling where vertical route length exceeds maximum distance that cable is rated to be self-supporting. Install vertical cable support system(s) as per manufacturer's guidelines.
- 3.2.9. Ground all components to manufacturer's specifications and standard practices.
- 3.2.10. Terminate all strands of each cable at both ends, including all spares.
- 3.2.11. Test, label and document as specified in this document.

3.3. OVERHEAD BACKBONE CABLE INSTALLATION

- 3.3.1. Install all cables identified as Overhead via the indoor and outdoor pathways as provided by the Electrical contractor. The Electrical Contractor will install all indoor conduit and outdoor overhead poles complete with a messenger wire.

- 3.3.2. Install cables so that they loosely lash around the messenger wire and/or are supported by suspension clamps over the entire length. Every cable shall be individually and loosely lashed to the messenger wire to allow for expansion and contraction of the cables and messenger. Under no circumstance shall one of the cables be used to support other cables.
- 3.3.3. Minimise excess stress on the Optical fibre cabling.
- 3.3.4. Installation of cables shall be with the use of a cable chute to pay out the cable as it is installed. Securely fasten the cable chute to the pole using a pole attachment and adapter.
- 3.3.5. Align the payout reel linearly with the pole and the direction of the cable travel. Locate the pay out reel a distance of twice the height of the messenger to avoid excess tension on the Cable as it is installed.
- 3.3.6. Use cable blocks or rollers at a distance of every 25 feet to support the cable or cables between poles.
- 3.3.7. Use a cable puller and adjustable pressure brake assembly as necessary to prevent slack from pulling back onto the strand line when tension is removed from the pull line.
- 3.3.8. Use spacers and bands to separate the cable from the messenger wire and hardware attached to the wire. The band shall be used to hold the cable and spacers next to the wire, it should not be drawn too tightly on the cable, and it should only support the cable.
- 3.3.9. Install one flat bottom expansion loop for every pole. Where distances between poles is greater than 200 feet, install two flat bottom expansion loops. Every cable installed should have a flat bottom expansion loop at every pole. Locate expansion loop directly at the pole. After the loop is formed, the cable is lashed to the spacer and the lashing wire shall be secured on one side. The lashing wire should be wrapped around the Wire three times and then tied off at the lashing wire clamp.
- 3.3.10. The Telecommunications Contractor will be required to make any necessary penetrations to building walls to pass the cables through the wall. Penetration size shall be minimised. Seal all penetrations with outdoor silicone to ensure no moisture or water ingress into the buildings. Silicone must be resistant to degradation from temperature cycles and UV exposure.
- 3.3.11. Use an approved cable guide and lashing device to secure the cable to the messenger strand.
- 3.3.12. Clamp cable to the exterior of the building with approved galvanized steel cable clamps.

3.4. CABLE BONDING

- 3.4.1. Refer to Section 27 05 26.00 GROUNDING AND BONDING FOR TELECOMMUNICATIONS SYSTEMS.

3.5. CABLE LUBRICANT

- 3.5.1. The use of pulling lubricants of any kind is strictly prohibited.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in the Contract Documents. The Telecommunications Contractor shall use pathways by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangars.
- 1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.
- 1.1.3. Ensure ANSI/EIA/TIA-568.2-D installation practices are followed. Install horizontal cables in accordance with manufacturer's specifications ensuring that proper installation techniques are adhered to.
- 1.1.4. Terminate all pairs of cable at each cable end.
- 1.1.5. Inform the Telecommunications Engineer's Representative immediately of any horizontal cable runs exceeding 90 m 295'(ft). Minimum horizontal cable run (if required) shall not be less than that specified in manufacturer's specifications.
- 1.1.6. The Telecommunications Engineer's Representative shall determine the quality of workmanship during installation. Cables that have not been properly installed will be reinstalled by the Telecommunications Contractor at no additional expense to the contract.

1.2. CABLE ROUTING

- 1.2.1. Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Telecommunications Engineer's Representative prior to installation.
- 1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Telecommunications Engineer's Representative and documented on as-built drawings.

PART 2 PRODUCTS

2.1. 4-PAIR HORIZONTAL COPPER CABLE

- 2.1.1. Four pair, twisted pair cable consisting of #22-26 AWG solid conductors, formed into four individually twisted pairs and enclosed in an appropriately rated thermoplastic jacket as required by local codes. All individual conductors to be insulated with fluorinated ethylene propylene (FEP).
- 2.1.2. All cabling must be CSA certified and stamped accordingly
- 2.1.3. Cable to withstand a bend radius of 25.4 mm (1") at a temperature of -20 deg. C \pm 1 deg. C without jacket or insulation cracking.

- 2.1.4. All cables shall have an outer jacket colour as identified below:

| Cable Designation | Colour |
|-----------------------|--------|
| Data | Blue |
| Wireless Access Point | Blue |
| AV Data | Blue |
| Security | Blue |

PART 3 EXECUTION

3.1. GENERAL CONDITIONS

- 3.1.1. Remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5 to 6a cables and 25 mm (1") for Category 3 cables. Any specific manufacturer's installation guidelines shall supersede the above.
- 3.1.2. Do not splice any cables for any reason, unless prior consent is given by the Engineer's Representative.

3.2. INSTALLATION

- 3.2.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Replace damaged cables without any additional compensation.

3.3. HORIZONTAL CABLE DISTRIBUTION

- 3.3.1. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available ceiling space and cable supports may also be used to coil slack. For completely enclosed zone conduit distribution systems, provide 3.05 m (10'-0") of slack at the Telecommunications room end only.
- 3.3.2. Follow proper installation and termination practices for UTP copper and Optical Fibre cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius. For Optical Fibre cables maintain a minimum of ten (10) times the cable diameter or 30mm (1.2") whichever is larger for a bend radius.
- 3.3.3. Bundle all horizontal cables on the Telecommunications Racks using Velcro straps. Separate Data cables into separate distinct bundles for identification purposes where applicable.
- 3.3.4. Strap bundles in Telecommunications rooms, at a maximum of 203 mm 8"(in) separation. Bundles shall contain no more than fifty (50) cables to eliminate any excessive stress on the cable jackets.
- 3.3.5. When bundling cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.
- 3.3.6. All exposed cabling at the workstation between wall/floor-input point locations and systems furniture is to be wrapped with black split loom tubing, size and length as required to suit.
- 3.3.7. Route/install Telecommunications cabling in systems furniture, lab casework furniture & mill work as denoted on floor plans.
- 3.3.8. Provide Data cables to each outlet indicated on the drawings. The Telecommunications Contractor shall refer to the legends on the drawing to determine the number of cables to each outlet location.

- 3.3.9. Terminate test and label each cable in accordance to the parameters stated in this specification document.
- 3.3.10. Ground all cables and components to manufacturer's specifications and standard practices.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in the Contract Documents. Use pathways provided by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangers.
- 1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage and connectorization.
- 1.1.3. Terminate all pairs of cable at each cable end.
- 1.1.4. Cable lengths within boxes shall be adequate to permit installation and removal of device for inspection without damage to cable or connections (minimum of 6").
- 1.1.5. Cable bends shall not be greater than that recommended by the manufacturer of the cable.
- 1.1.6. The Telecommunications Engineer's Representative shall determine the quality of workmanship during installation. Cables that have not been properly installed will be reinstalled by the Telecommunications Contractor at no additional expense to the contract.

1.2. CABLE ROUTING

- 1.2.1. Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically on the Drawings run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Telecommunications Engineer's Representative prior to installation.
- 1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on Drawings must be approved by the Telecommunications Engineer's Representative and documented on as-built Drawings.

PART 2 PRODUCTS

- 2.1.1. Horizontal Catv Copper Cable
- 2.1.2. All horizontal CATV cabling shall be RG6.
- 2.1.3. All cables shall have an outer jacket colour as identified below:

| Cable Designation | Colour |
|-------------------|--------|
| CATV | White |

- 2.1.4. Approved Products
- 2.1.5. Commscope F-6 Series (Commscope Part # 4100903/10) coaxial cable
- 2.1.6. Belden, or
- 2.1.7. Equivalent.

PART 3 EXECUTION

3.1. GENERAL CONDITIONS

- 3.1.1. When terminating coaxial cables, use only manufacturer recommended coaxial cable stripping tool to remove only enough cable jacket to perform termination.

- 3.1.2. Utilize only manufacturer recommended compression style tool to perform installation of Snap-N-Seal "F" connectors.

3.2. INSTALLATION

- 3.2.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Replace damaged cables without any additional compensation.

3.3. HORIZONTAL COAXIAL CABLE DISTRIBUTION

- 3.3.1. Provide coaxial cables to each outlet indicated on the Drawings. Refer to the legends on the drawing to determine the number of cables to each outlet location.
- 3.3.2. Neatly bundle cables using Velcro straps.
- 3.3.3. Follow proper installation and termination practices for coaxial cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius.
- 3.3.4. When bundling coaxial cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and cable geometry.
- 3.3.5. Terminate test and label each cable in accordance to the parameters stated in this specification document
- 3.3.6. Verify location of coaxial backbone cable within termination room. Provide adequate cable slack for termination and to reach backbone cable tap box.
- 3.3.7. Ground all cables and components to manufacturer's specifications and standard practices.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS.

1.2. OUTLET LOCATIONS

- 1.2.1. Horizontal Cable outlets may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3.05m (10'-0") without adjustment to the Contract price.

1.3. OUTLET COVER PLATES

- 1.3.1. When Electrical and Telecommunications receptacles are ganged together, cover plates shall be supplied and installed by the Electrical Contractor, unless otherwise noted. Where Telecommunications receptacles are stand alone or separate from Electrical receptacles, cover plates shall be supplied and installed by the Telecommunications Contractor.

PART 2 PRODUCTS

2.1. EIGHT-POSITION MODULAR CONNECTORS

- 2.1.1. The eight-position modular connectors must be matched appropriately with the cables to ensure that end to end Manufacturer Warranties will be applicable.
- 2.1.2. Eight-position modular style outlet with insulation displacement contacts for termination of all eight conductors.
- 2.1.3. Outlets shall be suitable for installation in faceplates at work station locations, surface raceway, or surface mount boxes.
- 2.1.4. All Data and Voice modules shall have the following minimum performance parameters:
- 2.1.4.1. Modular Jack Current rating: 1.5 amperes maximum
- 2.1.4.2. Modular Jack Durability: 1,000 mating cycles
- 2.1.4.3. Modular Jack Contact Pressure: 100 grams, minimum per contact
- 2.1.4.4. Dielectric Voltage Strength: 1,000 V RMS at 60 Hz for 1 minute
- 2.1.4.5. Insulation Resistance: 200 MΩ minimum
- 2.1.4.6. Contact Resistance: 1 M Ω per contact
- 2.1.5. All Horizontal 4-pair cables shall be terminated with the jack colours as described below. Where the specified Copper Patch Panels are modular, the same jack colours shall be used at both ends of each cable:

| Function | Colour | Quantity |
|--------------------|--------|-----------------|
| Data | Blue | As per Drawing |
| WAP (Workstation) | White | As per Drawing |
| WAP (Telecom Room) | Orange | As per Drawing |
| AV Data | Green | As per Drawing |
| Security | Grey | As per Drawings |

- 2.1.6. Outlets shall be suitable for installation in faceplates at workstation locations, surface raceway, or surface mount boxes.

2.2. OPTICAL FIBRE ADAPTER STRIPS AND CONNECTORS

- 2.2.1. The Optical Fire Adapter Strips shall:
- 2.2.1.1. Have either phosphor bronze or zirconia ceramic sleeves.
 - 2.2.1.2. Accommodate either multimode or single mode optical fibre.
 - 2.2.1.3. Be pre-loaded with 6 adapters (single density).
 - 2.2.1.4. Be compatible with FC, LC, MT-RJ, SC, SC Duplex, or ST connectors.
 - 2.2.1.5. Have an insertion loss of 0.2db for multimode sleeves and 0.15 db for single mode sleeves.
 - 2.2.1.6. Have a durability of 1000 matings.
 - 2.2.1.7. Have a tensile strength of 50-lbs. (220 n), <0.2 db change.
- 2.2.2. Singlemode Optical Fibre
- 2.2.2.1. The Single mode Optical Fibre Patch Cord Connector shall be field installable, either SPC or UPC polish-type with ceramic ferrule with a typical insertion loss of 0.15 dB (guaranteed 0.5 dB) and a reflectance of -40 dB for SPC and -55 dB for UPC.
 - 2.2.2.2. All field installable Single mode Fibre Optic Connectors for this project shall be LC.

2.3. CATV CABLE CONNECTORS

- 2.3.1. All CATV cable connectors shall be Snap-N-Seal "F" Connectors.
- 2.3.2. The Snap-N-Seal "F" Connectors shall have the following minimum performance parameters:
 - 2.3.2.1. Permanently stamped part number and colour-coded sleeves for easy identification before and after installation.
 - 2.3.2.2. Quad sealed system prevents moisture from migrating into the connection.
 - 2.3.2.3. 360° radial compression provides superior RF integrity (-95dB typical, 60% bonded foil cable).
 - 2.3.2.4. 1/4"x 1/4" cable preparation.
 - 2.3.2.5. Connector to cable retention 40 lbs minimum.
 - 2.3.2.6. Minimum return loss performance of -30dB to 1GHz.
 - 2.3.2.7. Manufactured of high quality 360 brass, cadmium plated with yellow chromate coating for maximum corrosion resistance. Plastic and O-ring providing a reliable environmentally sealed connector.
- 2.3.3. Terminate all CATV cable drops in Telecom Rooms on Snap-N-Seal "F" connectors. The Telecommunications Contractor shall coordinate with the CATV service provider, the exact termination locations and amount of slack to be left on each cable.

2.4. WORKSTATION OUTLETS

- 2.4.1. Modular Furniture Faceplate
- 2.4.2. Use 3 or 4-port modular furniture faceplate adapters for furniture outlets that have modular furniture knockouts. Equip each outlet with the appropriate UTP modules as indicated in this section.
- 2.4.3. Use recessed blanks for all unused ports. Blanks must match the frame colour.

- 2.4.4. Verify furniture manufacturer prior to ordering.
- 2.4.5. Provide a ½" spacer/adaptor, if required, to ensure faceplate can be properly installed on systems furniture maintaining proper bend radius

2.5. DECORA ADAPTERS

- 2.5.1. UTP Cables
 - 2.5.1.1. Where Telecommunications wall boxes are ganged with electrical outlet boxes, floor or raceway outlets shall utilise 3 or 4-port Decora style adapters/inserts. Equip each outlet with the appropriate UTP modules as indicated in this section.
 - 2.5.1.2. Provide all Telecommunications workstation adapters/inserts for all Telecommunications outlets (ganged or single) when decora style faceplates are utilized. Provide decora style faceplates for all Telecommunications wall box locations where not ganged with Electrical.
- 2.5.2. CATV
 - 2.5.2.1. Use 2-port Decora style adapters/inserts for Telecommunications boxes that are ganged with electrical boxes, wall, floor or raceway outlets. Equip each outlet with the appropriate "F" Female/Female bullhead modules.
 - 2.5.2.2. Coordinate colour of Decora style adapters/inserts with architect/interior designer.

2.6. BLANK INSERTS

- 2.6.1. Install Blank Inserts in unused Telecommunications ports. Blank inserts shall match faceplates.

2.7. SURFACE MOUNT BOXES

- 2.7.1. All systems furniture raceways that do not have a modular furniture knockout shall utilise 2- or 4-port surface mount boxes. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

2.8. FLOOR MONUMENT

- 2.8.1. Floor monuments and faceplates shall be provided by Division 26 (Electrical). Refer to Division 26 Specifications and Drawings for further information
- 2.8.2. Telecommunications Contractor shall determine type of module required to suit floor monument (i.e. MDVO, Keystone, etc.)
- 2.8.3. Where applicable, use recessed blanks for all unused ports. Blanks to match faceplate colour.

PART 3 EXECUTION

3.1. GENERAL CONDITIONS

- 3.1.1. When terminating Copper Cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5e/6/6A cables and 25 mm (1") for Category 3 cables.
- 3.1.2. At the workstation end, terminate each 4-pair Horizontal Cable on an appropriately colored 8-position module, located in the specified style faceplate. At the Telecommunications Room end, terminate cables within their respective termination fields. Refer to Detail Drawings for further details.

3.2. WORKSTATION OUTLET ORIENTATION

- 3.2.1. Verify the position of jacks with the Telecommunications Engineer's Representative prior to installation.

3.2.2. Modular Furniture Faceplate

3.2.2.1. The orientation of the Data and Voice modules at the Workstation from the perspective of the user is as indicated below:

| | | | | |
|--------|--------|----|--------|--------|
| Data 1 | Top | | Data 1 | Left |
| Data 2 | Middle | or | Data 2 | Middle |
| Voice | Bottom | | Voice | Right |

3.2.3. Decora Adapters

3.2.3.1. The orientation of the Data and Voice modules at the Workstation from the perspective of the user is as indicated below

| | | | | |
|--------|--------|----|--------|--------|
| Data 1 | Top | | Data 1 | Left |
| Data 2 | Middle | or | Data 2 | Middle |
| Voice | Bottom | | Voice | Right |

3.2.4. Surface Boxes

3.2.4.1. The orientation of the Data and Voice modules at the Workstation from the perspective of the user is as indicated below:

| | | | | |
|---------|--------------|----|---------|--------------|
| Data 1 | Top Left | | Data 1 | Bottom Left |
| Data 2 | Top Right | or | Data 2 | Top Left |
| Voice 1 | Bottom Left | | Voice 1 | Bottom Right |
| Voice 2 | Bottom Right | | Voice 2 | Top Right |

3.3. COVER PLATES AND DECORA STYLE BLANKS

3.3.1. Provide cover plates and decora style blanks to all unused Telecommunications rough-ins.

3.4. BLANK INSERTS

3.4.1. All unused Telecommunications ports must be installed with blank inserts. For copper patch panels, use Black. For workstation outlets match existing/electrical.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS.

1.2. OPTICAL FIBRE PATCH CORDS

- 1.2.1. The type of fibre Patch Cords be consistent with type of fibre backbone.
- 1.2.2. Singlemode Optical Fibre
- 1.2.2.1. Single mode Optical Fibre Patch Cords shall have a maximum attenuation of 0.8 dB/km @ 1310 nm and 0.5 dB/km @ 1550 nm.
- 1.2.2.2. The Single mode Optical Fibre Patch Cord connector shall be either SPC or UPC polish-type with ceramic ferrule with a typical insertion loss of 0.15 dB (guaranteed 0.5 dB) and a reflectance of – 40 dB for SPC and –55 dB for UPC.
- 1.2.3. The Optical Fibre Cord assembly shall be LC construction.

1.3. COPPER PATCH CORDS

- 1.3.1. Connect UTP Patch Cords in the Telecom Room to the active equipment using 8 position 4 pair T568A/B:T568A/B Patch Cords.
- 1.3.2. The Patch Cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the diameter, grade, and manufacturer of the Telecommunications cable that is being Warranted.

PART 2 PRODUCTS

2.1. OPTICAL FIBRE PATCH CORDS AND PIGTAIL ASSEMBLIES

- 2.1.1. Optical fibre Backbone cable strands shall be connected to the active equipment using Fibre Patch Cords. The Fibre Patch Cords shall be OFNR rated and stamped accordingly. Fibre Patch Cords shall be consistent with the grade and manufacturer of the Fibre cable that is being warranted.
- 2.1.2. Provide Fibre Patch Cords for complete connectivity of Fibre Cables. The Owner reserves the right to switch the Fibre Patch Cords to a different configuration at no extra cost, 10 business days prior to delivery.
- 2.1.3. Duplex Fibre Zip Cords quantities and lengths are as follows:
- | Type | Length | End 1 | End 2 | Qty |
|------|--------|-------|-------|----------------|
| SM | 7' | LC | LC | As per Drawing |

2.2. UTP PATCH CORDS AND PIGTAIL ASSEMBLIES

- 2.2.1. All Data Patch Cords shall be connected in the Telecom Room to the Owner supplied active equipment using 8 position 4 pair patch cords.
- 2.2.2. The Patch Cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the diameter grade and manufacturer of the Telecommunications cable that is being warranted.
- 2.2.3. Patch cords shall have stranded copper conductors (where system dictates) and designed to provide a mated-connection performance that exceeds the requirements per ANSI/TIA/EIA-568-D.

2.2.4. Patch cords and pigtail assemblies to be factory assembled and not site prepared, complete with snag less boot.

2.2.5. Patch Cord / Pigtail requirements:

| Designation | Termination | Colour | Length | Location |
|-----------------------|-------------|--------|---------------|---------------|
| Data | RJ45/RJ45 | Blue | 7' (ft) 2.13m | Telecom. Room |
| Data | RJ45/RJ45 | Blue | 7' (ft) 2.13m | Workstation |
| Wireless Access Point | RJ45/RJ45 | Orange | 7' (ft) 2.13m | Telecom. Room |
| Wireless Access Point | RJ45/RJ45 | White | 1' (ft) 0.3m | Workstation |
| AV Data | RJ45/RJ45 | Green | 7' (ft) 2.13m | Telecom. Room |
| AV Data | RJ45/RJ45 | Green | 3' (ft) 0.91m | Workstation |
| Security | RJ45/RJ45 | Grey | 7' (ft) 2.13m | Telecom. Room |
| Security | RJ45/RJ45 | Grey | 1' (ft) 0.3m | Workstation |

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Telecommunications Contractor without any additional compensation shall replace damaged cables.

3.2. OPTICAL FIBRE PATCH CORDS

3.2.1. Assume all strands of optical fibre cable(s) shall be patched.

3.3. UTP COPPER PATCH CORDS

3.3.1. At Telecommunications Room end, provide one (1) patch cord for each data cable installed. Communications Contractor shall be responsible for patching all data cabling. A patching schedule shall be provided to the Communications Contractor prior to installation. Patch Cords provided must maintain the Channel Solution.

3.3.2. At workstation end, provide one (1) patch cord for each data cable installed. Patch Cords supplied and installed must maintain the Channel Solution.

END OF SECTION



The University of Toronto

Communications Infrastructure Specifications, Standards and Practices

January 2025

Prepared by: Enterprise Infrastructure Solutions

Information Technology Services University of Toronto

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The following revisions have been incorporated since the previous release (April 2019) of this document have been made.

- Telecommunication/TC/TR Room terminology has been changed to “LAN room” where applicable.
- UTP cabling now recommends CAT6A UTP cables instead of CAT6 throughout, exceptions listed in Section 17 and Section 18.
- Painting of cables in LAN rooms is now prohibited. (Section 9.15)
- Cables in pull boxes shall be labelled appropriately. (Section 23.12)
- 28 AWG UTP patch cables are recommended for use in LAN rooms (Section 9.10)
- Glossary of Terms and Abbreviations

Updates February-2024

- LAN room equipment restrictions and exclusions clause (Section 9.0 top)
- LAN room automatic lights shut off (Section 9.6)
- Equipment racks outlet surge protectors (Section 9.11)
- LAN rooms mandatory emergency power for life-critical systems (Section 9.17)
- Outdoor Wireless Access Points (WAP) requirements (Sections 16.8, 16.9)
- 25-year parts warranty from the manufacturer (Sections 22.3, 22.4)
- Naming convention for Wireless Access Points and Cable (Sections 23.16, 23.17)
- Appendix A outdoor WAP installation and grounding requirements

Updates January 2025

- Maximum distance from LAN room to work area and minimum LAN room dimensions (Section 9.1)

| | | | |
|---|-------------------------|-------------|-------------|
| EIS – Specification Standards and Practices | Issue Date: 25-01-15 | By: EIS-ITS | Rev. 2.8 |
|---|-------------------------|-------------|-------------|

1. OVERVIEW

This document details the general requirements and installation practices developed by and in use at the University of Toronto, and should be used as a reference for contractors performing work on the communications infrastructure at the University. All work shall be performed in accordance with this document unless specific instructions overriding these specifications are provided in the Scope of Work section in the Work Order or tender specification specific to the project.

Note that this document includes specifications for horizontal, intra- and inter-building wiring, some of which may not be applicable to the scope of work provided in the project's work order or tender documents.

2. EMERGENCIES

The emergency number is 416 978-2222. If calling from a University phone dial the local (8-2222) only. If the situation requires quick response, dial the 911 service. If 911 is called the University emergency number must also be notified.

Each Project Manager and Property Manager will have their own list of contacts within their group and the contact must be notified immediately after making an emergency call. The contractor is responsible for advising all crew members of the emergency phone number should an emergency arise while on site.

3. GENERAL

Labour

- 3.1 All cabling installations must be performed by licensed unionized (IBEW) electricians. The electricians must follow the latest safety requirements from the Ministry of Labour.
- 3.2 The contractor shall update customer supplied drawings identifying cable routing and new infrastructure installed. In the case where drawings are not available a schematic drawing indicating building names and other reference points will be included. It is the contractor's responsibility to record the distances of the fibre/copper runs on drawings.

- 3.3 It is the contractor's responsibility to ensure that all part numbers identified in the scope and drawings are accurate with the manufacturers. Also, the contractor's responsibility is to ensure all locations and distances identified in this document are accurate. Any deviations must be brought forward for approval.

Applicable Standards, Guidelines and Practices

- 3.4 All work must conform to industry accepted practices, manufacturers' component installation guidelines, the Ontario Building Code, the Canadian Electrical Code, and all applicable standards including, but not limited to:

| <u>Standard</u> | <u>Title</u> |
|------------------------|---|
| ANSI/TIA-568.0-D | Generic Telecommunications Cabling for Customer Premises, Ed. D, 09-2015 |
| ANSI/TIA-568.1-D | Commercial Building Telecommunications Cabling Standard, Ed. D, 09-2015 |
| ANSI/TIA-568-C.2 | Balanced Twisted-Pair Telecommunication Cabling and Components Standard |
| ANSI/TIA-568.3-D | Optical Fiber Cabling and Components Standard, Ed. D, 10-2016 |
| ANSI/TIA-569-D | Telecommunications Pathways and Spaces |
| ANSI/TIA-606-C | Administration Standard for the Telecommunications Infrastructure |
| ANSI/TIA-607-C | Telecommunications Bonding and Grounding (Earthing) for Customer Premises |
| ANSI/TIA-598-C | Optical Fiber Cable Color Coding |
| ANSI/TIA-526-14-C- | Test procedures for installed multimode fiber cable plant |
| ANSI/TIA-526-7-A | Test procedure for installed single mode fiber cable plant |
| ANSI/TIA-604-3 | FOCIS 3 Fiber Optic Connector Interminability Standard |
| ANSI/ICEA S-83-596 | Optical Fibre Premises Distribution Cable |
| ANSI/ICEA S-87-640 | Optical Fibre Outside Plant Communications Cable |
| CSA C22.1 | Canadian Electric Code Part 1 Ontario Regulation 10/02 Ontario Hydro Electrical Safety Code |
| CSA C22.2 No. 232-M | Fiber Optic Cables |
| CSA-C22.2 No. 182.4-M9 | Plugs, Receptacles, and Connectors for Communication Systems |
| CSA-C22.2 No.214-94 | Communications Cables |
| ISO/IEC 11801 | Information technology — Generic cabling for customer premises |

4. WORK AREA AND PROJECT RESTORATION

General

- 4.1 The contractor shall be responsible for cleanup of all facilities and buildings related to the project, during and at completion.
- 4.2 The work site and adjacent areas shall be left in the same condition or cleaner than when starting a shift. This must be done daily.
- 4.3 The contractor shall protect exterior and interior building equipment in the immediate and adjacent work areas.
- 4.4 The contractor shall protect existing building finishes and services not affected by the modifications.

Surface Finishes

- 4.5 The general standard is that existing surfaces must be restored and finished back to the original condition or better. The Project or Property Manager shall determine the appropriate and acceptable finish. Contractors must be aware of the site conditions prior to bidding and account for the appropriate resources necessary for this aspect of the project.
- 4.6 Contractor must be trained for asbestos awareness. When penetrating surfaces where there is vinyl asbestos tile, cut and lift the tile prior to coring. Use the lifted tile to restore finishes where possible.
- 4.7 When penetrating terrazzo or concrete surfaces the restored surface must be finished using the same materials. A terrazzo patch kit must be used to restore surfaces that have been damaged beyond a 1/4-inch circumference of the penetrating structure. A patch area must be created that uses straight cuts at right angles to each other or to adjacent walls.
- 4.8 When penetrating carpeted surfaces, cut or lift the carpet prior to coring. Refit the carpet tight to the penetrating structure.
- 4.9 When penetrating wall or floor slabs both sides must be restored to the existing finish.
- 4.10 When painting surfaces use one primer / sealer coat of paint and two or more finish coats of paint. Block or brick walls are to be thoroughly sealed prior to finishing.
- 4.11 Any holes in surfaces created to secure operating equipment must be fully restored.

- 4.12 Any markings on surfaces such as spray paint or liquid markers must be removed, cleaned, and polished where necessary.
- 4.13 Any over painting of structures on to background surfaces may make it necessary to refinish the background area to match the new structure. It is the responsibility of the contractor to pre- determine this condition or to take care in avoiding the situation.

5. X-RAY AND HOLE CORING

- 5.1 The contractor will supply all vertical and horizontal hole cores. X-ray of proposed core locations must be performed prior to coring. Under no circumstances should X-rays be performed without the prior notification and approval of the Project Manager or Property Manager.
- 5.2 When site conditions do not make it feasible to x-ray the contractor must exercise reasonable judgment to evaluate whether there is a chance that coring will cause the severing of electrical, low voltage or any other services that may be in the structure that is being penetrated. The use of hammer chisels may be necessary in some buildings. A thorough inspection of both sides of the surfaces must be performed. A flux scanner to check for live loaded A.C. is to be used prior to any drilling, coring or chiseling. Where applicable the opening of drop ceilings on the undersides of floors, including fixed surfaces, must be done to expose the breakthrough area. Small diameter pilot holes must be drilled prior to the final coring or chiseling.
- 5.3 A qualified electrician with access to a circuit scanner must be present during coring or chiseling should any services be severed. The campus police must be contacted immediately using the emergency number should services be severed. The Project Manager must be notified of these occurrences immediately also. Depending on the circumstance the contractor may be asked to begin restoration procedures of severed services immediately.
- 5.4 Any penetration of structural beams, columns or supports must be cleared by the Project Manager before proceeding.
- 5.5 Patching and making good of coring is the responsibility of the contractor.

6. KEY ACCESS

Contractors will be required to complete a request form to request access to passage keys, needed to perform the work in the buildings. Typically, these keys can be picked up from the University of Toronto Police at 21 Sussex Avenue at the beginning of a work shift and must be dropped off at the end of the work shift to the same location.

Request form located at: [Request-for-contractor-access-to-LAN-and-data-equipment-rooms.pdf](#)

7. FIRE DETECTION SYSTEMS

The fire detection systems in the University can be set off by dust. When work is being performed in proximity to detectors it is necessary to inform The Project Manager 24 hours prior to the work being performed. The Project Manager will arrange with the University's Fire Marshall to have the local devices de-commissioned prior to the start of work. The contractor to ensure fire alarms are deactivated prior to proceeding with any work.

8. BUILDING ENTRANCE FACILITY (REFER TO FIG. 1)

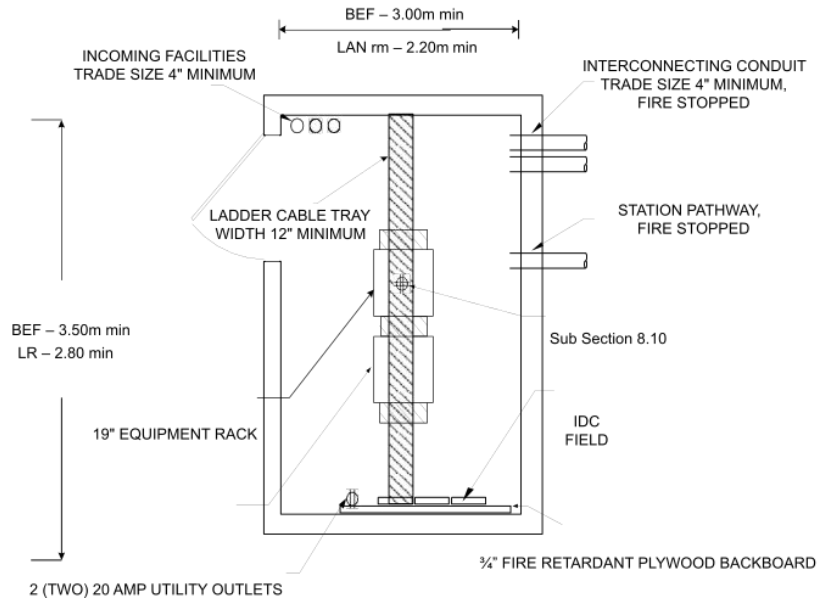
The term Building Entrance Facility (BEF) as employed by the University of Toronto is the location at which the intra-building communications backbone cabling meets the inter-building communications cabling.

- 8.1 Minimum recommended BEF room sizing is 3.50 x 3.00 metres for each 1,000 square metres area served. This is a secure, strategically located room for each University building with the following attributes:
- 8.2 The building entrance facility (BEF) shall be constructed with full height walls using steel studs with minimum 5/8-inch, or metric equivalent, drywall.
- 8.3 All walls shall be finished with in a light colour (e.g., light gray). All existing painted surfaces must be freshly painted including cement floors. All surfaces must have one coat of primer, one intermediate and one or more finish coats of latex paint.
- 8.4 Remove any existing carpet from new BEF's and seal the floor with anti-static material (to be approved by a qualified Professional Engineer). Floor finish shall be gray off-white colour.

- 8.5 If fire rated plywood is not available then the plywood shall be painted with at least two coats of fire-resistant paint.

- 8.6 A 3/4-inch fire rated plywood backboard is to be securely mounted on top of the new gypsum board wall or existing surface. The exact size and method of installation will be determined by the site conditions.

FIGURE 1. BUILDING ENTRANCE FACILITY / LAN ROOM (NOT TO SCALE)



- 8.7 Ceiling lights must be provided with a switch located immediately inside the access door to the room. The fixture(s) should deliver a minimum of 500 lux of illumination throughout the room.
- 8.8 Maintain positive pressure within the BEF with a minimum of one air change per hour. The HVAC shall be provisioned such that the temperature is kept in the range of 18 to 24 Celsius and the humidity is kept between 30 to 55% Relative Humidity. Dust filters must be installed on all inflow air vents or ducts.
- 8.9 The BEF shall be equipped with a minimum of two standard nineteen-inch (19") 44RU equipment racks securely bolted to the floor. A minimum 1.0m clearance on three sides (including front and back) of the racks shall be maintained. Each rack shall be provisioned with vertical cable management. A minimum twelve-inch (12") wire cable tray or equivalent shall be provided from the BEF wall to the equipment rack. If other elements of the building infrastructure are co-located with the LAN facilities in the BEF, a minimum clearance of 1.0 metre must be maintained from these elements. All installations must conform to applicable Canadian Electrical Code requirements.
- 8.10 Cable terminations and equipment placement shall be done in conformance with the typical layout illustrated as illustrated in Figure 2 - *Typical Layout of 19" Racks in BEF and TR*, below. Cable terminations shall be terminated and active equipment installed in separate racks, unless otherwise specified by the Project Manager.
- 8.11 Three (3) separately fused, isolated ground duplex electrical outlets with lock on breakers are to be installed. One to be wall mounted and the other two secured to the

top of the relay racks. Electrical outlets should be 20A, 120V (5-20R) Isolated Ground. Each equipment rack shall be provided with a minimum eight-outlet surge protected power bar horizontally rack-mounted at its bottom. If emergency generator back-up power is available, the BEF shall be connected to it. The receptacles installed should be red.

- 8.12 Grounding and bonding infrastructure meeting ANSI/TIA 607 requirements shall be designed and/or approved by a licensed Professional Engineer. The bonding shall be routed through all LAN rooms and shall terminate on a LAN room grounding bus bar equipped to handle NEMA compliant grounding hardware. All metallic non-current-carrying conductive parts, including equipment racks, shall be appropriately grounded. The main entrance facility/equipment room in each building shall be equipped with a LAN room main grounding bus bar (LRMGB). Each LAN closet shall be provided with a LAN room grounding bus bar (LRGB). The LRMGB shall be connected to the building electrical entrance grounding facility.
- 8.13 Fire rated door painted to match other existing doors or stained and finished where applicable. The door swing shall either be outward or not deemed as usable space.
- 8.14 The door shall be fitted with a lock set that matches existing locking hardware in the building. If matching lock sets are not available, then it is up to the contractor to confirm an acceptable alternative with the Project Manager. The locking cylinders in the lock sets must be compatible with the University of Toronto ITS master locking system. At no time should a lock set be installed that does not allow free exit from a room.

9. LAN ROOMS (REFER TO FIG. 1, 2, 3)

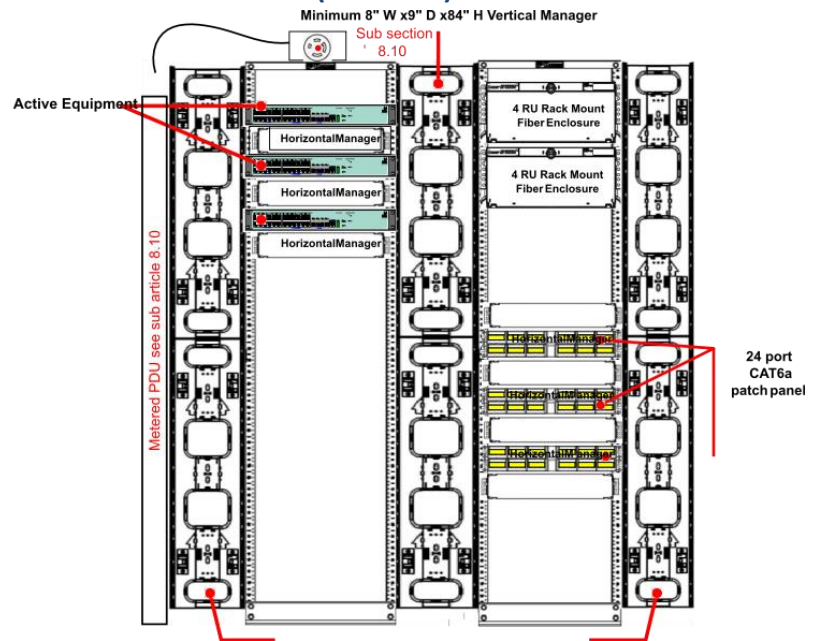
Note: Only approved telecommunications equipment shall be installed in University LAN rooms. Equipment unrelated to network infrastructure and the regular operations of the University networks shall not be installed in LAN rooms. Examples of unapproved equipment include, but are not limited to, the following: building automation devices, security and access controllers, electrical cables and panels, water or waste treatment pipes. Such equipment and facilities shall not be installed without the expressed written approval of the University.

- 9.1 The LAN room shall be located to ensure that UTP CAT6A cable distances to work areas are minimal and do not exceed 90 metres. Where this is not possible, additional LAN rooms on the floor are required. LAN room shall have recommended minimum dimensions of 2.20 m x 2.80 m, as shown in Figure 1.
- 9.2 The LAN rooms shall be constructed with full height walls using steel studs with minimum 5/8-inch drywall. (See Figure 1)

- 9.3 All walls shall be painted to match the existing colour and finish. The use of any other colour must be approved by the owner. All existing painted surfaces must be freshly painted. All surfaces must have one coat of primer, one intermediate, and one or more finish coats of paint.
- 9.4 Remove any existing carpet from new LR's. Seal the floor with anti-static material (to be approved by a qualified Professional Engineer). Floor finish shall be gray off-white colour.
- 9.5 A 3/4-inch fire-rated plywood backboard is to be securely mounted on top of the new gypsum board wall or existing surface. The exact size and method of installation will be determined by the site conditions. (See Figure 1)
- 9.6 Ceiling lights must be provided with a switch located immediately inside the access door to the LAN room. The fixture(s) must deliver at least 500 lux one metre above the finished floor. Provide automatic shutoff lights when LAN room is not in use (motion detector or timer).
- 9.7 Maintain positive pressure within the LR with a minimum of one air change per hour. The HVAC shall be provisioned such that the temperature is kept in the range of 18 to 24 Celsius and the humidity is kept between 30 to 55% Relative Humidity. Dust filters must be installed on all inflow air vents or ducts.
- 9.8 The LAN room shall be equipped with a minimum of one standard nineteen-inch (19") 44RU equipment rack securely bolted to the floor. A minimum 75 cm clearance on three sides (including front and back) of the rack or cluster of racks shall be maintained. Each rack shall be provisioned with vertical cable management. A minimum six-inch (6") wire cable tray or equivalent shall be provided from the TR wall to the equipment rack. (See Figure 1)

- 9.9 Refer to Typical Layout of 19" Racks in BEF and LAN room for an example of cable termination and active equipment placement in a LAN room equipped with two 19" racks. (See Figure 2)

**FIGURE 2. TYPICAL LAYOUT OF 19" RACKS IN BEF AND LAN ROOM
(44U RACK)**



- 9.10 Refer to Alternative Layout of 19" Racks in BEF and LAN Room (Figure 3, Photo 1 and 2) for an example of cable termination and active equipment placement in a LAN room. This setup is appropriate for locations where cable management is made difficult or impossible due to space. 1-foot UTP patch cables will be used from patch panel to network device.

FIGURE 3. ALTERNATIVE LAYOUT OF 19" RACKS IN BEF AND LAN ROOM (44U RACK)

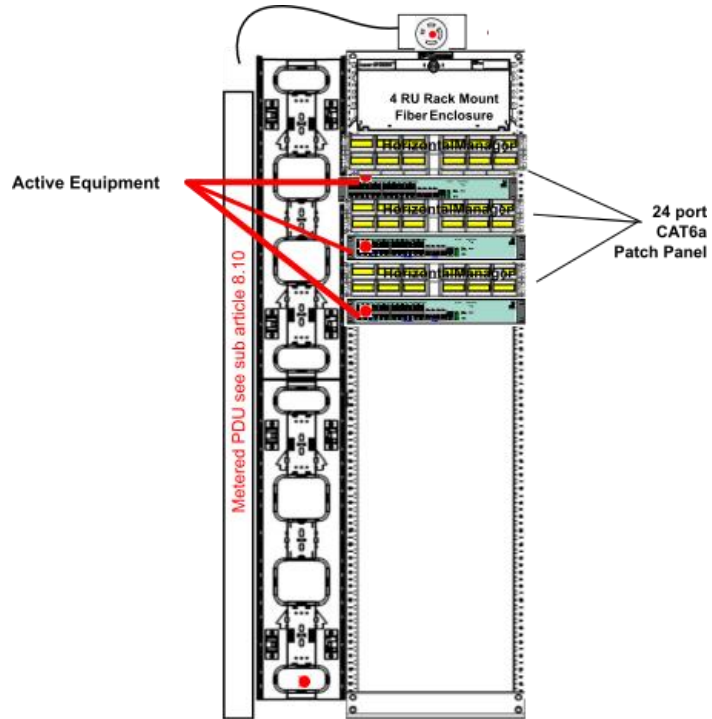


PHOTO 1. TYPICAL LAYOUT OF 19" RACKS IN BEF AND LAN ROOM (44U RACK)

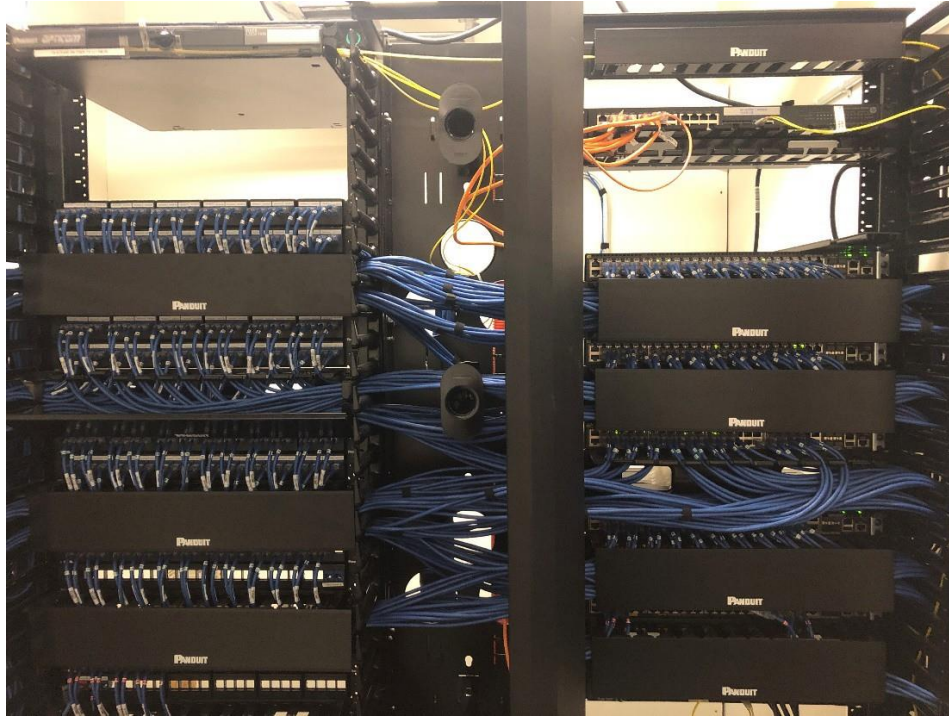
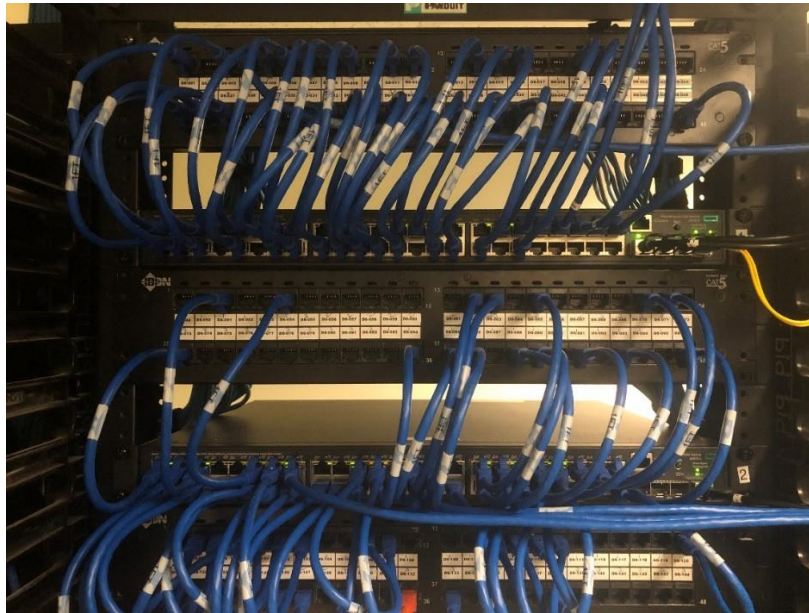


PHOTO 2. ALTERNATIVE LAYOUT OF 19" RACKS IN BEF AND LAN ROOM (44U RACK)



- 9.11 Separately fused, isolated ground duplex electrical outlets with lock on breakers are to be installed. One to be wall mounted and one secured to the top of each of the relay racks. Large equipment racks shall be provided with vertical power bar instead of horizontal for each rack with at least 16 surge protected outlets and rack-mounted on the back of the rack. Smaller equipment racks or wall mounted cabinet or racks shall be provided with a minimum six outlet surge protected power bar horizontally rack-mounted at its bottom.
- 9.12 Electrical outlets should be 20A 208V. Where cumulative power draw is expected to be less than 1500W, the use of 20A 110V outlets is acceptable.
- 9.13 Grounding and bonding infrastructure meeting Canadian Electrical Code and ANSI/TIA 607 requirements shall be routed through all LAN rooms and shall terminate on a LAN room grounding bus bar equipped to handle NEMA compliant grounding hardware. All metallic non-current-carrying conductive parts, including equipment racks, shall be appropriately grounded.
- 9.14 Solid core wood door painted to match other existing doors or stained and finished where applicable. The door shall open outward where permissible and if that is not the

case the swing of the door shall not be counted in the clearances specified for the equipment racks.

- 9.15 The door shall be fitted with a lock set that matches existing locking hardware in the building. If matching lock sets are not available, then it is up to the contractor to confirm an acceptable alternative with the Project Manager. The locking cylinders in the lock sets must be compatible with the University of Toronto ITS master locking system. At no time should a lock set be installed that does not allow free exit from a room.
- 9.16 Painting of UTP/Fibre cables is not permitted. If painting of UTP/Fibre cables occurs, regardless of reason it is presumed damaged. Contractors are liable for replacement and re-installation of damaged cables.
- 9.17 Emergency back-up power is mandatory for LAN/MTR rooms hosting networking equipment for life-critical systems. Example: ATA (analog telephone adapter) for an emergency phone system.

10. ELECTRICAL

General

- 10.1 All electrical work must comply with the latest edition of the Ontario Hydro Safety Code, University of Toronto Electrical Standards, Ontario Building Code, and applicable CSA and ULC Standards.
- 10.2 All electrical works and grounding system installations must be validated by a qualified Professional Electrical Engineer. Where required, Ontario Hydro inspection shall be applied for and paid by the contractor. Installer must provide certificate prior to final acceptance of work.
- 10.3 The use of tandem breakers is not permitted.
- 10.4 All electrical cable must be minimum 12 AWG and installed in minimum 3/4-inch EMT conduit supplied by the contractor and installed directly to the panel location. 12 AWG BX is acceptable only when fishing an existing wall.
- 10.5 The contractor must have a circuit tracer either onsite or readily accessible.
- 10.6 All electrical circuits that have been installed require labeling. The panel end of the circuit will indicate that the circuit is a dedicated ITS circuit and include the room number in which it terminates. The receptacle end of the circuit will indicate the panel number, panel location, and breaker number.
- 10.7 A lockable breaker is required at the panel.

Isolated Ground

- 10.8 The isolated ground (IG) receptacle shall be orange in colour and wired as an individual branch circuit outlet. The outlet will have a separate green or green/yellow wire which runs continuously from the ground conductor terminal to the first panel board where it is connected to the ground bus. Bonding of the conduit boxes, etc., of the circuit is accomplished by ordinary means (conduit or a separate ground wire). The two grounds are connected only at the panel board.
- 10.9 The IG outlet shall be grounded to the same ground as the electrical distribution system. The only difference is that it is connected to ground via a separate wire. There is no 'clean' 'separate' or 'dedicated' ground. The Electrical Safety Code allows only one earthing ground.

11. PATHWAYS

Communications cables shall be contained in pathways installed parallel or perpendicular to building lines unless otherwise specified by the Project Manager. At the point of entry to a building, outside plant communication cables must be plenum-rated CMP (FT-6). The contractor has the choice of running point-to-point riser-rated cable or outside rated cable with a fusion splice near the building entrance to riser-rated cable. When CMP (FT-6) rated cable is specified it shall be supported by J-hooks and/or cable tray when not run-in conduit.

Interference Drawings

- 11.1 When requested by the Project Manager, interference drawings must be submitted prior to commencing with the installation of conduits. These drawings must indicate the conduit routing and pull box locations with reference measurements from two walls or permanent fixtures. Include construction notes describing elevation changes, wall penetrations, and information related to existing fixtures that may be affected by the installation of the conduit. Neatly hand drawn routing and notes on the floor plans provided with the tender are acceptable.

Conduits

- 11.2 All conduits shall be EMT electrical metal tube type installed with steel, set-screw type fittings except on the exterior of the building which shall be rigid galvanized steel with

threaded connectors. Conduit shall be installed in compliance to prevailing codes and standards. Conduits must be installed at right angles and parallel to building grids.

- 11.3 Pull strings must be supplied in all new and reworked conduit.
- 11.4 Pull elbows or LBs are not allowed. Only sweep or 90-degree elbows shall be utilized and no more than 180 degree of bends will be permitted between pull boxes (example: two 45 degree bends plus one 90 degree bend). The minimum radius of curvature shall be 10 times the conduit internal diameter (ID).
- 11.5 In LAN rooms the conduit shall be installed parallel to the backboard with a 90-degree bend toward the floor or enter within 10 inches of and parallel to the cable tray.
- 11.6 All conduit ends shall be fitted with plastic bushings.
- 11.7 All exposed conduit and junction boxes will be painted to match the existing environment. All conduits and pull boxes must be treated and cleaned prior to painting. The conduit must have one coat of primer paint, one intermediate coat, and one or more finish coats of paint. Any colour other than the existing environment must be approved by the owner prior to use.
- 11.8 Maximum distance of conduit run between two pull boxes shall be 30 metres. The pull box shall have a screw type cover not hinged. All pull boxes shall be accessible with a minimum 24 x 24-inch hinged access hatch provided where required. Pull boxes for vertical conduits must be installed to provide a straight pass through for vertical cables. The sizes of junction boxes shall be 8 times the size of the inside diameter size of the conduit entering it. The exception is when 4-inch conduit is used, and then 30x24x6 inch junction boxes are acceptable. Pull boxes are not to be installed in elevator machine rooms. Conduits installed in elevator machine rooms must provide clearance and must not restrict the service area.
- 11.9 When conduit is installed in utility closets the conduit must be installed in a steel sleeve that is 6 inches high and the gap between the floor and the sleeve must be watertight.
- 11.10 All wall and floor penetrations shall be filled with a fire stop rated as per code and finished to match the existing fire stop surface.

Flexible Conduit or Innerduct Tubing

- 11.11 INNERDUCT shall not be used unless specified in the detailed scope of work.
- 11.12 If tubing is specified the inside surface must have a smooth finish that will allow cable to be easily fished.

- 11.13 Tubing must resist crushing pressures and must not collapse within normal bending limits.
- 11.14 It should have an internal diameter of not less than 1 inch.
- 11.15 If tubing is used, the contractor must supply the tubing manufacturer's specifications with the tender response.
- 11.16 Tubing may be specified wherever fibre cable may be subjected to bending forces that would place it at risk of damage.
- 11.17 Tubing may be specified in transitions when in and out of conduit pathways do not line up.
- 11.18 Tubing may be specified in LAN rooms when cable needs to be installed in free air when other support structures are not feasible.
- 11.19 Tubing will not be used to overcome problems induced through bad installation practices of other components.
- 11.20 Fastening of ends of tubing to conduit, racks, or tray to be through mechanically sound fittings, not plastic tie wraps.

Cable Tray

- 11.21 Cable tray specified for LAN rooms shall be wire cable tray or equivalent, no less than 6 inches wide in LAN room and 12 inches wide in BEF by 3.5 inches deep. Only fittings such as sweeping 30, 45, 60, and 90 degree elbows, tees and crosses manufactured by the OEM are to be used to change direction. Use fittings of the smallest available bending radius and still accommodate the bending radius of the backbone cabling. Butting two sections of tray together to create right angle turns is not acceptable. Any custom alterations to the tray must be approved by the Project Manager prior to installation.
- 11.22 When tray is running parallel to backboards install it 4 inches off the backboard to allow passage of cables between the tray and the backboard.
- 11.23 When the tray is adjacent to a wall use right angle brackets or UNISTRUT to support it.
- 11.24 When the tray it is installed in free air to cross a closet, suspend it from the ceiling using threaded rod.
- 11.25 When tray is installed above a relay rack use threaded rod to support the tray 12 inches from the top of the rack where possible.

12. INTER-BUILDING CABLE AND HARDWARE

Inter-building cables are copper and fibre optic cables that provide connectivity between buildings. Three major categories of inter-building cables are defined on campus: main trunk cables (typically between core router locations); branch cables (from a router location to major cross-connects covering a significant area); and, local cables (between building one of each is either small or the last on a cableway). Unless otherwise specified, the following shall apply:

- 12.1 Inter-building cables are OS2 single mode fibre optic and multi-pair Cat3 UTP copper cables.
- 12.2 The use of legacy multimode (OM1 and OM3) fibre cable is permitted for integration into existing legacy fibre infrastructures. If required, the specific type of cable will be specified in the project Scope of Work.

Backbone cables

- 12.3 Backbone cables are installed between major facilities hosting Core layer network devices. Cabling shall be indoor/outdoor loose tube, dry water block fibre cable consisting of, at minimum, 96 single-mode fibres in a water resistant, armoured jacket. Cables shall be installed in a minimum 4-inch (100 mm) duct between buildings.

Branch cables

- 12.4 Branch cables connect major IT facilities to buildings hosting Distribution layer network devices. Cabling shall be indoor/outdoor loose tube, dry water block fibre cable consisting of, at minimum, 48 single-mode fibres in a water resistant, armoured jacket. Cables shall be installed in a minimum 4-inch (100 mm) duct between buildings.

Access cables

- 12.5 Access cables are installed to connect Distribution layer facilities to Access layer facilities (typically smaller standalone buildings).
- 12.6 Cabling shall be indoor/outdoor loose tube, dry water block fibre cable consisting of at least 24 single-mode fibres in a water resistant, armoured jacket. Cables shall be installed in a minimum 4-inch (100 mm) duct between buildings.

- 12.7 A 25-pair EIA/TIA Cat3 UTP cable in a water resistant, armoured jacket shall be installed between buildings. unless otherwise specified by the project scope of work or the Project Manager. Sharing of the 4-inch duct with the fibre cables is acceptable.

Installation Notes

- 12.8 All cables will be installed with 10-foot (~3 metre) service coils at all termination points and transition closets. Service loops may be stored on backboards, in unoccupied sections of cable tray or in conduit pull boxes. Do not store service loops in the fibre cable in the connector tray.
- 12.9 The contractor is responsible for the location of buried utilities, where applicable. These arrangements will be made in advance prior to commencement of work. The contractor is also responsible for the restoration of the area under construction to its original condition or better.
- 12.10 Where landscape property has been disturbed, the contractor must account for the restoration of grass, plants, walkways, etc.

13. INTRA-BUILDING CABLE AND HARDWARE

Intra-building backbone cables are the copper and fibre optic cables that run between the BEF and the LAN rooms within a building.

- 13.1 As a minimum, the building backbone infrastructure should consist of at least 12 strands single-mode cable between each LAN room and the BEF. Multimode and/or UTP CAT6A cabling can be added if requested.
- 13.2 Nineteen-inch relay racks with 77 inches of usable space (44RU) bolted to the floor shall be installed in each LAN room. Rack layouts will include:
- a) One 2RU horizontal cable management bracket for every two 24 port fibre or copper patch panels (or one 48 port). Likewise, 2RU horizontal management shall be provisioned for active equipment residing in the rack.
 - b) One power bar (with internal breaker) mounted switch to the front and outlets on rear utilizing only one rack space.
 - c) A minimum 6-inch vertical cable management with cable bend control mounted to the side of the rack.

- d) A minimum 6-inch-wide wire cable tray or equivalent with 8 inches spacing between rungs to support cables from the LR entry point to the termination locations.
- 13.4 All backbone copper and fibre inter-building and intra-building cables will be installed with 10-foot (3 metre) service coils installed at all termination points and transition closets. The service loops may be stored on the backboard, in an inactive section of cable tray or in the conduit pull box.
- 13.5 Pull string/rope shall remain in all conduits upon completion of cable installation. Backbone and horizontal cable may co-exist in the same conduit. However, all fibre cable must be in separate conduit from the copper type where two conduit paths have been installed.

14. HORIZONTAL CABLING AND HARDWARE

- 14.1 The horizontal distribution cable is the copper or fibre optic cable that runs between the workstation outlet and the rack-mounted patch panel in the LAN room.
- 14.2 Unless otherwise specified, at least two (2) blue jacketed CAT6A TP four-pair cable shall be installed from the rack-mounted modular patch panel in the LAN rooms through the horizontal conduit infrastructure to the outlet location. Where specified, the fibre cable shall be at least 6 (six) strand singlemode cable.
- 14.3 Drop cables may share the riser conduits when installation occurs between floors. When there is a choice, these drop cables should always be installed in the riser conduit that accommodates the corresponding media type (copper with copper, fibre with fibre).
- 14.4 Properly sized conduit should be used between the junction boxes on the horizontal distribution conduits and the user outlet boxes. In many cases the conduit will be surface run-down walls to a surface mount outlet box designed to accept a flush mounted modular faceplate installed on the box.
- 14.5 Wiremold use is acceptable in lieu of EMT conduits where aesthetics are a concern (e.g., historic buildings). Extents of wiremold use should be limited to the necessary minimum.
- 14.6 The use of FT6 fire-rated plenum cable in plenum spaces of buildings is permitted.
- 14.7 RJ-45, 8-position jack modules shall be installed and configured to the EIA/TIA 568A standard as required in the modular faceplate. Blanks shall be used to cover unused spaces in the face plate.

- 14.8 Project specifications may require colour coded jack modules, e.g., orange for wireless.

15. OUTLET PLACEMENT

- 15.1 Standard outlet height when boxes are installed on a wall is 12 inches from the floor.
- 15.2 Conduit or boxes are not to obstruct the function of any adjacent fixtures.
- 15.3 When outlets are mounted on the floor the outlet box should be mounted on its widest surface so that the faceplate is on the side of the box and the cover plate is able to be opened.
- 15.4 Installations involving architectural details, such as elaborate baseboards or outlets mounted at counter level in labs, should be reviewed by the contractor with the Project Manager prior to installing the outlet box if not specified in the detailed scope of work.
- 15.5 The University reserves the right to relocate any LAN outlet by up to 3.0 metres without penalty before installation is complete.

16. WIRELESS SPECIFICATIONS

Wireless AP locations

- 16.1 For each new wireless installation on campus a predictive wireless site survey shall be performed, and results (WAP layout) incorporated with project documentation at the planning stage.
- 16.2 Wireless site survey is performed either by the Information Technology Services (ITS) or by a certified external contractor approved by ITS.
- 16.3 For lengthy capital projects some revisions of WAP layout should be expected at the final stage of wireless implementation to accommodate revisions in floor plans, and technology and industry standards changes.

Wireless design guidelines

- 16.4 To provide pervasive wireless coverage in a building, wireless design shall provide the minimum of negative 65 dBm wireless signal in both 2.4 GHz and the 5 GHz bands.
- 16.5 Wireless design shall specify where WAPs are to be installed and type of mount to be used (wall or ceiling mount).

- 16.6 The model of AP specified must be appropriate to handle the anticipated density requirements of the area being served. Multiple WAPs are typically specified for areas with more than 40- 50 anticipated users.
- 16.7 The design must provide solutions for any potential signal interference or obstruction issues.
- 16.8 Unless otherwise indicated, outdoor WAP's must have wall mounted Lightning Arresters installed in the associated LAN room with the CAT6A cable from the outdoor AP connected into the Lightning Arrester and from there to the patch panel. Where not practical or feasible to install the Lightning Arrester near the patch panel, the Lightning Arrester can be installed near the outdoor WAP. The approved Lightning Arrester is L-Com Model: HGLN-CAT6AJ. Any substitution of equipment will be proposed by the contractor and approved by the University's Project Manager. Contractors will work with the University's Project Manager or delegate to determine the specific mounting methods and location.
- 16.9 Grounding of outdoor AP's will be in accordance with the Canadian Electrical Code CSA C22.1 conforming to sections 10 Grounding and Bonding and to section 60 Electrical Communications Systems or to the Ontario Electrical Safety Code 28th edition. Typical WAP's and Lightning Arresters grounding is continuous stranded green coded wire at AWG #8 - depending on the size of the equipment ground lugs and/or associated electrical ground terminal screws.

Data cabling for wireless APs

- 16.10 The cabling from the LAN room to the wireless data outlet shall be two CAT6A UTP four pair cables. All cables shall be fully contained in new conduit, new raceway and/or the existing building communication pathways that are suitable and conform to Section 14 of this document.
- 16.11 Terminations at the LAN room shall be in rack-mounted patch panels equipped with orange coloured, 8-pin modular jacks and configured to the TIA 568A standard.
- 16.12 New data outlets for the WAPs should be installed approximately 3 metres above the floor level. WAPs shall be mounted on the wall adjacent to the corresponding data outlets. WAPs must not be mounted in locations where the coverage of the WAP is shadowed by HVAC, vents, or other metal or concrete structures.
- 16.13 For the WAP end surface, mount boxes for ceiling mount locations, and in flush mount boxes for wall mount locations, shall be used. The boxes shall be equipped with modular faceplates. White coloured, 8-position jack modules shall be installed as required in the

modular faceplate at the WAP end and configured to the EIA/TIA 568A standard. Blanks are to be provisioned for unused spaces in the face plate.

17. UTP CABLE SPECIFICATIONS

- 17.1 All media shall conform to transmission characteristics specified by the ANSI/EIA/TIA-568-C.2 and ANSI/EIA/TIA-568-C.3 standards.
- 17.2 Intra-building copper UTP cabling shall meet or exceed the ANSI/EIA/TIA Category 6a specification.
- 17.3 Inter-building copper UTP cabling shall meet or exceed the ANSI/EIA/TIA Category 3 specification.
- 17.4 For the grounding of copper cable the contractor shall supply and install BIX/Cable output Cover and splice chamber.
- 17.5 The contractor shall supply and install all necessary protector modules 5 pin black.
- 17.6 The contractor shall supply and install ground wire from Terminal Building Ground to the entrance protector- unit accepts #6 - #14 ground wire, ground wire size is dependent on the distance from source.
- 17.7 The contractor shall terminate incoming cable directly onto the circuit protector.
- 17.8 The contractor shall test as per TIA/EIA standards.
- 17.9 CAT6A cabling should be used for all 911 analog phone cables installed on UofT premises.
- 17.10 Limited use of UTP CAT6 or lower cabling is permitted for data circuits with low bitrate (e.g., IoT applications).
- 17.11 Painting of UTP/Fibre cables is not permitted. If painting of UTP/Fibre cables occurs, regardless of reason, it shall be considered damaged. Contractors are liable for re-installation of all damaged cables.

18. UTP PATCH CABLE SPECIFICATIONS

- 18.1 UTP patch cable connecting network switches to UTP patch panels shall be CAT6A, 28 AWG patch cables.

- 18.2 UTP patch cable length is determined by the type of rack layout in the LAN room.
 - 18.2.1 In a Typical Layout (See Fig. 2 Chapter 9), the patch cables should be an appropriate length from patch panel to active equipment.
 - 18.2.2 In an Alternative arrangement (See Figure A and B Chapter 9), to minimize the need for horizontal cable management, the use of 1-foot patch cables is permitted.
- 18.3 Limited use of legacy UTP CAT6 or less cabling is permitted for data circuits with low bitrate (e.g., IoT applications).

19. FIBRE CABLE SPECIFICATIONS

- 19.1 All inter-building cable must be single mode (OS2) indoor/outdoor loose tube, dry water block, armoured cables with a watertight jacket and central strength member.
- 19.2 With approval, Multi-Mode cable (OM1) may be permitted on horizontal runs within a building to support and/or maintain existing infrastructure.

20. COMPONENT INSTALLATION

- 20.1 All cable and components must be installed as per the manufacturer's specifications.
- 20.2 Connectors should be LC type, ceramic ferrule: physical contact finish with no aluminum construction. The attenuation shall be 0.2 dB typical to 0.4 dB maximum.
For new installations, only fusion splice terminations are accepted. This is to be done in conjunction with manufactured pigtail assemblies with LC connectors. Field termination of connectors is not permitted. Mechanical splice methods are not permitted.
- 20.3 Fusion splicing using pigtails may be permitted to repair defective legacy equipment and/or when adding panels to an existing enclosure.
- 20.4 Lubrication: if cable pulling lubricant is used for Fibre optic cable installations, the contractor must provide in writing the manufacturer and product specification sheet. The contractor is responsible for ensuring the lubrication product is suitable for the installation application.

21. 'AS BUILT' DOCUMENTATION

The contractor must supply complete and accurate documentation for the completed installation. It must include the following information:

- a) All pull box locations referenced to building co-ordinates.
- b) All outlet locations referenced to building co-ordinates.
- c) Conduit routing relative to building co-ordinates.
- d) Pull box and conduit sizes.
- e) Labeling details of all infrastructure components.

When referencing building co-ordinates use the distance between two walls or permanent fixtures.

The project will not receive final acceptance without complete documentation. The minimum documentation to be supplied is "as built" on the tender drawings with the required information. The preferred method is that the contractor supply "as built" documentation in soft copy DXF or (.dwg) format using industry recognized layering conventions and accompanied by two D-size hard copies.

22. TESTING AND WARRANTY

- 22.1 The following copper and fibre optic tests must be satisfactorily performed with the specified documentation provided prior to project sign-off. All test results will be delivered in a machine-readable form compatible with Microsoft Windows. The information shall be formatted as a CSV (Comma Separated Values) flat file. Other formats may be approved by formal request and approval.
- 22.2 Submit to the University the fibre test tool calibration certificate.
- 22.3 Contractors must be certified by the cable manufacturer to provide a 25-year parts and installation warranty from the manufacturer. The contractor is to ensure that all manufacturer registration and compliance regulations are met based on their product selection.
- 22.4 If parts for installation is not covered by a manufacturer's warranty, then the cabling contractor must provide the owner a minimum one (1) year materials and labour warranty.

Copper - 4 Pair

- 22.4 Provide full testing and documentation to satisfy Cat 6A specifications. Tests will be performed from the horizontal cable patch panel in the LAN room to the faceplate jack for all drop cables.

Copper - 25 Pair

- 22.5 Provide full testing and documentation to satisfy all specifications appropriate to the grade of cable installed. Tests will be performed from IDC connector strip to IDC connector strip for each four pairs.
- 22.6 All copper 4- and 25-pair tests will be performed by installers using certification field testers verifying that the cabling system meets the transmission performance requirements as specified in TIA/EIA.

The test results will be documented including the following information:

- a) Cable ID
- b) U of T building number
- c) Tx location
- d) Rx location
- e) Test equipment; Tx type and Rx type
- f) Contractor name
- g) Technician name and signature
- h) Date test performed
- i) Relevant additional comments

Fibre (singlemode)

- 22.7 Bi-directional attenuation tests 1310 nm and 1550 nm for single mode fibre operating wavelengths must be performed on all fibre strands. The test results must be provided with the following information:
- a) Cable ID
 - b) U of T building number
 - c) Attenuation values

- d) Tx location
- e) Rx location
- f) Wavelength
- g) Fibre type
- h) Connector type
- i) Test equipment; Tx type and Rx type
- j) Reference setting at first wavelength
- k) Reference setting at second wavelength
- l) Contractor name
- m) Technician name and signature
- n) Date test performed
- o) Relevant additional comments
- p) Soft copy test results must be supplied in a text file form

23. LABELING

23.1 Labeling shall, in general conform to the AINSI/TIA/EIA-606 standard. The following details the practices to be used at University of Toronto.

Drawing Identifiers

23.2 The legend on all drawings to show building and floor number. All drawings to be referenced as Data Plans

23.3 Each drawing will be prefixed with *DPbbbbff* - where *bbbb* is the building number, *ff* is the floor number

Example: DP012302

Building Identifiers

23.4 All of University of Toronto buildings are identified using the following format:

23.5 2A three-digit number preceded by either a 0 or A.

Example: 0123 or A123

23.6 The Building ID exists in the legend, in the title block and the file name.

Floor Identifiers

23.7 All floors in U of T buildings to be identified by two digits:

01...99 Floors above ground, including ground

GR Ground floor when not identified as Floor 1

1B 1st Basement (where there is only one basement it will be referred to as 1st basement)

2B 2nd Basement

3B 3rd Basement

MZ Mezzanine

LAN Rooms

23.8 All LAN rooms to be identified as **LR xxxx-yyz** - where LR is LAN room, xxxx is the building identifier, yy is the floor identifier and z is the closet identifier, unique per floor.

Equipment

23.9 All equipment shall be identified in the format ***type-building-LR-number***.

Example: **F96-0038-01A-03** designates a 96-port fibre patch panel in building number 38 in LAN room A of the first floor and it is the third fibre patch panel there.

23.10 Consult the Project Manager for equipment designations that should be used.

Inter-building Cable Identifiers

23.11 All cable identifiers shall use the format ***building-type-building-number***. Cable numbers shall be sequential starting at 1 and be unique.

Example: **0009C-0032-02** represents the second copper cable originating in building 9 and ending in building 32.

Pull Boxes

- 23.12 Each cable in every pull box along cable paths shall be labelled for easy. Labels shall reflect the cabling standard. For example, inter-building cables inside a pull box shall be labelled *building-type-building-number*.



Typical Photo 3. Cable chamber with labelled cables

Riser Cable Identifiers

23.13 Riser cables shall be identified in the format building-type-LRa-LRz-number.

Example: **0009C-1BA-04A-04** represents a copper cable in building 9 running from LAN room A of the basement to LAN room A of the 4th floor.

Horizontal Cables

23.14 The horizontal cables shall be labeled in the format D-floor#-room#-cable#. The per room cable numbers shall be sequential beginning at 1.

Example: D03-038-2 represents a second data cable to room 038 of the third floor.

Example: D11-099-5 represents a fifth data cable to room 099 of the 11th floor.

23.15 Note: At the University in many buildings the floor is implicit in the room number. Thus, where labeling space is tight (e.g., modular jacks in a UTP patch panel) therefore, the label may be shortened by omitting the explicit floor number to room#-cable#.

Naming Convention for Wireless Access Point

23.16

1. Internal WAP names:

a. A single WAP in a room or area:

building code-room# (or corridor#) e.g. bf-102

b. Two to eight WAPs in a room or area:

building code- room# (or corridor#)-{direction} e.g. bf-215-n

c. More than eight WAPs in a room or area:

building code-room# (or corridor#, or floor)-{serial} e.g. my-150-a; rl-11-d

2. External WAP names:

- a. Three or fewer WAPs in an area:
building code-x-{direction} e.g. ss-x-s

- b. More than three WAPs in an area:
building code-x-{serial}

3. Notation:

- a. **{direction}** refers to one of eight options: {n, s, e, w, ne, nw, se, sw, m}.
- b. **{serial}** refers to one of 24 options: {a to z}.
- c. For the WAPs that use **{serial}** option, the WAPs' names shall be marked on floor plans at the locations where the WAP will be mounted. The floor plans shall be submitted to ITS.

Labeling Convention for Wireless Cable

23.17

Label for the wireless cables used by internal WAPs:

- a. A room or area with a single WAP:
w-room# (or corridor#)-cable# e.g. w-102-1; w-102-2
- b. A room or area with two to eight WAPs:
w-room# (or corridor#)-{direction}-cable# e.g. w-215-n-1; w-215-n-2
- c. A room or area with more than eight WAPs:
w-room# (or corridor#, or floor#)-{serial}-cable# e.g. w-150-a-1, w-150-a-2

2. Label for the wireless cables used by external WAPs:

- a. An area with three or fewer WAPs:
w-x-{direction}-cable# e.g. w-x-s-1; w-x-s-2
- b. An area with more than three WAPs:
w-x-{serial}-cable# e.g. w-x-a-1; w-x-a-2.

3. Notation:

- a. **{direction}** refers to one of eight options: {n, s, e, w, ne, nw, se, sw, m}.

- b. **{serial}** refers to one of 24 options: {a to z}.
- c. **Cable#** numbers may be either 1 or 2.
- d. For cables that use **{serial}** option, the labels shall be marked on floor plans at the location where the corresponding WAPs will be mounted. The floor plans shall be submitted to ITS.

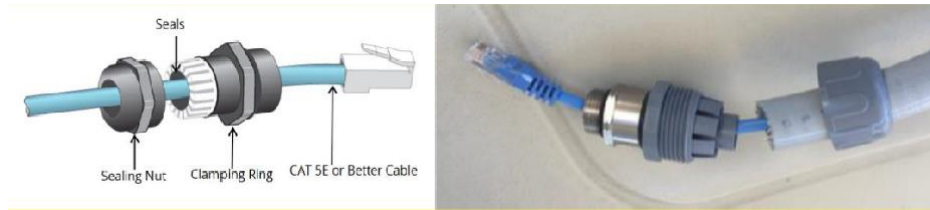
24. Glossary of Terms and Conditions

| | |
|--------------|---|
| A | Amps |
| AC | Alternating Current |
| AP's – WAP's | Wireless Access Points |
| AWG | American Wire gauge |
| BEF | Building Entrance Facility |
| BX | Metal clad armored cable |
| CAT6A | Category 6 cable |
| CMP | Plenum rated cable |
| CSA | Canadian Standards Association |
| CSV | Comma Separated Values |
| DXF | Drawing Exchange Format |
| EMT | Electrical Metallic Tubing |
| HVAC | Heating Ventilation and Air Conditioning |
| IBEW | International Brotherhood of Electrical Workers |
| IG | Isolated Ground |
| IT | Information Technology |
| ITS | Information Technology Services |
| IoT | Internet of Things |
| LAN | Local Area Network |
| LC | Lucent Connector |
| LRMGB | LAN room grounding bus bar |
| LR | LAN room |
| Lux | Illuminance |
| NEMA | National Electrical Manufacturers Association |
| OEM | Original Equipment Manufacturer |
| PM | Project Manager or Property Manager |
| RU | Rack unit |
| Rx | Receive |
| TC | Telecommunications closet |

| | |
|-----|----------------------------------|
| TR | Telecommunications room |
| Tx | Transmit |
| ULC | Underwriters Laboratories Canada |
| V | Volts |
| W | Watts |
| WAP | Wireless Access Point |
| UTP | Unshielded Twisted Pair |

Appendix A - Typical Installation of Outdoor WAP's

- Install the outdoor APs at the locations marked on the drawing(s).
- At the AP end use Flex Conduit and M20-to-1/2" NTP adapter to protect Ethernet cables. The conduit and M20-to-1/2" NTP adapter can allow terminated connector through to the AP connector. Refer to the images below.



- The cables shall be terminated in an outdoor waterproof electrical, single gang, junction box to stage connections and glands. Refer to the images below.



Grounding of outdoor AP's will be in accordance with the Canadian Electrical Code CSA C22.1 conforming to sections 10 Grounding and Bonding and to section 60 Electrical Communications Systems or to the Ontario Electrical Safety Code 28th edition. Typical AP's and Lightning Arresters grounding is continuous stranded green coded wire at AWG #8 - depending on the size of the equipment ground lugs and/or associated electrical ground terminal screws.

Unless otherwise indicated or recommended by consultants, outdoor WAP's are required to have Lightning Arresters installed as a wall mount in the associated LAN room. CAT6A cable from the outdoor AP to be connected into the Lightning Arrester and before the patch panel. Where not practical or feasible to install the Lightning Arrester near the patch panel, the Lightning Arrester can be installed near the outdoor AP. Contractors will work with the University's Project Manager or delegate to agree upon the mounting methods and location. The approved Lightning Arrester is L-Com Model: HGLN-CAT6AJ. Any substitution of equipment will be proposed by the contractor and approved by the University's Project Manager.

Outdoor Aruba AP



Fig 1. Images of an Aruba AP 565 and with mounting bracket



Fig 2. Images of an installed Aruba AP 565 with grounding

PART 1 GENERAL

1.1. PROJECT CLOSEOUT SUBMITTALS

- 1.1.1. Project closeout submittals shall include:
 - 1.1.1.1. As-built drawings
 - 1.1.1.2. Commissioning test results and reports for each device, each system, and each function
 - 1.1.1.3. Systems settings, configuration, and documentation
 - 1.1.1.4. Operation and Maintenance Manuals
 - 1.1.1.5. Warranty Letters and Certificates
- 1.1.2. Cyber Security Report Letter Clearly mark all changes and deviations on construction drawing(s) during the construction process, include all conduit and cable pathways to and from equipment.
- 1.1.3. As-built drawing(s) shall be kept up-to-date during construction.
- 1.1.4. The as-built drawing(s) shall also include all additional devices and cables installed during the project. The Electronic Safety and Security Engineer's Representative shall be permitted to review the status of the as-built drawing(s) from time to time during the construction process. On completion of the project, forward to the Electronic Safety and Security Engineer's Representative electronic drawings indicating all such changes and deviations for review within 10 business days of the completion of the project.
- 1.1.5. Request (via email) from the Electronic Safety and Security Engineer's Representative soft copy of drawings for use in preparation for Record Drawings.
- 1.1.6. Return record drawing(s) via secure file transfer using the latest native drawing file format or better. If this requirement cannot be met, Smith + Andersen will update all hand-drawn Record Drawings to the native drawing file format. The cost for this service shall be based on Smith + Andersen's per diem rates at the time of completion. Pay for all costs associated with this work.
- 1.1.7. The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) are provided.

1.2. SUBMITTALS – TESTING, AND COMMISSIONING

- 1.2.1. Provide testing and commissioning documentation in soft format for all items and their related components to the Electronic Safety and Security Engineer's Representative before the completion of the project or at the Electronic Safety and Security Engineer's Representative's request. Include maintenance manuals and operating instructions for the Owner's staff use.

1.3. PERMITS, LICENSE REVIEWS, AND FEES

- 1.3.1. Where materials are specified which require special approval of CSA or local authorities obtain such approval for the particular installation with the co-operation of the material supplier.
- 1.3.2. Submit required documents and shop drawings to authorities having jurisdiction to obtain approval for the work. Prepare any additional information, details, and drawings that these authorities may require.

1.4. ALTERNATE PRODUCT

- 1.4.1. This document specifies the use of complete end-to-end Electronic Safety and Security Systems as manufactured, warranted, and certified by a single manufacturer. Alternate materials (from the overall system) will not be accepted unless specifically noted.

- 1.4.2. Where the supply of the materials would compromise the schedule, submit a request to use an alternate product to the Electronic Safety and Security Engineer's Representative. Depending on the circumstance, the Electronic Safety and Security Engineer's Representative may provide written authorization to substitute the Product. The written authorization shall be obtained before alternatives are purchased or installed.

1.5. SCHEDULING

- 1.5.1. Within one week of award of the contract submit a formal project schedule to the Electronic Safety and Security Engineer's Representative showing start and finish dates of major tasks as denoted by System, material order, and delivery to site, installation, testing, and commissioning.
- 1.5.2. Updated schedules shall be submitted as periodically requested by Electronic Safety and Security Engineer's Representative.

1.6. PROJECT MANAGEMENT

- 1.6.1. Provide complete project management for this project. Complete project management shall include :
- 1.6.1.1. Develop a detailed Gantt chart project plan and submit it to the Owner and Electronic Safety and Security Engineer's Representative for review and approval before the start of the project.
- 1.6.1.2. Chair biweekly construction meetings for the duration of the project. Construction meetings shall be on-site or via conference call at the Owner's and or Electronic Safety and Security Engineer's Representative's discretion.
- 1.6.1.3. Generate and submit detailed biweekly construction progress reports to the Owner and Electronic Safety and Security Engineer's Representative. Each progress report shall include itemized detailed description and extent of tasks completed, itemized detailed description and quantification of materials installed, and labeled photos that clearly show the extent of construction progress.

1.7. PROJECT MEETINGS

- 1.7.1. Attend site meetings when requested by the Electronic Safety and Security Engineer's Representative and/or the Project Manager. Regular meetings may occur once per week at the Electronic Safety and Security Engineer's Representative's and/or the Project Manager's discretion.
- 1.7.2. Attend weekly project meetings throughout the project to review the status of current and planned activities, schedule, and conduct other business associated with the project.

1.8. PROGRESS REPORTS

- 1.8.1. Issue a status report at the weekly project meeting including the status of progress, project completion for phases, material ordering, and delays.

1.9. CLEANUP

- 1.9.1. Keep the site and surrounding area clean, safe, and free from debris at all times. Remove all debris from the site daily.
- 1.9.2. Upon completion of the work and before acceptance and final payment will be made, remove from the site, all surplus and discarded materials, temporary structures, and debris of every kind. Surplus and waste materials removed from the site shall be disposed of following applicable laws and regulations.

1.10. ACCEPTANCE

- 1.10.1. Before acceptance by the Electronic Safety and Security Engineer's Representative, all the equipment and cabling must be installed, cleaned, tested commissioned. At points of termination, all cabling and terminations must be labeled must be free of any cable pulling lubricants before acceptance by the Electronic Safety and Security Engineer's Representative.

1.11. REVIEW AND TESTING REQUIREMENTS

- 1.11.1. Develop testing and commissioning checklist for each system and submit it to the Electronic Safety and Security Engineer's Representative for approval 10 business days before commissioning commences.
- 1.11.2. The Electronic Safety and Security Engineer's Representative must approve the testing and commissioning procedure before the commencement of testing and commissioning and may request to be present.
- 1.11.3. The Electronic Safety and Security Engineer's Representative shall be invited to witness field testing and commissioning, and shall be notified of the start date of the testing phase 10 business days before testing and commissioning commences.
- 1.11.4. Test and commission all electronic safety and security systems.

1.12. LABOUR

- 1.12.1. Comply with all project job-site requirements for the duration of the project.
- 1.12.2. Do not assign or sub-contract any work without the prior written consent of the Project Manager. A list of sub-Contractors shall be submitted with the Tender response.
- 1.12.3. For all work related to this project, use only tradesmen who are fully trained, qualified, and experienced in the installation and commissioning of the Electronic Safety and Security Systems.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. CODES, STANDARDS, AND REGULATIONS COMPLIANCES

- 1.1.1. Adhere to the latest edition of all applicable Codes, Standards, Regulations, and documents listed throughout this document.
- 1.1.2. All products installed must meet or exceed all Local, Provincial, and Federal Building, Fire, Health, Safety, and Electrical Codes.
- 1.1.3. Non-plenum and plenum-rated cables shall be ETL or ULC (UL) Listed and CSA Certified as type CMR / CMP (respectively).
- 1.1.4. The equipment, material, and installation shall conform to the latest version of the applicable Codes, Standards, and Regulations of authorities having jurisdiction as indicated in the table below. In the case of conflict or discrepancy the more stringent code, standard or regulation shall apply.

| STANDARD | TITLE |
|------------------|--|
| ANSI/ICEA | |
| S-80-576 | Standard for Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for Use in Communications Wiring Systems Technical Requirements |
| S-83-596 | Optical Fibre Premises Distribution Cable, latest version |
| S-87-640 | Optical Fibre Outside Plant Communications Cable, latest version |
| S-104-696 | Standard for Indoor-Outdoor Optical Cable, latest version |
| Z136.2 | American Standards for the Safe Operation of Optical Fibre Communication Systems Utilizing Laser Diode and LED Sources |
| TIA/EIA | |
| 455-C | Optical Fibre Test Procedures |
| 568-1-D | Commercial Building Telecommunications Cabling Standard: General Requirements |
| 568-C.2 | Commercial Building Telecommunications Cabling Standard: Balanced Twisted Pair Cabling |
| 568-C.3-D | Commercial Building Telecommunications Cabling Standard: Optical Fibre Cabling Components Standard |
| 569-D | Commercial Building Standard for Telecommunications Pathways and Spaces including all addenda |
| 606-C | Administration Standard for Telecommunications Infrastructure |
| 607-C | Telecommunications Grounding (Earthing) and Bonding for Customer Premises |
| 758-B | Customer Owned Outside Plant Telecommunications Cabling Standard. |
| 862-B | Structured cabling infrastructure Standard for Intelligent Building Systems |
| RS232C | Interface between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange |
| RS485 | Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems |
| CSA | |

| | |
|-----------------------------|--|
| C22.1-18 | Canadian Electric Code Part I: Safety Standards for Electrical Installations. |
| C22.2 No. 182.4-M90 | Plugs, Receptacles, and Connectors for Communication Systems. R2015 |
| C22.2 No. 214-17 | Communications Cables |
| CAN/CSA-C22.2 No. 0-10 | General Requirements, Canadian Electrical Code, Part II (latest version) |
| CAN/CSA-C22.2 232-17 | Canadian Electric Code Part II: Optical Fibre Cables. |
| C22.2 NO. 205-12 | Signal Equipment |
| T527-94 | Grounding and Bonding for Telecommunications in Commercial Buildings |
| T528-93 | Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings. |
| T529-95 | Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings. |
| T530-99 | Building Facilities, Design Guidelines for Telecommunications |
| NFPA | |
| NFPA70 | National Electrical Code |
| OTHER | |
| CAN/ULC-S115:2018 | Standard Method of Fire Tests of Firestop Systems |
| CAN/ULC-S101-14 | Standard Method of Fire Endurance Tests of Building Construction and Materials |
| CAN/ULC-S102 latest version | Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies |
| CAN/ULC S316-14 | Standards for Performance of Video Surveillance Systems |
| CAN/ULC S319-05 | Electronic Access Control Systems |
| CLC | Canada Labour Code, Part II Occupational Health and Safety, and Provincial and Local Health and Safety regulations |
| UL 294 | The Standard of Safety for Access Control System Units |
| UL 365 | Police Station Connected Burglar Alarm Units and Systems |
| ULC1076 | Proprietary Burglar Alarm Units and Systems |
| UL 609 | The Standard of Safety for Local Burglar Alarm Units and Systems |
| UL 639 | Standard for Intrusion-Detection Units |
| UL 1610 | Standard for Central-Station Burglar-Alarm Units |
| ULC-S306-03 | The Standard of Safety for Intrusion Detection Units |
| UL 969 | Standard for Marking and Labeling Systems |
| UL 1037 | Standard for Antitheft Alarms and Devices |
| UL 1067 | Standard for Electrically Conductive Equipment and Materials for Use in Flammable Anesthetizing Locations |
| UL 1492 | Standard for Audio-Video Products and Accessories |
| UL 2044 | Standard for Commercial Closed-Circuit Television Equipment |
| CEC, Part 1 | The Canadian Electrical Code, Part 1 |
| CSA ISO/IEC 11801 | Information Technology: Generic Cabling for Customer Premises |
| ICEA S-80-576 | Individually Unshielded Twisted Pair Indoor Cable for Use in Communications Wiring Systems |
| IEEE Std 1100 | IEEE Specified Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book) |
| IEC 603-7, Part 7 | Detailed Specifications for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Schemes |
| ISO/IEC IS 11801A | Generic Cabling for Customer Premises |

| | |
|--------------------|--|
| WC 63.1 | Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System |
| OHSa | Occupational Health and Safety Act - R.S.O. 1990, c. 0-1 |
| UL 444 and 13 | Adopted Test and Follow-Up Service Requirements For The Optional Qualification of 100Ω Twisted-Pair. |
| CCTA | Canadian Cable Television Association |
| NCTA-02/89 rev. 93 | NCTA Specified Practices for Measurements on Cable Television Systems. |
| Industry Canada | ICES 003 Emissions |
| RoHs | Restriction of Hazardous Substances Directive 2011/65/EU |
| Subpart B | RF Emissions |
| CE Standards | EN 55022 RF Emissions |
| CE Standards | EN 55024 RF Immunity |
| FCC | Federal Communications Commission |
| FCC Part 15 | Radio Frequency Device |
| FCC Part 68 | Connection of Terminal Equipment to the Telephone Network |
| CE Standards | EN 60950-1 Equipment Safety |
| OESC | Ontario Electrical Safety Code – latest edition. |
| O.R. 388/97 | Ontario Fire Code – latest edition. |
| O.R. 403/97 | Ontario Building Code – latest edition. |
| Quebec | Canadian Electrical Code, – latest edition with Québec amendments |

- 1.1.5. Comply with applicable Electrical Safety Code, all Local, Provincial and Federal laws, where applicable, and with requirements of the Canadian Standards Association (CSA) when mandatory. Make any changes or alterations required by the authorized inspector of the authority having jurisdiction, at no extra charge to the Owner.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. CODE, STANDARD, AND REGULATION COMPLIANCES

- 3.1.1. All cables and components shall be installed and terminated following CSA. Particular attention shall be given to ensuring proper distance is kept from fluorescent light fixtures, electrical cables, or any other source of EMI. Cables shall be combed and bundled in a neat and organized manner. The Electronic Safety and Security Engineer's Representative will determine the neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at no extra cost. Coordinate with the Electronic Safety and Security Engineer's Representative before termination in any Telecom Rooms.
- 3.1.2. The maximum horizontal run length shall not exceed the equipment manufacturer's specifications. If the constraint cannot be met, notify the Electronic Safety and Security Engineer's Representative of any cables that exceed the equipment manufacturer's stated limitations. Include for rectification of the limitation in their bid. Rectifications shall include active and passive devices, signal boosters, signal extenders, protocol converts, installation of wire gauge suitable to the cabling length being installed, and/or a combination of the aforementioned.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Fire Stopping
 - 1.1.1.1. Provide seals in all Fire Rated Separations and Firewalls to form tight barriers to retard the passage of flame and smoke.
 - 1.1.1.2. The installed seals shall provide and maintain the fire-resistance rating of the adjacent floor, wall, or other fire separation assembly to the Code Requirements.
 - 1.1.1.3. Moisture seals as well as fire and smoke seals shall be required for all floor penetrations.
 - 1.1.1.4. Establish and or re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed.
 - 1.1.1.5. Supply and install Fire Stop pillows for existing cable tray penetrations through firewalls.
 - 1.1.1.6. For this specification, the only acceptable Fire Stop Systems shall be those that have been tested to the applicable ULC Standards.
 - 1.1.1.7. Supply and install non-permanent CSA approved Fire Stop systems that are dielectric, water-resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required).
 - 1.1.1.8. All fire stopping shall maintain a minimum one-hour rating and shall meet applicable Federal, Provincial and Local building codes.
 - 1.1.1.9. All Fire Stop Systems shall be listed and tested by an SCC and accredited Third-Party Testing Agency following the Standards.
 - 1.1.1.10. Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire-resistance rating of the surrounding Fire Separation or Firewall.
 - 1.1.1.11. All Smoke Seals selected for use shall comply with Standards.
 - 1.1.1.12. Where moisture seals are required for floor penetrations in Operating Rooms, Morgues, and Laboratories in Hospitals, Universities, and Schools, the Fire Stop Materials selected shall be compatible with Formalin.
 - 1.1.1.13. All Fire Stop Materials and Smoke Seals shall have elastomeric characteristics to allow for building settling and seismic movement. All Fire Stop Materials and Smoke Seals shall be free of asbestos.
- 1.1.2. Water Proofing
 - 1.1.2.1. Seal all foundation penetrating conduits and service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.
 - 1.1.2.2. All service entrance conduits through the building shall be sealed or resealed upon cable placement. Spare conduits shall be plugged with expandable plugs.
- 1.1.3. Quality Assurance
 - 1.1.3.1. Provide fire stopping systems that comply with the following requirements following:
 - 1.1.3.1.1. Fire stopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for fire stop system acceptable to authorities having jurisdiction.
 - 1.1.3.1.2. Fire stopping products bear the classification marking of qualified testing and inspection agency

- 1.1.3.2. Provide the work of this Section using competent installers, experienced in the application of the materials and systems being used, approved, and trained by the material or system manufacturer.
- 1.1.3.3. Fire Stop Systems shall conform to the fire (F), hose (H), and temperature (T) ratings of Codes.
- 1.1.3.4. Fire Stop Materials and Smoke Seal materials shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class "A").
- 1.1.3.5. For this specification, the only acceptable Fire Stop Systems are those that have been tested to the CAN/ULC S115 Standard.
- 1.1.4. Performance
 - 1.1.4.1. Fire-rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons, and changes will occur.
 - 1.1.4.2. Where non-mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during or after construction.
 - 1.1.4.3. Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.
 - 1.1.4.4. Openings for cable trays shall be sealed using re-enterable fire-stopping pillows.
- 1.1.5. Project Conditions
 - 1.1.5.1. Do not install fire stopping products when ambient or substrate temperatures are outside limitations specified by the manufacturer
 - 1.1.5.2. Do not install fire-stopping products when substrates are wet due to rain, frost, condensation, or other causes.
 - 1.1.5.3. Maintain minimum temperature before, during, and for a minimum of 3 days after installation of materials.
 - 1.1.5.4. Do not use materials that contain flammable solvents.
 - 1.1.5.5. Coordinate construction of openings and penetrating items to ensure that through-penetration fire stop systems are installed according to specified requirements.
 - 1.1.5.6. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.
 - 1.1.5.7. Schedule installation of fire stopping after completion of penetrating item installation but before covering or concealing of openings.

PART 2 PRODUCTS

2.1. GENERAL

- 2.1.1. Use only fire-stopping products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.2. MANUFACTURERS

- 2.2.1. Products manufactured by Hilti (or approved equivalent) are acceptable.
- 2.2.2. Obtain fire stop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.3. MATERIALS

- 2.3.1. Firestop Sealants: The following products are acceptable.
 - 2.3.1.1. Hilti FS-ONE high-performance Intumescent Firestop Sealant
 - 2.3.1.2. Hilti CP 601S Elastomeric Firestop Sealant.
 - 2.3.1.3. Hilti CP 606 Flexible Firestop Sealant
 - 2.3.1.4. Hilti CP 604 Self-Leveling Firestop Sealant
- 2.3.2. Cast-In Firestop Device: A one-step cast-in firestop device for a variety of pipe materials and diameters. The following product is acceptable.
 - 2.3.2.1. Hilti CP 680-M Cast-in Firestop Device
- 2.3.3. Firestop Putty: An intumescent, non-hardening, firestop putty for cable and pipe penetrations. The following product is acceptable:
 - 2.3.3.1. Hilti CP 681 Firestop Putty Stick.
- 2.3.4. Firestop Plug: Ready-to-use intumescent and reusable plug for small openings. The following product is acceptable:
 - 2.3.4.1. Hilti CP 658T Firestop Plug.
- 2.3.5. Fire Rated Cable Pathways: Re-penetrable cable management device:
 - 2.3.5.1. Hilti CP 653 Speed Sleeve.

PART 3 EXECUTION

3.1. FIRE STOPPING

- 3.1.1. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for the installation of fire stopping following the manufacturer's installation instructions and technical information
- 3.1.2. Examine sizes and conditions of Fire Stop Material voids. Fill and or correct Fire Stop Materials to eliminate voids.
- 3.1.3. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion
- 3.1.4. Prepare surfaces in contact with Fire Stop Systems and Smoke Seals to manufacturer's instructions. Mask where necessary to avoid spillage and overcoating onto adjoining surfaces; remove stains on adjacent surfaces.
- 3.1.5. Install/replace sound barrier/fire stopping materials as soon as cables have been pulled through the opening.
- 3.1.6. In all Fire Stop Systems that require mineral wool or ceramic fibre backer or filler materials, these materials shall be dry and free of other contaminants before, during, and after installation of sealant Fire Stop Materials. Alkaline water contamination of the backer or filler materials may cause corrosion of metallic penetrating items.
- 3.1.7. Apply Fire Stop Systems and Smoke Seals in strict accordance with manufacturer's instructions to prevent the passage of fire and smoke, and where required or specifically designated, the passage of fluids
- 3.1.8. Provide temporary forming and packing as required. Tool or trowel all exposed surfaces to a smooth, tidy finish.

- 3.1.9. Fire Stop and smoke seal gaps and holes in all Fire Separation and Firewall construction through which cables pass as a result of work in this document.
- 3.1.10. In Combustible Construction (membrane GWB type) where the framing members are wood or where paper-faced insulation is incorporated within the separation, a Fire and Temperature rise "FT" rating is required equal to that of the rating of the Fire Separation. Include openings that have been formed and sleeved.

3.2. WATERPROOFING

- 3.2.1. Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with hydraulic cement or waterproof duct seal.

3.3. EXPOSED SERVICE PENETRATIONS IN CEILING OF UNDERGROUND PARKING AREAS

- 3.3.1. Where the bottom of a Fire Stop System is exposed, seal the bottom side of the assembly with a fire-rated elastomeric Fire Stop sealant.

3.4. CLEAN UP

- 3.4.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of the Project Manager. Remove and or correct staining and discoloring of adjacent surfaces as directed.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Conform to the requirements of Divisions 0 and 1, which apply to and form part of all sections of the work.
- 1.1.2. Security Specifications shall be read in conjunction with University of Toronto's Security and Access control Systems Specifications Document. (**University of Toronto Security and Access control Specifications Standard Rev 2**)
- 1.1.3. Where there is a conflict between the requirements outlined in this Electronic Safety and Security specifications document and requirements indicated in Divisions 0 and 1 the more stringent and/or more onerous requirement shall apply.
- 1.1.4. Read and comply with all sections of this document.
- 1.1.5. The Specification is divided into Sections that are not intended to identify contractual limits between Sub-Contractors nor between the Contractor and Sub-Contractors. The requirements of anyone Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.
- 1.1.6. Provide Electronic Safety and Security components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.
- 1.1.7. Provide all labour, materials, tools, and equipment required for the complete installation, commissioning and start-up of Electronic Safety and Security systems called for in all sections of the Contract Documents.

1.2. SECTIONS AFFECTED

- 1.2.1. These instructions apply to and form a part of all Electronic Safety and Security Sections.

1.3. SCOPE OF WORK

- 1.3.1. Include all necessary wiring, cabling, labor, tools, equipment, and ancillary materials required to furnish and install complete and operational Electronic Safety and Security Systems.
- 1.3.2. This specification includes a general description as well detailed functional and technical requirements for the Electronic Safety and Security Systems.
- 1.3.3. This specification provides all information necessary to produce a complete proposal for scalable multi-user, multi-tasking Electronic Safety, and Security Systems. The Electronic Safety and Security Systems shall include all computer hardware and software, controllers, interfaces, card readers/keypads, credentials, alarm sensing devices, communication devices, electric door locking hardware, power supplies, cable/wire, conduit, raceways, enclosures, mounting hardware, and all other equipment as indicated on contract drawings and as specified herein. Except where noted to reuse existing, all materials shall be new, commercial-grade, and of good quality.
- 1.3.4. This document is the Specification for the supply and installation of Electronic Safety and Security Systems for the following project:
- 1.3.5. This project consists of the complete supply, installation, and commissioning of the following Electronic Safety and Security systems:
 - 1.3.5.1. Access Control
 - 1.3.5.2. Video Surveillance System

- 1.3.6. All Electronic Safety and Security systems supplied and installed shall be turnkey complete and fully operational. All Electronic Safety and Security systems shall be integrated as per the contract drawings and specifications.
- 1.3.7. The Electronic Safety and Security Systems shall be installed based on the drawing documents provided herewith.
- 1.3.8. All cables for the Electronic Safety and Security Systems shall be installed via conduits and or cable tray.
- 1.3.9. The scope of work shall include but shall not be limited to:
 - 1.3.9.1. Supply and installation of all active and passive hardware and cables as specified within this document to support the Electronic Safety and Security Systems.
 - 1.3.9.2. Where active and passive hardware and cabling are not specified but are required to make the Electronic Safety and Security Systems turnkey and to meet the intent, supply, and install such active and passive hardware and cabling at no extra cost.
 - 1.3.9.3. Supply and installation of equipment cabinets, complete with all accessories.
 - 1.3.9.4. Supply and installation of backboards.
 - 1.3.9.5. Supply and installation of all fire stop materials/mechanisms for all penetrations.
- 1.3.10. While every attempt has been made to ensure that all information is correct at the time of publication, the products specified are available, and that the part numbers identified are correct, verify all part numbers and report any errors and omissions in this Specification with their bid submissions.
- 1.3.11. This document and all related drawings shall be read in conjunction with the project-related Door Schedule and Door Hardware Schedule.
- 1.3.12. Dimensions shown on Contract Drawings are approximate. Verify dimensions by reference to shop drawings and field measurements.
- 1.3.13. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.
- 1.3.14. Include in bid all labour, materials, plant, transportation, storage costs, training, equipment, insurance, temporary protection, permits, reviews, bonding, taxes, and all necessary and related items required to provide a complete and operational Electronic Safety and Security Systems.

1.4. INTENT

- 1.4.1. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.
- 1.4.2. Be completely responsible for the acceptable condition and operation of all systems, equipment, and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment, and repair related damages. The replacement of equipment and repair to damages shall be coordinated with other trades completed in a timely fashion so as not to affect the complete construction of the Electronic Safety and Security Systems and/or work by others.

1.5. DRAWINGS, CHANGES, AND INSTALLATION

- 1.5.1. The drawings are intended to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.

- 1.5.2. The location, arrangement, and connection of equipment and material as shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Electronic Safety and Security Engineer's Representative to make changes required to accommodate conditions arising during the progress of the work, at no extra cost.
- 1.5.3. Certain details indicated on the drawings are general and specific labeled detail references to each occurrence of use are not indicated, however, such details shall apply to every occurrence on the drawings.
- 1.5.4. The location and size of existing services shown on the drawings are based on the best available information. Verify the actual location of existing services in the field before commencing work.
- 1.5.5. At no extra cost, make all changes and modifications necessary to ensure coordination and to avoid interference and conflicts with other trades, or to accommodate existing conditions.
- 1.5.6. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.
- 1.5.7. Leave adequate space and provisions for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.5.8. Where equipment is shown to be 'roughed in only' obtain accurate information from the Electronic Safety and Security Engineer's Representative before proceeding with the work.
- 1.5.9. The location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers, and all other equipment shown on drawings (if shown) is diagrammatic.
- 1.5.10. Remedy any work not installed in the correct location. Mark out work and fully coordinate with all other trades. Review with Electronic Safety and Security Engineer's Representative before rough-in. Prepare dimensioned layouts of each room before rough-in for review by Electronic Safety and Security Engineer's Representative. Do not proceed with any work until the Electronic Safety and Security Engineer's Representative has reviewed and approved the layout drawings.

1.6. APPROVED EQUAL

- 1.6.1. Wherever the term "or approved equal" and or "approved equivalent" is used herein, it is to be understood that reference to the specified trade name, brand name, manufacturer's name, model number, and catalog number has been made solely to indicate the minimum standard of quality required in material, workmanship, and service. Any proposed alternate shall be submitted for review and acceptance before procurement and installation. The review and acceptance shall be at the sole discretion of the owner and their Engineer's Representatives.

1.7. SUBSTITUTIONS

- 1.7.1. Proposed substitutions to be assessed must include the following:
 - 1.7.1.1. Description of proposed substitution;
 - 1.7.1.2. Respective cost of items originally specified and the proposed solution;
 - 1.7.1.3. Compliance with the applicable Building Codes and the requirements of jurisdictional authorities;
 - 1.7.1.4. Compliance with the applicable standards;
 - 1.7.1.5. Affect concerning compatibility with and interface with adjacent building materials and components;
 - 1.7.1.6. Compliance with the intent of the Contract Documents;
 - 1.7.1.7. Reasons for the request.

- 1.7.2. The Electronic Safety and Security Engineer's Representative's decision regarding the acceptance or rejection of the proposed substitution shall be final. Substitutions may be accepted if the delivery of the component or item is such that it will not jeopardize the construction schedule. Otherwise, substitution will not be allowed.

1.8. CONFLICTING REQUIREMENTS

- 1.8.1. In the case of conflict or discrepancy in the requirements indicated in the contract documents the more stringent and/or more onerous requirement shall apply.

1.9. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

- 1.9.1. Materials and equipment supplied by this Division shall be new and free from defects.
- 1.9.2. All equipment and material for which there is a listing service shall bear a UL/ULC and/or CSA and/or ESA label.
- 1.9.3. Equipment shall meet all applicable FCC/CRTC Regulations.
- 1.9.4. Materials shall have a flame spread rating of 25 or less and a smoke-developed rating of 50 or less, following NFPA 255.

1.10. COOPERATION WITH OTHER DIVISIONS

- 1.10.1. Electronic Safety and Security cabling shall not touch or be supported from piping, ductwork, conduits, ceiling supports, or any other structure/equipment.
- 1.10.2. Supply all items to be built in ample time for the rapid progress of the work. Schedule and proceed with work as required to satisfy the construction schedule.

1.11. EXISTING SERVICES AND EQUIPMENT

- 1.11.1. All changes and connections to existing services shall be made only in a manner and at a time approved by the Safety and Security Engineer's Representative and/or the Owner to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal working hours, at no extra cost to the Contract.
- 1.11.2. Where connections are made to existing services, existing fire stopping shall be made good under this Division.

1.12. METRIC CONVERSIONS

- 1.12.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, equipment, material, and site services in both new and existing installations.

1.13. SCHEDULE, ACCESS, PROTECTION, AND CLEAN-UP

- 1.13.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.
- 1.13.2. Refer to the General Conditions and conform to all requirements.
- 1.13.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. There shall be no smoking, and the site shall be kept clean at all times.

1.14. CUTTING, PATCHING, AND REPAIRING

- 1.14.1. Perform all cutting, patching, repair, and making good related to the Electronic Safety and Security Systems work including any penetrations through walls or floors.
- 1.14.2. Allow for all costs associated with cutting, patching, repair, and making good related to the Electronic Safety and Security Systems work including any penetrations through walls or floors.

- 1.14.3. Paint all visible Electronic Safety and Security systems conduit to match existing.
- 1.14.4. Coordinate the color and location of all conduits, security devices, and their housing with architect and architectural drawings on-site 9before installation.

1.15. HOISTING FACILITIES

- 1.15.1. Provide all hoisting required to perform all work.

PART 2 PRODUCTS

2.1. ELECTRONIC SAFETY AND SECURITY SYSTEMS

- 2.1.1. Provide all materials as required for complete turnkey, end-to-end Electronic Safety and Security Systems.
- 2.1.2. Fasteners
 - 2.1.2.1. Provide security tamperproof fasteners for all visible exposed devices, equipment, and components in all areas. Coordinate fastener type with the Owner.

PART 3 EXECUTION

3.1. PRODUCT DELIVERY REQUIREMENTS

- 3.1.1. Unload materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of the cable shall not be unloaded by dropping them off the vehicle.

3.2. PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

- 3.2.1. Be responsible for the assembly of equipment/materials, protection of equipment, and related items until the project cutover. Be responsible for any damage to equipment. All damage shall be repaired at the Owner's request, the equipment shall be replaced at no extra charge to the Owner.

3.3. ELECTRONIC SAFETY AND SECURITY SYSTEMS

- 3.3.1. Supply and install complete turnkey, end-to-end Electronic Safety and Security Systems.

3.4. WARRANTY MAINTENANCE SERVICES

- 3.4.1. Provide a Warranty for the completed work to be free of defects in workmanship and materials for 2 years from the date of system acceptance. If the workmanship or materials is found to be defective or not following the contract documents during the warranty period, correct it promptly with factory-certified technicians at no cost. Provide all labor and materials to facilitate correction.
- 3.4.3. Warranty shall cover all installation for the Electronic Safety and Security Systems including all hardware, hardware configurations, software, software configurations, wiring/cabling, conduit, pathways, and all active and passive components.
- 3.4.4. Provide maintenance at no extra cost during the warranty period. The maintenance shall include:
 - 3.4.4.1. Execute system health check every 6 months during the warranty period on all systems components including devices, cabling all passive and active hardware all software, and firmware. Correct all defects and make all corrections to components and software to ensure the entire system is functioning optimally and according to the manufacturer's recommendations.

3.5. GENERAL REQUIREMENTS

- 3.5.1. Provide all services required and equipment necessary to maintain all operations of the installed Electronic Safety and Security Systems during the period of the warranty.

3.6. SOFTWARE

- 3.6.1. Provide all available software and firmware updates during the period of the warranty and verify operation in the system. All updates shall be accomplished on time, fully coordinated with the Owner's representatives, shall include training for the new changes/features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

3.7. DESCRIPTION OF WORK

- 3.7.1. Provide respective systems manufacturer's required scheduled and unscheduled maintenance and all other work necessary to keep the system at its maximum performance.

3.8. PERSONNEL

- 3.8.1. Service personnel shall be factory certified in the maintenance and repair of the system equipment installed under this specification. The Owner shall be advised in writing of the name of the designated service representative, and any change in personnel.

3.9. RECORDS AND LOGS

- 3.9.1. Maintain records and logs of each task performed. Organize cumulative records for each component and the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection on-site, demonstrating that planned and systematic adjustments and repairs have been accomplished.

3.10. WORK REQUESTS

- 3.10.1. Record separately each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of the trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within five (5) days after work is accomplished.

3.11. SYSTEM MODIFICATIONS

- 3.11.1. Make any recommendations for system modification in writing to the Owner. No system modifications shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

END OF SECTION

PART 1 GENERAL

1.1. TRAINING

- 1.1.1. Include for adequate training of a minimum of 4 operations personnel on the operation and maintenance of the Electronic Safety and Security Systems. The training shall be a minimum of eight (8) hours of instruction in two (2) 4-hour segments.
- 1.1.2. Coordinate with the Owner to configure and or reconfigure and populate and or repopulate all Electronic Safety and Security system-related databases, configure and or reconfigure all the systems parameters to the Owners' satisfaction, until initial databases are complete and functional, and until all the security system parameters are working to the Owners satisfaction. Provide one technician to work side-by-side with the Owner's representatives to assist and instruct the Owner's representatives with further customization of all systems functionalities to the Owner's satisfaction.
- 1.1.3. The training shall include oral and written presentations and onsite system interactive training sessions that ensure operational competency of operations personnel on each Electronic Safety and Security system.
- 1.1.3.1. Provide an electronic of maintenance manuals and operating instructions. This shall include comprehensive descriptive datasheets, brochures, and technical manuals for all systems and equipment forming part of the contract. The manuals shall include wiring and schematic diagrams for the Electronic Safety Security System and all related subsystems.
- 1.1.3.2. For each Electronic Safety and Security subsystem, Provide an A4 laminated sheet with short-form operating instructions on one side, and a site diagram showing systems components on the other.
- 1.1.3.3. Submit a full schedule of maintenance that shall be carried out on each Electronic Safety and Security system during the warranty period and under subsequent maintenance contracts.
- 1.1.4. Training shall cover all aspects of all the systems under the electronic safety and security scope.
- 1.1.5. Provide video files and training material files for all training sessions via secure file transfer for later use by the Owner.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. DESCRIPTION OF SYSTEM

1.2.1. Provide raceways and back boxes only for this security system. A complete security system shall be supplied and installed by others.

PART 2 PRODUCTS

2.1. SECURITY SYSTEM

2.1.1. The security system will be tendered by Division 28, security contractor. Coordinate with the security consultant, which division supplies and installs the wiring and cables, and which division installs and terminates the devices.

PART 3 EXECUTION

3.1. INSTALLATION

3.1.1. Install conduits and back boxes only.

END OF SECTION

PART 1 GENERAL

1.1. FLOOR/CEILING TILES

- 1.1.1. Allow for the removal and re-installation of all floor/ceiling tiles in areas affected by their work. This shall be done daily for all areas that are occupied during the construction period. Otherwise, remove and re-install the tiles after their work is complete.
- 1.1.2. Replace all soiled and or damaged ceiling tiles during the installation of any work described in this document. Damages include chipping, breaking, or fingerprints. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Project Manager and/or the Electronic Safety and Security Engineer's Representative.
- 1.1.3. Store and protect all floor/ceiling tiles when they have been removed from the floor/ceiling grid.

1.2. SAFETY OF PERSONS AND PROPERTY

- 1.2.1. Comply with all laws, ordinances, rules, regulations, policies of the Owner, and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss.
- 1.2.2. Moderate public pedestrian traffic should be expected around all work locations. Ladders scaffold, installation materials, and all other hazardous conditions shall be fully protected at all times. Warning cones, signs, barricades, and warning tapes shall be used to warn and protect persons and property at all times in public corridors.
- 1.2.3. Work shall not interfere with legal fire exits. Corridors, areas of egress, fire protection standpipes, hydrants, and exit stairs shall be maintained at all times.
- 1.2.4. No open flames/smoking shall be permitted without the prior written approval of the Owner.
- 1.2.5. Set up and remove all signage and safety measures to ensure that other trades and non-trade personnel are safe from all work being performed.

1.3. ACCESS TO SITE

- 1.3.1. Coordinate site access with the General Contractor and Owner as determined during the initial project meeting.

1.4. IDENTIFICATION

- 1.4.1. All personnel shall be identified by either uniform or company ID. In addition, wear Owner provided ID for required card access locations or identification. All Owner ID must be returned daily or at the end of the project as determined by the Owner.

1.5. EMERGENCY FACILITIES

- 1.5.1. Maintain at all times free access to fire lanes and emergency and utility control facilities such as fire alarm boxes, utility vaults, manholes, and junction boxes.

1.6. PRODUCT DELIVERY REQUIREMENTS

- 1.6.1. Allow for complete delivery, handling, and installation of all materials used in the performance of the work.
- 1.6.2. Arrange for the delivery of Owner furnished equipment/materials related to this Specification and related items, including unloading of supplier's truck, elevator scheduling, and placement on Owner premises as indicated on Contract Drawings.

1.7. PRODUCT AND TOOLS STORAGE REQUIREMENTS

- 1.7.1. Allow for complete storage and handling of all materials used in the performance of the work.
- 1.7.2. Storage of job boxes on the site during construction may be allowed by the Owner. Coordinate the storage of job boxes onsite with the Owner. The Owner and his representatives shall be in no way responsible for any stored tools and or materials.

1.8. CONFINED SPACES

- 1.8.1. Comply with all code-related and Owner specific safety requirements when performing work in a confined space.

1.9. CO-ORDINATION WITH OCCUPANTS

- 1.9.1. Coordinate all work with the Owner/tenant of the floor space for their daily work.

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. PRODUCT DELIVERY REQUIREMENTS

- 3.1.1. Unload materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2. PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

- 3.2.1. Assemble the above equipment/materials and protect the above equipment and related items until the project cutover. Replace all damaged equipment at no extra charge.

END OF SECTION

PART 1 GENERAL

1.1. NOT USED

PART 2 PRODUCTS

2.1. RECORD DRAWINGS

2.1.1. Request in writing from the Engineer's Representative all Contract Drawings in native drawing file format (AutoCAD, Revit, .pdf, etc.) required to complete the Record Drawings. Complete the attached form and pay the Engineer's Representative directly the costs identified within the form before receiving the Contract Drawings. After the final Record Drawings have been reviewed, provide a copy of the drawings via secure file sharing utility. Provide a copy to the Engineer's Representative for their records and a copy with each set of operation and maintenance manuals. Provide additional copies if required under the General Conditions. Use the latest release of the native drawing file format software.

2.1.2. The Record Drawings shall include :

2.1.2.1. native drawing file format and .pdf copies of Site and Floor Plans indicating locations of all devices

2.1.2.2. native drawing file format and .pdf copies of Point-to-point wiring schematics of all systems and subsystems

2.1.2.3. native drawing file format and .pdf copies of Elevations of all rack, cabinets, and backboard showing details device mounting

2.1.2.4. MS Word/Excel and .pdf copies of All related schedules

2.1.2.5. MS Word/Excel and .pdf copies of Testing and commissioning documentation for all devices

2.1.3. Identify the cost of Record Drawings and the Operation and Maintenance Manuals as a separate line item on progress draw. The following values are to be broken out:

| | |
|----------------|---|
| \$3,500 | For Contracts up to \$250,000 |
| 2% of Contract | For Contracts from \$250,000 to \$1,500,000 |

2.1.4. The project will remain incomplete and no money will be released until the final electronic versions of Commissioning Test Results, As-built Drawings and Operations and Maintenance Manuals are received.

2.1.5. Final Record Drawings shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Architect and Engineer must be deleted from the drawings.

2.1.6. Final Record Drawings shall include all revisions made to the drawings during construction, including all approved changes. The Record Drawings shall also include the routing of all feeders except for branch circuits. Include slab layout drawings in the as-built drawing package.

2.1.7. Drawings Requirements:

2.1.7.1. All Record Drawings shall be prepared using the Owner's drawings standards. Obtain the Owner's drawing standards from the Owner before preparing Record Drawings

2.1.7.2. A complete list of layer names and a brief description of each layer's use shall accompany all files.

2.1.7.3. Final Record Drawings drawings shall be returned via secure file transfer.

2.1.7.4. Each file shall be dated and named with Engineer's Representative and Owner, Contract number, file names, and Drawing number.

2.1.7.5. All drawings shall be in the same units as issued on Bid Documents.

- 2.1.7.6. Provide a complete list of symbol (block) names with a description of each symbol.
- 2.1.7.7. Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.
- 2.1.8. Maintain hard or electronic copy of drawings on-site on which mark as the job progresses, all changes and deviations from that shown on Contract Drawings.
- 2.1.9. On completion of the building, forward to the Engineer's Representative electronic copy of final drawings indicating all such changes and deviations for review by the Engineer's Representative.

PART 3 EXECUTION

3.1. NOT USED

Project Name: _____

attention: _____

Project No.: _____ Date: YYYY-MM-DD _____ Issued by: _____

Conditions for Limited Use of Drawings

Authorization for limited use of the drawing files listed below is hereby granted, subject to the following conditions. The signing of this form constitutes acceptance and agreement with the conditions and limitations.

Copyright is reserved. The drawing and design contained in the drawing file is at all times the exclusive property of the Architect/Engineer and shall not be used without the Architect/Engineer's written consent.

The drawing file may not be used wholly or in part for any purpose other than the intended use as stated on this form. Copying or distribution of this drawing file in whole or in part to parties other than those signing below is not allowed.

The file represents drawings that were prepared primarily to obtain tender prices. The drawings may or may not incorporate subsequent revisions, change orders, or addenda that have modified the drawings. files obtained from different disciplines may not be fully updated and coordinated with other disciplines and must be verified from the tender documents. The Architect/Engineer assumes no liability for errors or omissions in the drawing files. The authorized user assumes all risk and expense associated with the use of the drawing files in the production of his work.

References to the Architect and Engineer must be deleted from the drawings.

Please indicate a P.O. Number for charges associated with administrative costs to provide requested drawings.

| | | | | |
|-----------------------------|--|---------------|--|--------------------------------|
| Our charges are as follows: | \$50.00 each for the first 5 drawings | | | |
| | \$20.00 for each additional drawing from 6 to 19 | | | |
| | \$500.00 for 20 drawings or more | | | |
| List of requested drawings: | | | | |
| Total No. of Drawings: | | Total Charge: | | + GST or HST, as applicable |

Intended use (Shop drawings, As-built drawings, Installation and Interference drawings, etc.) _____

E-mail (please provide e-mail address) _____

Email address to have a link sent to (one-time download). A cheque in the above amount shall be payable to Smith + Andersen or indicate the PO information below. Please sign and email this form to the sender or info@smithandandersen.com acknowledging the above charges and Conditions for Limited Use of Drawings

Accepted by: _____
Signature

Name (print or type)

Company Name

P.O. #

Company Address

Phone #

c.c. Accounting ; (Project Principal) – Smith + Andersen

END OF SECTION

PART 1 GENERAL

1.1. NOT USED

PART 2 PRODUCTS

2.1. SUBMITTALS/SHOP DRAWINGS

- 2.1.1. Submittals/Shop Drawings shall indicate the materials and/or equipment being supplied, all details of construction, accurate dimensions, capacity, operating characteristics, and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. B-P2-AAA).
- 2.1.2. All shop drawings shall identify the specific model number of equipment being supplied.
- 2.1.3. Each Shop Drawing for non-catalog items shall be prepared specifically for this project. Shop Drawings data sheets and brochures for catalog items shall be marked clearly to show the items being supplied.
- 2.1.4. Each Shop Drawing or catalog sheet shall be stamped and signed to indicate that the shop drawing has been checked for conformance with all requirements of the contract drawings and specifications, that all proposed materials have been coordinated with other equipment to which it is attached, and/or connected and that all dimensions have been verified to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that all electrical, mechanical, and architecture coordination are complete before submitting drawings for review.
- 2.1.5. Shop Drawings shall include:
 - 2.1.5.1. Catalogue datasheets for each product that will be provided
 - 2.1.5.2. Detailed schematic riser drawings indicating the physical and logical connectivity of each system and how each product will be implemented in the physical and logical connectivity of each system.
 - 2.1.5.3. A system narrative explaining the physical and logical connectivity of each system as well as the functionality of each system.
 - 2.1.5.4. Detailed floor plan drawings with a legend indicating the location of each device that will be installed. An itemized shop drawing index with a summary list of items being submitted for review. The list shall indicate Item Number, Item Manufacture and Model Number and Item name and a Review Comments Column.
 - 2.1.5.5. All additional requested information as determined by the Engineer's Representative

PART 3 EXECUTION

- 3.1.1. Submit all submittals/shop drawings electronically in PDF format. Submittal shall be complete with a transmittal bound to the PDF file with the transmittal identifying the total number of pages in the submittal including the transmittal page.
- 3.1.2. Installation of any equipment shall not start until after the Engineer's Representative has reviewed Shop Drawings.
- 3.1.3. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation
- 3.1.4. Provide space for Shop Drawing review stamps for Engineer's Representative. This space shall be clear of all technical information and shall not be on the back of any sheets.
- 3.1.5. One original Shop Drawing will be returned electronically.

END OF SECTION

PART 1 GENERAL

1.1. DEFINITIONS

1.1.1. Generally, the following definitions are used in this Division:

| | | |
|--|---|--|
| Addendum | - | Normative document used to provide additional requirements and recommendations to a published document (e.g., standards, contracts). When published, an addendum effectively becomes part of the document that it supports. |
| Bonding | - | The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed. |
| Bonding Conductor (BC) | - | A conductor is used specifically for bonding. |
| Building Entrance Facility | - | The room or space inside a building where telecommunications cables enter and leave the building. |
| Electronic Safety and Security Contractor | - | The successful bidder to this Specification responsible for the supply and installation of the Integrated Electronic Safety and Security Systems. |
| Change Notice | - | Normative document approved to provide additional requirements and recommendations that describe and authorize the implementation of an engineering change to the product and its approved configuration documentation. |
| Contemplated Change Notice | - | Normative document to provide additional requirements and recommendations that describes the implementation of an engineering change to the product and its approved configuration documentation for pricing. This document does not authorize the implementation of a change to the product and its approved configuration documentation. |
| Electronic Safety and Security Engineer's Representative | - | Salwan Ramo Smith + Andersen 1100 – 100 Sheppard Ave. East Toronto ON M2N 6N5 |
| Cut Over | - | The live date(s) when the Owner will occupy the space as indicated by date and/or phasing. |
| Contract Documents | - | All Electronic Safety And Security Systems / Security, Electrical, Architectural, Mechanical and Structural Drawings and specifications and schedules issued about this project including any future changes and revisions of said documents. |
| Contract Drawings | - | All Electronic Safety And Security Systems / Security, Electrical, Architectural, Mechanical and Structural Drawings issued about this project including any future changes and revisions of said documents. |
| Grounded Conductor | - | A system or circuit conductor that is intentionally grounded. |
| Grounding System | - | A system of hardware and wiring that provides an electrical path from a specified location to an earth-ground point. |
| Project | - | Supply and installation of a complete Integrated Electronic Safety and Security Systems as described in this document. |
| Provide | - | Supply, install and configure as per contract documents. |

| | | |
|--------------|---|--|
| Shop Drawing | - | Drawings, diagrams, illustrations, schedules, performance charts, and other data prepared by the contractor illustrate how specific portions of the work shall be installed. This includes point to point high-level integration diagram, riser diagram, termination diagram, panel layout, door types, and product datasheet. |
|--------------|---|--|

1.2. ABBREVIATIONS

1.2.1. Generally, the following abbreviations are used in this Division:

| | | |
|--------|---|--|
| A | - | Ampere |
| ac | - | Alternating current |
| ACR | - | Attenuation to Cross-Talk Ratio |
| ADC | - | Analog to Digital Converter |
| ADSL | - | Asymmetric Digital Subscriber Line |
| A/E | - | Architect or Engineer |
| AFF | - | Above Finished Floor |
| AHJ | - | Authority Having Jurisdiction |
| ALPETH | - | Aluminum Polyethylene |
| AME | - | Architectural, Mechanical, Electrical |
| AN | - | Access Node |
| ANSI | - | American National Standards Institute |
| AP | - | Access Point |
| ARPAP | - | Resin-coated Aluminum, Polyethylene Aluminum, Polyethylene |
| ASCII | - | American Standard Code for Information Interchange |
| ASP | - | Aluminum Steel Polyethylene |
| ASTM | - | American Society for Testing and Materials |
| ATD | - | Asynchronous Time Division |
| ATDM | - | Asynchronous Time Division Multiplexing |
| ATM | - | Asynchronous Transfer Mode |
| Attn | - | Attenuation |
| AV | - | Audiovisual |
| AWG | - | American Wire Gauge |
| BAS | - | Building Automation System |
| BC | - | Bonding Conductor |
| BCD | - | Backbone Conduit |
| BCT | - | Bonding Conductor for Telecommunications |
| BEF | - | Building Entrance Facility |
| BER | - | Bit Error Rate |
| BERT | - | Bit Error Rate Test |
| BFOC | - | Bayonet Fibre Optic Connector |
| BIC | - | Building Industry Consultant |
| BICSI® | - | Building Industry Consulting Service International |
| bit | - | Binary Digit |
| BOM | - | Bill Of Material |
| b/s | - | Bit per Second |
| BWA | - | Broadband Wireless Access |
| CA | - | Cable |
| CACSP | - | Coated Aluminum Coated Steel Polyethylene |
| CAD | - | Computer Aided Design |
| CATV | - | Community Antenna Television (Cable Television) |
| CCIA | - | Computer Communications Industry Association |
| CCN | - | Contemplated Change Notice |
| CCTV | - | Closed Circuit Television |
| CD | - | Compact Disc |
| CD | - | Change Directive (same as Change Notice and Change Order) |

| | |
|-----------------|---|
| CEC | - Canadian Electrical Code |
| CEF | - Cable Entrance Facility |
| cm | - Centimetre |
| CMP | - Communications Plenum |
| CMR | - Communications Riser |
| CN | - Change Notice (same as Change Directive and Change Order) |
| CO | - Change Order (same as Change Notice and Change Directive) |
| coax | - Coaxial Cable |
| CO-OSP | - Customer-Owned Outside Equipment |
| CP | - Consolidation Point |
| CPU | - Central Processing Unit |
| CPVC | - Chlorinated Polyvinyl Chloride |
| CSA | - Canadian Standards Institute |
| CSC | - Construction Specifications Canada |
| CSI | - Construction Specifications Institute |
| CT | - Cable Tray |
| Cu | - Copper |
| c/w | - Complete With |
| dB | - Decibel |
| dB/km | - Decibel per Kilometre |
| dBm | - Decibel milliwatt |
| dBmV | - Decibel millivolt |
| demarc | - Demarcation Point |
| D-ring | - Distribution Ring |
| DSL | - Digital Subscriber Line |
| EF | - Entrance Facility |
| EIA | - Electronics Industry Alliance |
| ELFEXT | - Equal Level Far-End Crosstalk |
| ESSS | - Electronic Safety and Security System/s |
| e-mail | - Electronic Mail |
| EMI | - Electromagnetic Interference |
| EMI/RFI | - Electromagnetic Interference / Radio Frequency Interference |
| ER | - Equipment Room |
| ESD | - Electrostatic Discharge |
| e/w | - Equipped With |
| FC | - Fibre Connector |
| FCC | - Federal Communications Commission |
| FDDI | - Fibre Distributed Data Interface |
| FEP | - Fluorinated Ethylene Propylene |
| FEXT | - Far-End Crosstalk |
| FOTP | - Fibre Optic Test Procedure |
| ft | - Foot / Feet |
| ft ² | - Square Foot / Feet |
| FTTD | - Fibre To The Desk |
| FT 1 / FT 3 | - Fractional T 1 / Fractional T 3 |
| G | - Giga |
| Gb | - Gigabit |
| GB | - Gigabyte |
| Gb/s | - Gigabit per Second |
| GC | - General Contractor |
| GHz | - Gigahertz |
| HC | - Horizontal Cross-connect |
| Hz | - Hertz |
| I | - Current |
| IC | - Intermediate Closet |

| | |
|-----------------|--|
| IC | - Intermediate Cross-connect |
| ID | - Identification |
| ID | - Inside Diameter |
| IDC | - Insulation Displacement Connection |
| IDC | - Insulation Displacement Connector |
| IDC | - Insulation Displacement Contact |
| IDF | - Intermediate Distribution Frame |
| IEEE® | - Institute of Electrical and Electronics Engineers, Inc.® |
| IG | - Isolated Ground |
| in | - Inch |
| in ² | - Square Inch |
| I/O | - Input / Output (Device) |
| IOR | - Index Of Refraction |
| IP | - Internet Protocol |
| ISDN | - Integrated Services Digital Network |
| ISO | - International Organization for Standardization |
| IT | - Information Technology |
| kb | - Kilobit |
| kB | - Kilobyte |
| kg | - Kilogram |
| km | - Kilometre |
| kV | - Kilovolt |
| kVA | - Kilovoltampere |
| kW | - Kilowatt |
| kWh | - Kilowatt hour |
| LAN | - Local Area Network |
| laser | - Light Amplification by Stimulated Emission of Radiation |
| lb | - Pound |
| LED | - Light Emitting Diode |
| LO | - Laser Optimized |
| LSZH | - Low Smoke Zero Halogen |
| m | - Metre |
| m ² | - Square Metre |
| mA | - Milliampere |
| MAC | - Move, Add, or Change |
| MAN | - Metropolitan Area Network |
| Mb | - Megabit |
| MB | - Megabyte |
| Mb/s | - Megabit per Second |
| MB/s | - Megabyte per Second |
| MC | - Main Cross-connect |
| MDF | - Main Distribution Frame |
| MGB | - Main Grounding Busbar |
| MHz | - Megahertz |
| mi | - Mile |
| MIMS | - Mineral Insulated Metal Sheathed |
| min | - Minute |
| mm | - Millimetre |
| MM | - Multimode |
| MMF | - Multimode Fibre |
| MPP | - Modular Patch Panel |
| ms | - Millisecond |
| MSDS | - Material Safety Data Sheet |
| MUTO | - Multi-user Telecommunications Outlet |
| MUTOA | - Multi-user Telecommunications Outlet Assembly |

| | | |
|----------|---|---|
| mW | - | Milliwatt |
| MW | - | Megawatt |
| NBCC | - | National Building Code of Canada |
| NESC | - | National Electrical Safety Code |
| NEXT | - | Near-end Crosstalk |
| NIC | - | Network Interface Card |
| NIR | - | Near-end crosstalk-to-Insertion loss Ratio |
| NRCC | - | National Research Council of Canada |
| OD | - | Outside Diameter |
| OEM | - | Original Equipment Manufacturer |
| OF | - | Optical Fibre |
| OSDP | | Open Supervised Device Protocol |
| OSP | - | Outside Plant |
| PBX | - | Private Branch Exchange |
| PDU | - | Power Distribution Unit |
| PSACR | - | Power Sum Attenuation to Crosstalk Ratio |
| PSELFEXT | - | Power Sum Equal Level Far-End Crosstalk |
| PSNEXT | - | Power Sum Near-End Crosstalk |
| PVC | - | Polyvinyl Chloride |
| QA | - | Quality Assurance |
| QC | - | Quality Control |
| QoS | - | Quality of Service |
| Qty | - | Quantity |
| RCDD® | - | Registered Communications Distribution Designer |
| RF | - | Radio Frequency |
| RFI | - | Radio Frequency Interference |
| RJ | - | Registered Jack |
| rms | - | Root Mean Square |
| RU | - | Rack Unit (1.75") |
| RX | - | Receive |
| RX | - | Receiver |
| SAN | - | Storage Access Network |
| SC | - | Single Fibre Coupling Optical Fibre Connector |
| SCC | - | Standards Council of Canada |
| SCS | - | Structured Cabling System |
| ScTP | - | Screened Twisted Pair |
| SFTP | - | Screened Foiled Twisted Pair |
| SI | - | International System of Units (Le Système International d'Unités) |
| SLA | - | Service level Agreement |
| SM | - | Singlemode |
| SMF | - | Singlemode Fibre |
| SNMP | - | Simple Network Management Protocol |
| SNR | - | Signal-to-Noise Ratio |
| STALPETH | - | Steel Aluminum Polyethylene |
| STP | - | Shielded Twisted Pair |
| STP-A | - | Shielded Twisted Pair A |
| T 1 | - | Trunk Level 1 |
| TBB | - | Telecommunications Bonding Backbone |
| TBBIBC | - | Telecommunications Bonding Backbone Interconnecting Bonding Conductor |
| TC | - | Telecommunications Closet |
| TDD | - | Telecommunications Device for the Deaf |
| TGB | - | Telecommunications Grounding Busbar |
| TGR | - | Telecommunications Grounding Rod |
| TIA | - | Telecommunications Industry Association |

| | |
|---------|---|
| TMGB | - Telecommunications Main Grounding Busbar |
| TP | - Twisted Pair |
| TR | - Telecommunications Room |
| TS | - Technical Standard |
| TSB | - Telecommunications Systems Bulletin (formerly Technical Systems Bulletin) |
| TTY | - Teletypewriter / Text Telephone |
| TV | - Television |
| TX | - Transmit |
| TX | - Transmitter |
| UD | - Underfloor Duct |
| UL® | - Underwriters Laboratories Inc.® |
| ULC | - Underwriters Laboratories of Canada |
| UPC | - Universal Product Code |
| UPS | - Uninterruptible Power Supply |
| UTP | - Unshielded Twisted Pair |
| V | - Volt |
| VA | - Volt-Ampere |
| VCSEL | - Vertical Cavity Surface Emitting Laser |
| VLAN | - Virtual Local Area Network |
| VoIP | - Voice over Internet Protocol |
| VPN | - Virtual Private Network |
| W | - Watt |
| WAN | - Wide Area Network |
| WAP | - Wireless Application Protocol |
| WiFi | - Wireless Fidelity |
| Wi-Fi | - Wireless Fidelity |
| WLAN | - Wireless Local Area Network |
| WMAN | - Wireless Metropolitan Area Network |
| WWAN | - Wireless Wide Area Network |
| X | - Cross-connect |
| XLPE | - Cross-linked Polyethylene |
| XPE-PVC | - Expanded Polyethylene Polyvinyl Chloride |

PART 2 PRODUCTS

2.1. NOT USED

PART 3 EXECUTION

3.1. NOT USED

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Supply and install conductors and cables as detailed in Contract Documents and as required and as specified by the manufacturer to ensure proper operation of all devices and systems. Use pathways to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point supply and install conduit as needed to support and secure the cables.
- 1.1.2. Where pathways are not provided by Division 26 provide pathways for all Electronic Safety and Security Systems conductors and cables.
- 1.1.3. All Electronic Safety and Security Systems conductors and cables shall be installed in pathways as shown on contract drawings. Pathways shall include conduit, cable trays, and cable troughs.
- 1.1.4. Avoid scraping, denting, or otherwise damaging cables, before, during, or after installation. Without any additional compensation replace damaged cables.
- 1.1.5. Ensure that all cable lengths are sufficient to allow for horizontal and vertical runs, wastage, connectorization, and future moves.
- 1.1.6. Make any necessary changes or additions to the routing of cables and pathways to accommodate structural, mechanical, electrical, and architectural conditions. Where pathways or cables are shown diagrammatically install them in straight lines making 90 degree turns parallel to building grid lines. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Engineer's Representative before installation.

1.2. CABLE ROUTING

- 1.2.1. Make any necessary changes or additions to the routing of cables, pathways to accommodate structural, mechanical, electrical, and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to grid lines. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Electronic Safety and Security Engineer's Representative before installation.

PART 2 PRODUCTS

2.1. CABLING

- 2.1.1. Conductors and cables shall be CMR where installed completely in conduit or where installed in non-plenum rated areas. Conductors and cables shall be CMP where not completely installed in conduit or installed in plenum-rated areas. All cables shall conform to the recommendations of the manufacturers of the electronic safety and security systems.
- 2.1.2. Manufacturers:
 - 2.1.2.1. Belden
 - 2.1.2.2. Honeywell
 - 2.1.2.3. PCSC
- 2.1.3. Conductors and cables shall be outdoor-rated where installed outdoor or installed in locations where they will be exposed to weather elements.
- 2.1.4. Conductors and cables shall be rated for the environment and or environments in which they are being installed.

- 2.1.5. Provide and install shielded cables where required and or recommended by the manufacturer of the electronic safety and security systems.
- 2.1.6. The cabling shown is for typical systems. All cabling shall be as required and specified by the manufacture of the electronic safety and security systems.
- 2.1.7. All wiring shall be of the proper gauge, type, and quantity of conductors as required and as specified by the manufacturer to ensure proper operation of electronic safety and security systems and peripheral devices.
- 2.1.8. Multiconductor cables shall have the conductors color-coded.
- 2.1.9. All conductors and cables shall be CSA approved and shall be stamped accordingly.
- 2.1.10. Conductors and cables for Internet Protocol (IP) Door Controllers
 - 2.1.10.1. Minimum 4 pair Category 6A cable.
 - 2.1.10.2. Minimum 2 conductor, AWG 18 or as required based on distance from power source
- 2.1.11. Card Readers: Minimum 3 pair, AWG 22, overall shielded or as required by the manufacturer.
- 2.1.12. All card readers shall be wired with a cable with a minimum of 6 conductors, excluding any grounding conductors.
- 2.1.13. Door contact (magnetic contact): Minimum 4 conductor, AWG 22 or as required based on distance from the controller
- 2.1.14. Motion request to exit devices: Minimum 4 conductor, AWG 22 as required based on distance from the controller
- 2.1.15. Electric strikes, magnetic locks, electric latches, electric mortise locks, and all other electrified locks: Minimum 4 conductor, AWG 18 or as required based on distance from the power source
- 2.1.16. Push button and latch bolt monitor request to exit devices: Minimum 4 conductor, AWG 22 as required based on distance from the controller
- 2.1.17. Fibre Optic Cable:
 - 2.1.17.1. Cable: 24 strand 50/125 micron OM4 multimode, 10 GB, indoor/outdoor rated, all-dielectric fibre optic cable
 - 2.1.17.2. Provide 50/125 micron OM4 multimode, 10 GB, fibre optic connectors
 - 2.1.17.3. Patch Panel: 24 port, 19" rack mount fibre optic patch panel
 - 2.1.17.4. Patch Cords: allow for six (6) 2M duplex 50/125 micron OM4 multimode, 10 GB, fibre optic patch cords
 - 2.1.17.5. Confirm fibre optic connector types with the Owner before procurement
- 2.1.18. Increase conductor quantities and or sizes beyond the above-stated minimums as required to facilitate the proper and complete operation of each respective device and system.
- 2.2. ETHERNET-OVER-COPPER EXTENDER**
 - 2.2.1. Provide Ethernet extenders to power all IP-connected devices that are located beyond 90 metres from their respective IP data switch. The Ethernet extender shall consist of a local (adjacent to the data switch) transceiver and a remote (adjacent to the IP-connected device) transceiver. Provide an appropriate power supply for the local transceiver. The remote transceiver shall derive power from the local power supply via their respective cable.
 - 2.2.2. The Ethernet extender shall have the following minimum features:
 - 2.2.2.1. Full 10/100 Mbps Bandwidth

- 2.2.2.2. Supports Multicast, Unicast, and Jumbo Frame
- 2.2.2.3. Symmetric Bandwidth provides consistent upload and downloads with virtually zero packet loss over the total usable distance
- 2.2.2.4. Type tested to RFC-2544 TCP/IP network bandwidth packet transmission standards
- 2.2.2.5. User-selectable data rate for maximum bandwidth and transmission distance utilization.
- 2.2.2.6. Complies with all major IEEE standards and RFC network protocols for UDP, TCP/IP, HTTP/HTTPs
- 2.2.2.7. Transmits individual Ethernet data channels with PoE+ Power Injection or Pass-through PoE+ over standard UTP or Coaxial cable
- 2.2.2.8. Status indicating LEDs provide a rapid indication of critical operating parameters.
- 2.2.2.9. Extends Ethernet over UTP cable
- 2.2.2.10. Extends Ethernet over Coaxial cable
- 2.2.2.11. Extended Pass-through PoE meets the IEEE 802.3at standard for Power over Ethernet
- 2.2.2.12. Small form factor. Provide an appropriate size junction box to house and protect the remote transceiver. Where junction boxes are provided by Division 26 coordinate with the size of the remote transceiver junction box with the Electrical Contractor.
- 2.2.2.13. Support Auto-Negotiation for 10 Mbps or 100 Mbps, full-duplex or half-duplex data.
- 2.2.3. Manufactures: Perle, Comnet, Enable-IT, or equivalent.

PART 3 EXECUTION

3.1. CABLE DISTRIBUTION

- 3.1.1. Where cables are not installed in conduit neatly bundle and tie-wrap all cables using Velcro tie-wraps.
- 3.1.2. Follow proper installation and termination practices for all cables. Do not kink or exceed the cable minimum bend radius. Maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius.
- 3.1.3. When bundling cables, comply with the manufacturer's specified bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.

3.2. CONDUCTORS AND CABLES

- 3.2.1. Supply and install all wiring as required for the proper operating of each electronic safety and security system and each peripheral device.
- 3.2.2. Provide and install metal wiring duct to facilitate proper organization and proper dressing of all cables at and around each electronic safety and security system panel.
- 3.2.3. Supply and install metal wiring duct from conduit endpoints to and around all control panels.
- 3.2.4. All wiring ducts shall be installed such that the ducts house, protect, and facilitate the routing of all cables at 90-degree angles to and around all access control panels.
- 3.2.5. Provide non-metallic wiring ducts within all control panels to manage all wiring to termination points.
- 3.2.6. All wiring duct shall be sized to house all cables while maintaining the [manufacturer's](#) specified bend radius.

- 3.2.7. Provide all fitting for all wiring duct as required, including; couplings, end caps, brackets, etc.
- 3.2.8. After installation, and before termination, all wiring and cabling shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields. A V.O.M. shall be utilized to accomplish these tests and a reading of greater than 20 Megohms shall be required to complete the test. All Category 6 and Category 6A cables shall be tested to EIA/TIA standards.
- 3.2.9. Visually inspect wire and cable for faulty insulation before installation. Protect cable ends at all times with acceptable end caps except during actual termination.
- 3.2.10. Protect wire and cable from kinks.
- 3.2.11. Provide grommets and strain relief where required.
- 3.2.12. Comply with controller and peripheral device [manufacturer's](#) installation and termination recommendation.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Applicable Codes & Standards
- 1.1.2. Provide grounding & bonding following good industry practices and following the following Codes and Standards:
 - 1.1.2.1. CSA Standard C22.2 No.41 latest version – Grounding & Bonding Equipment
 - 1.1.2.2. CSA Standard T527 (ANSI/TIA/EIA-607-C)
 - 1.1.2.3. CSA Standard T 530-99 - Telecommunications Pathways and Spaces
 - 1.1.2.4. ANSI/EIA/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers
 - 1.1.2.5. Local Codes & Bylaws
 - 1.1.2.6. BICSI requirements
- 1.1.3. Refer to Electrical Specifications for Electrical Codes and Building Codes.

PART 2 PRODUCTS

- 2.1.1. THE ELECTRICAL CONTRACTOR SHALL PROVIDE A COPPER GROUNDING BUSBAR AND associated HARDWARE IN EACH EQUIPMENT ROOM (TELECOMMUNICATIONS ROOM, LAN ROOM, HUB ROOM, SECURITY ROOM, ETC.) WHERE ELECTRONIC SAFETY AND SECURITY EQUIPMENT WILL BE INSTALLED. THE BUSBAR SHALL BE PERMANENTLY CONNECTED TO THE BUILDING GROUND SYSTEM BY THE ELECTRICAL CONTRACTOR.

2.2. GROUNDING & BONDING INFRASTRUCTURE

- 2.2.1. Rack Grounding Strips
 - 2.2.1.1. Panduit Part# RGS134-1Y or equivalent
- 2.2.2. Rack Jumper Kits
 - 2.2.2.1. Panduit Part# ACG24K or equivalent
- 2.2.3. Thread forming screws
 - 2.2.3.1. Panduit Part # RGTS-CY or equivalent
 - 2.2.3.2. Panduit RGTSM6-C or equivalent
- 2.2.4. Bonding screws
 - 2.2.4.1. Panduit Part# RGTBS-C or equivalent
 - 2.2.4.2. Panduit RGTBSM6-C or equivalent
- 2.2.5. Provide a green jacketed #6 AWG Stranded Copper Conductor to bond the grounding system to all:
 - 2.2.5.1. Cabinets
 - 2.2.5.2. Racks
 - 2.2.5.3. Metallic Pathways including Cable Tray, Conduit, etc.
 - 2.2.5.4. Metallic sheath of all shielded cables (use cable manufacturer's recommended bond clamp)

- 2.2.5.5. Metallic enclosures including equipment and controller enclosures, building entrance protection panels, etc.

PART 3 EXECUTION

3.1. GENERAL

- 3.1.1. Ground and or Bond all metal components of the Electronic Safety and Security Systems per all applicable codes and standards.
- 3.1.2. Provide, test, label, and document all grounding and bonding cables and related terminations.
- 3.1.3. Ensure that complete metal-to-metal contact is made when grounding to painted or powder-coated metal surfaces.
- 3.1.4. Where Grounding & Bonding Infrastructure is provided the Grounding & Bonding Infrastructure shall not interfere with, impede and or reduce the integrity of existing grounding systems and practices.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Supply and install cabling as detailed in Contract Documents. Provide all required pathways to distribute the cables throughout the facility. Where cables leave the pathways, Supply and install cable slings and/or j-hooks to support cabling up to point of termination.

1.2. CABLE DISTRIBUTION

- 1.2.1. Utilize all indicated and available cable pathways such as conduits, Communications cable tray, ducts, surface raceways, and furniture system channels except where otherwise noted.
- 1.2.2. Inside buildings minimize any possibilities of disruption by maintaining the following minimum clearances from electrical and heat sources when routing cables.

| Item | Minimum Separation Distances | | |
|--|------------------------------|---------------------|---------------------|
| | (<2kVA) | (2-5kVA) | (>5kVA) |
| Unshielded power lines or electrical equipment in proximity to open or non-metallic pathways. | 127 mm (5"(in)) | 305 mm (12"(in)) | 610 mm (24"(in)) |
| Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway. | 64 mm (2.5"(in)) | 152 mm (6"(in)) | 305 mm (12"(in)) |
| Power lines are enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway. | --- | 76 mm (3"(in)) | 152 mm (6"(in)) |
| Motors | 1.2 m (4'-0") | | |
| Transformers | 1.2 m (4'-0") | | |
| Fluorescent Luminaires | 300 mm (12") | | |
| Pipes (gas, oil, water, etc.) | 120 mm (5") | | |
| HVAC (equipment, ducts, etc.) | 152 mm (6") | | |

PART 2 PRODUCTS

2.1. NON-CONTINUOUS CABLE SUPPORT

- 2.1.1. Supply and install cable support for the distribution of horizontal and backbone cables where conduit or ladder tray has not been provided.
- 2.1.2. The size of J-hooks/support shall suit the number of cables in runs used for distribution.
- 2.1.3. Include any other miscellaneous hardware (angled hanger bracket, hammer/screw-on clamps) required to support horizontal and backbone cabling.

2.2. VELCRO TIE-WRAPPS

- 2.2.1. Supply and install Velcro tie-wraps. Only Velcro tie-wraps shall be acceptable. Under no circumstance shall plastic tie-wraps be used.

2.3. GROUNDING WIRE

- 2.3.1. Supply and install #6 AWG green grounding wire for all metallic components that shall be grounded and Code Conductor Two Hole Long Barrel with Window Lug to bond the conductor to the GB.

PART 3 EXECUTION

3.1. CABLE DISTRIBUTION

- 3.1.1. Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow the manufacturer's maximum pull-force and minimum bend radii.
- 3.1.2. All cables and components shall be installed and terminated following applicable Codes, Standards, and Regulations.

3.2. CABLE SUPPORT

- 3.2.1. Hangers shall be installed at 1219mm (48") intervals (maximum). Cables shall be run such that sag between supports does not exceed 100 mm (4"). Secure all cables to J-hooks/supports with Velcro tie-wraps. Cables shall be combed and dressed for all visible portions of the install. The above-noted conditions will be strictly checked. Comb and redress any cables that are unsatisfactory at no additional cost.
- 3.2.2. Attaching to T-bar support rods is not acceptable. Anchors for hangers must not be drilled into post-tensioned beams under any circumstances. Do not use Pneumatic hammers. All anchors must be drilled into the slab.
- 3.2.3. Do not 'fire spray' insulation during the installation of cable supports.

3.3. VELCRO TIE-WRAPPS

- 3.3.1. Velcro tie-wraps shall be used to neatly dress cables; they shall be placed at a maximum of 1219 mm (48") intervals for horizontal distribution (centre points between cable supports).
- 3.3.2. Velcro tie-wraps shall also be used to dress cables into racks/cabinets. Maximum spacing of Velcro for cables into or along vertical cable managers shall be no more than 152 mm (6"), this includes cabling dropped from the ladder tray or ceiling above.

3.4. CABLE DISTRIBUTION

- 3.4.1. Do not exceed the copper cable's maximum tensile rating during installation. Monitor tension of the cable during installation. Use a dynamometer to record installation tension. Use a tension limiting device to prevent the exceeding of maximum pulling tension specifications during installation. The tension limit shall be set at or below the manufacturer's limit. The cable shall be taken up at intermediate pulling points with an intermediate take-up device as approved by the Electronic Safety and Security Engineer's Representative, to prevent over tension on the cable.
- 3.4.2. The minimum bend radius shall be as per the manufacturer's recommendations.
- 3.4.3. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.
- 3.4.4. Protect exposed cable ends from moisture ingress.

3.5. DUCT AND CONDUIT

- 3.5.1. Clean out each section of duct or conduit by pulling a steel wire brush and mandrel of the correct size through the duct or conduit before pulling cables. Bush, ream and remove any sharp projections on all conduits prior to installation of communications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Electronic Safety and Security Engineer's Representative of the problems encountered.
- 3.5.2. Apply manufacturer's specified lubricant to cables to reduce friction between the cable and the conduit. Cable grip shall be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

END OF SECTION

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Provide A Class 3 system as per the latest version of the ANSI/TIA/EIA 606 Standards.
- 1.1.2. All elements of the Electronic Safety and Security Systems shall be labeled with unique identifiers.
- 1.1.3. Where labeling schemes are not provided co-develop a labeling scheme with the Owner and the Electronic Safety and Security Engineer's Representative before the installation of any permanent labels on the Electronic Safety and Security Systems components.
- 1.1.4. Labeling schemes shall be confirmed with the Electronic Safety and Security Engineer's Representative before installation.

PART 2 PRODUCTS

2.1. LABELS

- 2.1.1. All cable and equipment labels shall meet the legibility, defacement, and adhesion requirements specified in ANSI/UL 969. In addition, the labels shall meet the general exposure requirements in ANSI/UL 969 for indoor and outdoor use.
- 2.1.2. Cable labels shall be of self-laminating vinyl construction with a white printing area and a clear tail that self-laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times. The width shall be sufficient to accommodate the appropriate label designation.
- 2.1.3. Provide vinyl substrate with a white printing area and black print. If cable jacket or equipment is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
- 2.1.4. Labels shall be flexible vinyl or other substrates to apply easily and flex as cables are bent.
- 2.1.5. Labels shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.
- 2.1.6. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light) and should have a design life equal to or greater than that of the labeled component.
- 2.1.7. All labels shall be mechanically printed using a laser printer. Hand-written labels are not permitted.
- 2.1.8. All backbone and horizontal cables including patch cord labels shall be printed in 10 point Arial Narrow, black, bold font.
- 2.1.9. All equipment labels shall be printed in 14 point Arial Narrow, black, bold font.
- 2.1.10. All Hub, Main Cabinets, and controlling device enclosure labels shall be black lamacoid plates with white 60 point Arial Narrow, engraved upper case letters enclosed by a white border on black background.

PART 3 EXECUTION

3.1. LABELLING

- 3.1.1. Submit sample labels to Communications Consultant for approval before procurement and installation.

- 3.1.2. Supply and install all labels as indicated in this document and contract drawings.
- 3.1.3. Supply and install all labels for all cables and all active and passive devices, conduits, and pull boxes.
- 3.1.4. Label all ends of conduits including ends of conduits that terminate in pull boxes. The label shall be installed within 304mm (12") of each conduit end. Label designations for conduit and pull boxes shall be confirmed with the consultant before procurements and installation. Allow for adding label designations (soft) for conduits and pull boxes to soft cabling schedules.
- 3.1.5. Labels shall be located on cables and equipment as indicated in this document and on contract drawings.
- 3.1.6. Labels should be visible during the installation and normal maintenance of the infrastructure.
- 3.1.7. Labels shall be affixed to the front and rear of equipment where required and 150 mm (6") from the end of all backbone and horizontal cables.
- 3.1.8. Labels shall be affixed 75 mm (3") from the end of all patch cords.
- 3.1.9. Labels should be attached at both ends of all cables (within 75 mm (3") of the end).
- 3.1.10. All temporary labels shall be removed from cables and equipment before commissioning.
- 3.1.11. All labels shall be visible.
- 3.1.12. All active and passive equipment shall be labeled.

END OF SECTION

PART 1 GENERAL

1.1. NOT USED

PART 2 PRODUCTS

2.1. TEST EQUIPMENT

2.1.1. Provide portable two-way radios and or other communication devices.

2.2. PROPRIETARY TEST EQUIPMENT

2.2.1. Provide all proprietary test equipment that is required to facilitate testing and commissioning of the Electronic Safety Security System. All proprietary test equipment shall become the property of the owner upon completion of the commissioning.

2.2.2. Obtain and review design documents for overall design intent and the overall required systems configurations.

2.2.3. Obtain and review shop drawings and submittals for installation criteria and the required construction details, as they support and further define the system's features.

2.2.4. Make general reviews at the job site and review the following for configuration:

2.2.4.1. Quality of construction

2.2.4.2. Adherence to design requirements

2.2.4.3. Conformance with shop drawings and submittal information.

PART 3 EXECUTION

3.1. COMMISSIONING PROCESS

3.1.1.1. Execute the following :

3.1.1.1.1. Identify all systems, equipment, components, and functions to be commissioned

3.1.1.1.2. Develop itemized test procedures including itemized functional test forms and device test checklists

3.1.1.1.3. Review commissioning plan and process with the Electronic Safety and Security Engineer's Representative

3.1.1.1.4. Perform pre-start-up tests

3.1.1.1.5. Perform device tests

3.1.1.1.6. Perform functional tests

3.1.1.1.7. Perform system integration functional tests

3.1.1.1.8. Perform retests as necessary

3.1.1.1.9. Turnover

3.2. COMMISSIONING

3.2.1.1. Identify all components, functions, and systems that shall be commissioned.

3.2.1.2. Develop device checklists, functional test forms, and system integration test forms that shall be executed.

- 3.2.1.2.1. Device Checklists
 - 3.2.1.2.1.1. Each device checklist shall include but not limited to:
 - 3.2.1.2.1.1.1. Unique identifier of each device and component of the respective system
 - 3.2.1.2.1.1.2. Location of device
 - 3.2.1.2.1.1.3. Name of commissioning agent
 - 3.2.1.2.1.1.4. Name of witness
 - 3.2.1.2.1.1.5. Date of commissioning
 - 3.2.1.2.1.1.6. For each device; all functions and performance requirements indicated in the relative system specifications sections of this document, all function and performance requirements indicated on all associated drawings, all industry-standard tests, all manufacturer-recommended tests, all test that are required to confirm that the respective device is in proper working order.
 - 3.2.1.2.1.1.7. Confirmation of device tests performed
 - 3.2.1.2.1.1.8. Confirmation of tests passed or failed and related comment
 - 3.2.1.2.2. Functional Test Forms
 - 3.2.1.2.2.1. Each functional test form shall include but not limited to:
 - 3.2.1.2.2.1.1. Identification of system under test
 - 3.2.1.2.2.1.2. Location of system
 - 3.2.1.2.2.1.3. Name of commissioning agent
 - 3.2.1.2.2.1.4. Name of witness
 - 3.2.1.2.2.1.5. Date of commissioning
 - 3.2.1.2.2.1.6. For each system; all function and performance requirements indicated in the relative system specifications sections of this document, all functions indicated on all associated drawings, all industry-standard functional tests, all manufacturer-recommended functional tests, and all functional tests that are required to confirm that the respective system is in proper working order.
 - 3.2.1.2.2.1.7. Confirmation of functional tests performed
 - 3.2.1.2.2.1.8. Confirmation of tests passed or failed and related comment
 - 3.2.1.2.3. Systems Integration Functional Test Forms
 - 3.2.1.2.3.1. Each system integration test form shall include but not limited to:
 - 3.2.1.2.3.1.1. Identification of systems under test
 - 3.2.1.2.3.1.2. Location of systems
 - 3.2.1.2.3.1.3. Name of commissioning agent
 - 3.2.1.2.3.1.4. Name of witness
 - 3.2.1.2.3.1.5. Date of commissioning
 - 3.2.1.2.3.1.6. All integrated functions and performance requirements that are indicated in the electronic safety and security system integration specifications section of this document, all integrated functions indicated on all associated drawings, all industry-standard integration functional tests, all manufacturer-recommended integrated functional tests, and all integrated functional tests that are required to confirm that the respective systems are integrated and are in proper working order.
 - 3.2.1.2.3.1.7. Confirmation of integrated functional tests performed

- 3.2.1.2.3.1.8. Confirmation of tests passed or failed and related comment
- 3.2.1.3. Forward the device checklists, functional test forms, and systems integration test forms to the Electronic Safety and Security Engineer's Representative for review and approval before commencing commissioning.
- 3.2.1.4. Pre-Start-up Test
- 3.2.1.4.1. Perform pre-start-up tests to verify that the devices and systems that are to be commissioned are powered, calibrated, operational, and ready for device and functional testing.
- 3.2.1.5. Perform Device Tests
- 3.2.1.5.1. Perform device tests for all devices following the device checklists.
- 3.2.1.6. Perform Functional Tests
- 3.2.1.6.1. Perform functional tests for all devices and systems following the functional test forms.
- 3.2.1.7. Perform System Integration Tests
- 3.2.1.7.1. Perform system integration functional tests for all devices and systems following the system integration functional test forms.
- 3.2.1.8. Perform Retests as Necessary
- 3.2.1.8.1. For all failed tests, make all necessary repairs and perform retests. Failure of the integrated test may require the retest of one or more individual tests. Conduct repairs and retests until all tests are passed.
- 3.2.1.9. Turnover
- 3.2.1.9.1. Prepare a comprehensive commissioning report that includes but not limited to completed device checklists, completed functional test forms, completed systems integration functional test forms with measured data. The commissioning report shall be submitted along with system operation and maintenance manuals for review and approval by the Electronic Safety and Security Engineer's Representative.

3.3. ACCEPTANCE CRITERIA

- 3.3.1. To be determined by the Electronic Safety and Security Engineer's Representative.

3.4. ACCEPTANCE PROCEDURES

- 3.4.1. To be determined by the Electronic Safety and Security Engineer's Representative
- 3.4.2. To ensure the Owner and all contracting parties agree, a formal acceptance procedure has been established for the security sub-system of this Division. The acceptance is based on the successful completion of the testing requirements and therefore not open for punch list items. Final acceptance of the commissioning shall be when all tests are completed and the results of the tests are reviewed and accepted by Electronic Safety and Security Engineer's Representative.

END OF SECTION

PART 1 GENERAL

1.1. PURPOSE

- 1.1.1. The building's and facility's Access Control System's primary function is to protect the assets. The contents of this document are critical and are considered confidential. This information shall not be disclosed to anyone other than authorized personnel.
- 1.1.2. All burglar and the PCSC Fault Tolerant door access system hardware and software must be 100% compatible and fully integrated with the EBI system software installed by Honeywell and operated by the University of Toronto Police.
- 1.1.3. The University has already purchased and installed the EBI server software, database and completed installation of door access hardware components at existing campus locations.
- 1.1.4. Installation of additional door access system components must fully meet the specifications of the existing EBI installation and integrate seamlessly with that system.
- 1.1.5. The access control system shall allow for interfaces with other systems including, but not limited to, the burglar alarm, intercom, fire and CCTV systems.
- 1.1.6. The burglar alarm system shall allow for interfaces with other systems including, but not limited to, the access control, intercom, fire and CCTV systems.
- 1.1.7. The burglar alarm system hardware and software must be 100% compatible and fully integrated with the EBI system software installed by Honeywell and operated by the University of Toronto Police and/or to the FBII CP220 Central Station Receiver.

1.2. SCOPE OF WORK

- 1.2.1. The work covered by this section includes the furnishing, installation and activation of all equipment & materials associated with complete Access Control System as shown and as specified herein. This work may include, integration with the associated subsystems and components listed in these sections.
- 1.2.2. All DGP's and power supplies shall have battery backup to keep the systems fully functional for a minimum of 4 hours.
- 1.2.3. Security Contractor to supply and provide all associated salto softwares, nodes and gateways.
- 1.2.4. Salto wireless locks by door hardware contractor.
- 1.2.5. Security contractor shall coordinate and commission the Salto wireless lock system.

1.3. CONTROLLER SYSTEM FUNCTION AND PERFORMANCE REQUIREMENTS

- 1.3.1. The Access Control System shall be an extension of and shall be integrated with the existing Honeywell PCSC Fault Tolerant System managed by Honeywell Enterprise Building Integrator (EBI) software.
- 1.3.2. The access control system shall be an inter-connected group of components consisting of the following devices:
 - 1.3.2.1. Controllers
 - 1.3.2.2. Detecting and controlling devices
 - 1.3.2.3. Communication devices
 - 1.3.2.4. Access control software
 - 1.3.2.5. Credential Readers

- 1.3.2.6. Credentials
- 1.3.2.7. Electrified door locks
- 1.3.2.8. Power supplies
- 1.3.2.9. Personal computers
- 1.3.2.10. Servers
- 1.3.3. The system shall have of the following minimum functions:
 - 1.3.3.1. Regulate and monitor access at system controlled doors.
 - 1.3.3.2. Control access to elevator floors and monitor elevator floor button activity.
 - 1.3.3.3. Monitor connected detectors (supervised and auxiliary inputs) with the ability to manually or automatically arm and disarm them.
 - 1.3.3.4. Control event initiated devices connected to system outputs, such as alarms or video recorders, with the ability to automatically or manually arm or disarm them.
 - 1.3.3.5. Report an alarm condition.
 - 1.3.3.6. Distribute an annunciated alarm condition via an email notification off-site.
 - 1.3.3.7. Establish a hierarchy of alarm types to prioritize handling alarm conditions.
 - 1.3.3.8. Maintain a comprehensive database recording all site activity.
 - 1.3.3.9. Interface with intrusion controllers.

PART 2 PRODUCTS

2.1. GENERAL

- 2.1.1. All products and materials must be new and approved in the pre-installation submittals.
- 2.1.2. Exterior devices shall be sealed and protected against weather conditions including heat, cold, moisture, dust, and sand.
- 2.1.3. Commercial grade, high quality and rated for the environment in which it is being installed
- 2.1.4. Compatible with the access control system.

2.2. NETWORK CONTROLLER (HONEYWELL)

- 2.2.1. All Network Controllers shall be PCSC Fault Tolerant FT

2.3. IP DOOR CONTROLLER(HONEYWELL)

- 2.3.1. All Door Controllers shall be PCSC FT SDM / DDM

2.4. ELEVATOR DOOR CONTROLLER(HONEYWELL)

- 2.4.1. All Elevator Controllers shall be PCSC IQ ELV

2.5. SALTO ACCESS CONTROL DEVICES

- 2.5.1. Salto IP Door Controller
- 2.5.2. Salto Card Reader
- 2.5.3. Salto HUBS Gateways (#GATEWAYW2C) and Nodes (#RFNODE) for Wireless Electric Locks
- 2.5.4. Salto Wireless Electric Locks (AJ660A00IM38W) (By Door Hardware)

2.6. NETWORK CONTROLLER CREDENTIAL READERS(HONEYWELL)

- 2.6.1. Credential readers shall be Genuine HID iCLASS Readers available in the following form factor:
 - 2.6.1.1. Model HID iClass R40 Switch plate Reader.
 - 2.6.1.2. Model R10 Mullion Reader (doors surrounded glazing).

2.7. AUDIBLE ALERTS

- 2.7.1. Access control doors shall utilize the integral audible alert of the card reader and shall annunciate when the door is in both "Door Held Open" and "Door Forced Open" alarm conditions.
- 2.7.2. Access doors with additional Sounder Alarm device shall annunciate when the door is in both "Door Held Open" and "Door Forced Open" alarm conditions. Refer to drawings for reference.
- 2.7.3. Sounder Alarm Device shall be Honeywell WAVE-2 Two Tone Siren.

2.8. CREDENTIALS

- 2.8.1. Credentials shall be provided by Campus Police

2.9. PERIPHERAL DEVICES

- 2.9.1. Magnetic Contacts (Steel)
 - 2.9.1.1. All door contacts shall be Sentrol 1078T 1" door contact or approved equal.
- 2.9.2. Magnetic Contacts (Overhead Door)
 - 2.9.2.1. Miniature and low-profile design
 - 2.9.2.2. Stainless steel armoured cable for added security and reliability
 - 2.9.2.3. Aluminium bar stock to resist corrosion in harsh environments
 - 2.9.2.4. Floor or track mount as required
 - 2.9.2.5. Provide Sentrol 2200 Series or approved equal
- 2.9.3. All Request to Exit devices are an integral part of the door hardware, provided by door hardware division. Device will be in the handle or push bar of the lock.
- 2.9.4. Remote Release Button:
 - 2.9.4.1. Potter Surface Mount HUB-M or approved equivalent.
 - 2.9.4.2. Salto Access Control Devices

2.10. POWER SUPPLY

- 2.10.1. Power supplies shall include all controller power supplies, all electrified lock power supplies and all peripheral device power supplies.
- 2.10.2. Provide separate power supplies for controllers, provide separate power supplies for maglocks, provide separate power supplies for electrified locks separate from maglocks (e.g., electric strikes, electric latch retraction, electric mortise locks), and provide separate power supplies for peripheral devices.
- 2.10.3. All controller and peripheral device power supplies shall provide back-up battery to facilitate complete and simultaneous full operation of all connected and powered devices for up to Four (4) hours operation upon loss of AC power. The controller shall retain database information for up to seven days upon loss of power. Delete if not required.
- 2.10.4. All electrified lock power supplies except maglocks power supplies shall provide back-up battery to facilitate complete and simultaneous full operation of all connected and powered devices for up to four (4) hour operation upon loss of AC power.

- 2.10.5. All maglock lock power supplies shall have the capacity to add back-up battery to facilitate complete and simultaneous full operation of all connected and powered devices for up to one (1) hour operation upon loss of AC power.
- 2.10.6. All Maglock Power Supplies to be monitored for LOSS of Power and shall be supervised by the access control system as a trouble alarm.
- 2.10.7. Agency Listings
 - 2.10.7.1. UL Listed for Access Control Systems (UL294),
 - 2.10.7.2. Power Supplies for use with Burglar-Alarm Systems (UL603),
 - 2.10.7.3. Hospital Signaling and Nurse Call Equipment (UL1069),
 - 2.10.7.4. Power Supplies for Fire Protective Signaling Systems (UL1481),
 - 2.10.7.5. CUL Listed - CSA Standard C22.2 No.205-M1983, Signal Equipment.
- 2.10.8. Features/Specifications:
 - 2.10.8.1. Voltage: output as required to facilitate complete system operation.
 - 2.10.8.2. Amperage: Rating as required to facilitate complete and simultaneous operation of all associated powered devices.
 - 2.10.8.3. Class 2 Rated power limited outputs.
 - 2.10.8.4. PTC (Positive Temperature Coefficient) protected outputs.
 - 2.10.8.4.1. Each connected and powered device shall be connected to a separate PTC power supply output.
 - 2.10.8.5. Fuse rating as required or complete operation of each connected and powered device
 - 2.10.8.6. 115VAC 60Hz, input.
 - 2.10.8.7. Filtered and electronically regulated outputs.
 - 2.10.8.8. Short circuit and thermal overload protection.
 - 2.10.8.9. Built-in charger for sealed lead acid or gel type battery backup.
 - 2.10.8.10. Zero voltage drop upon transfer to battery backup.
 - 2.10.8.11. AC input and DC output LED indicators.
 - 2.10.8.12. AC fail supervision.
 - 2.10.8.13. Low battery and battery presence supervision.
 - 2.10.8.14. Fire alarm system interface.

2.11. ACCESS CONTROL CONTROLLER ENCLOSURES

- 2.11.1. Provide access control controller enclosures to house and protect all controllers.
- 2.11.2. All access control controller enclosures shall be a single key locking metal box.
- 2.11.3. Size as required to house and protect all controllers.
- 2.11.4. Equipped with door tamper switch. Connect each door tamper switch to the access control system.
- 2.11.5. The quantity and size of access control controller enclosures shall not exceed the real estate provided for mounting access control controller enclosures. Refer to contract drawings and coordinate as such. Find a spec online for generic enc

2.12. ELECTRIFIED LOCKS

- 2.12.1. All electrified locks shall be provided by others.
- 2.12.2. Electrified locks shall include, electric mortise locks, electric latch retraction, maglocks all electrified locks noted on project door hardware schedule and or architectural drawings and schedules. Electrified doors as part of the security system shall not include electric strikes.
- 2.12.3. Provide a separate power supply for electrified locking devices to facilitate complete operation of all electrified locks.

PART 3 EXECUTION

3.1. COORDINATION

- 3.1.1. The ESSC shall be responsible for the systems specified in this Section, including coordination with related trades.
- 3.1.2. The ESSC shall coordinate all work and submittal details with the electronic door hardware supplier to ensure proper sizing of control equipment and shall be responsible for proper sizing of interface equipment (i.e., relays, contact ratings, etc.) to eliminate interface problems.
- 3.1.3. Provide the following related work:
 - 3.1.3.1. Coordination of all work related to the door hardware contractor, all electrified door hardware and electrified locks.
 - 3.1.3.2. Provide all interface, wiring and connections to all electrified door hardware and electrified locks as required to facilitate a complete and operational electronic access control system.
 - 3.1.3.3. Related Electrical Works
 - 3.1.3.4. Related Control Work and/or annunciation
 - 3.1.3.5. All 120 Volt wiring and connections from power source to terminal strips in electronic low-voltage controllers, power supplies and devices.
 - 3.1.3.6. Provide cable troughs, raceway, conduits, including all back boxes and pull strings and device specific and or proprietary and or special back boxes.

3.2. CONTROLLERS AND PERIPHERAL DEVICES

- 3.2.1. Provide and install access control controllers/enclosures as required to house and protect all controllers.
- 3.2.2. All controllers and peripheral devices shall be installed and configured in accordance with manufacturer's installation instructions and recommendations, as per the Owner's requirements and as per contract drawings and specifications.
- 3.2.3. Coordinate the exact mount location of peripheral device devices with the electrical contractor to ensure that all conduits and back boxes are installed in the optimal locations.
- 3.2.4. Coordinate exact mounting locations of all controllers on site with security Engineer's Representative and client.
- 3.2.5. Supply and install all peripheral devices where indicated on contract drawings and documents.
- 3.2.6. Refer to Architectural Door and Door Hardware Schedules and ensure that each peripheral device is coordinated with its respective door and door hardware.
- 3.2.7. All peripheral devices shall be compatible with the access control system.
- 3.2.8. Submit shop drawings of all devices to the Security Engineer's Representative for approval prior to procurement and installation.

- 3.2.9. Allow for “needs assessment sessions” with client to determine the exact mode/s of operation of each peripheral device.
- 3.2.10. Configure each peripheral device and each controller to suit the client’s requirements.
- 3.2.11. Configure each motion request to exit device to shunt door contact (magnetic contact) and allow free egress without alarms.
- 3.2.12. Configure permissible door hold open timeframe on doors with auto door operators to 30 seconds. Configure permissible door hold open timeframe on doors without auto door operators to 15 seconds.
- 3.2.13. Allow for setup and configuration of card/credential holder database including programming of each credential.

3.3. POWER SUPPLY

- 3.3.1. Supply and install power supplies as required for a fully functional access control system. Power supplies shall include all controller power supplies, all electric lock power supplies and all peripheral device power supplies.
- 3.3.2. All power supplies shall be installed to manufactures recommendations and as required to furnish a fully functional access control system.
- 3.3.3. All power supplies shall be sized to facilitate connection of each electrified lock and each powered device to separately fused power output.

3.4. ELECTRIC LOCKS

- 3.4.1. All electric locks shall be supplied and installed by the door hardware contractor.
- 3.4.2. Electrified locks shall include :
 - 3.4.2.1. Electric strikes
 - 3.4.2.2. Magnetic locks/Maglocks
 - 3.4.2.3. Electric mortise locks
 - 3.4.2.4. Electric latch retraction
- 3.4.3. Coordinate with the door hardware contractor and electrical contractor, make all wire connections to all electric locks as required for a complete access control system.
- 3.4.4. Supply and install wiring as required for complete operation all access control devices and systems.
- 3.4.5. Include for all costs and work associated with acquiring permits for all magnetic locks.

3.5. WIRELESS LOCKS

- 3.5.1. Wireless locks are outside the scope of work and are shown on contract drawings for door hardware coordination only.

3.6. INSTALLATION

- 3.6.1. Install all system components and appurtenances in accordance with the respective manufacturer’s specifications, referenced practices, guidelines, and applicable codes. Furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

- 3.6.2. Install the wiring system and integrate the system as indicated in this specification. All wiring is to be installed in dedicated conduit throughout. Wiring shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring.
- 3.6.3. All low voltage wiring outside the control console, cabinets, boxes, and similar enclosures, shall be plenum rated where required by code.
- 3.6.4. All wiring conductors shall be individually numbered and each cable or wiring group being extended from a controller or cabinet to a building mounted device shall be identified with the name and number of the particular device.
- 3.6.5. All exposed wiring inside and outside the control console, cabinets, boxes, and similar enclosures, shall be dressed down neatly and secured with wiring cleats or wire ties.
- 3.6.6. All exposed metallic flexible conduit and armored cable shall be dressed down neatly and secured with low profile, metal fasteners.
- 3.6.7. All cabinets, boxes, and similar enclosures containing security system components and/or cabling and which are easily accessible to employees or to the public shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible.
- 3.6.8. All junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamper proof screws.
- 3.6.9. End-of-Line resistors shall be installed at the field device location and not at the controller location.
- 3.6.10. System devices identified on building drawings are intended to generally indicate areas where such devices are to be located. Determine and coordinate the final locations of these devices on site with the electrical contractor to ensure that all conduits and associate Backboxes are located where respective devices will be installed. Be responsible for all costs resulting from failure to execute the above.
- 3.6.11. Riser diagrams are schematic and do not show every conduit, wire box, fitting, or other accessories. Provide such materials as necessary for a complete and functioning installation. Install in accordance with referenced codes and these specifications. Use weatherproof equipment or covers where installed in areas exposed to weather.
- 3.6.12. All equipment shall be mounted with sufficient clearance to meet all applicable codes and facilitate observation and testing. All equipment shall be securely fastened with appropriate fittings to ensure positive grounding and be free of ground loops.
- 3.6.13. Determine conductor requirements for each device in accordance with the Contract Documents and manufacturer requirements.
- 3.6.14. Install cable in accordance with Security System manufacturer requirements
- 3.6.15. Neatly route cables parallel or perpendicular to building lines.
- 3.6.16. Provide J hooks and other cable support systems (spaced at regular intervals) within accessible ceiling spaces. Fasten cables to the cable support systems and provide strain relief to protect cables and ensure compliance with required cable bends.
- 3.6.17. Keep cable not run in conduit a minimum of 18" from high voltage (120 VAC and above) circuits (e.g. light fixtures, wire run parallel with conduit, transformers, electric controllers, etc.).
- 3.6.18. Run cables at least six inches from the communications cable plant, intercom wires, input/output wires, and siren wires.
- 3.6.19. Route wire and cable as required preventing interference and signalling contamination of both Security System cable and cable associated with other systems. Coordinate the routing of wire and cable requiring isolation from power, radio frequency (RF), telephone, etc.

- 3.6.20. Provide sleeves and code compliant fire proofing techniques for all penetrations of fire rated partitions, masonry walls, and slabs, where the penetrations are made by or used for installation of Security Systems.
- 3.6.21. Separate high voltage (120 VAC and above) cables from low voltage cables within enclosures
- 3.6.22. Run wire and cable continuous from device location to the final point of termination. No mid-run cable splices will be allowed
- 3.6.23. Bundle and tie wire and cable with cable ties.
- 3.6.24. Cover exposed high voltage (120 VAC and above) power terminations within controller, power distribution cabinets and other security enclosures.

3.7. LABELED FRAMES, DOORS AND ENCLOSURES

- 3.7.1. In no instance shall any UL labeled door, frame or enclosure be drilled, cut, penetrated, or modified in any way.

3.8. PROGRESS OBSERVATION

- 3.8.1. Security Engineer's Representative will conduct progress observations during construction to verify construction progress and verify the construction schedule. Coordinate progress observation site visits with the Contractor.
- 3.8.2. Security Engineer's Representative will conduct the following minimum progress observations:
 - 3.8.2.1. Security Conduit Rough-in and Preliminary Wire and Cable Installation
 - 3.8.2.1.1. The intent of this observation is to verify that adequate and proper conduit rough-in is installed, verify that wire and cable are being properly installed and labeled, and identify and resolve issues regarding conduit and wire and cable installation.
 - 3.8.2.2. Preliminary Wire Termination Progress
 - 3.8.2.2.1. The intent of this observation is to verify that the contractor will install and terminate equipment in accordance with specifications and standards.
 - 3.8.3. Observations will occur upon initial installation of each type of equipment (i.e. Controllers, Card readers, alarm devices, junction boxes, etc.).
 - 3.8.4. Observations must be complete prior to proceeding with the installation of remaining similar or like equipment.
 - 3.8.5. The Electronic Safety and Security Contractor shall coordinate appropriate timing of each observation with the general contractor, security Engineer's Representative as required to meet intended goals.
 - 3.8.6. The reviewers will issue reports for each observation to summarize findings and document clarifications noted during the observation.

PART 1 GENERAL

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 34 – CONDUITS, CONDUIT FASTENERS AND FITTINGS.
- 1.1.4. Section 26 08 01 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.
- 1.1.5. Section 26 05 21 – WIRES AND CABLES UNDER 2000 V.

1.2. REFERENCES

- 1.2.1. CAN/ULC-S524, Installation of Fire Alarm Systems, latest edition.
- 1.2.2. CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems, latest edition.
- 1.2.3. CAN/ULC-S537, Verification of Fire Alarm Systems, latest edition.
- 1.2.4. CAN/ULC-S1001, Integrated Systems Testing of Fire Protection and Life Safety Systems, latest edition.
- 1.2.5. CAN/ULC-S553, Standard For Installation of Smoke Alarms, latest edition.
- 1.2.6. CSA C22.2 No. 124, Mineral-Insulated Cable, latest edition.
- 1.2.7. CAN/ULC-S559, Standard for Equipment for Fire Signal Receiving Centres and Systems, latest edition.
- 1.2.8. CAN/ULC-S561, Standard for Installation and Services for Fire Signal Receiving Centres and Systems, latest edition.

1.3. SYSTEM DESCRIPTION

- 1.3.1. All equipment and components shall be new, and the manufacturer's current model.
- 1.3.2. Spare modules will be provided for future tenant tie ins. Panels will be tied into emergency standby generators, fire pumps, security panels, and auxiliary and ancillary devices.
- 1.3.3. Elevator shafts will have a weather proof heat detector located in the pit along with a smoke detector located at the top of the shaft.
- 1.3.4. Emergency power feed from generator(s) shall have two supervisory zones each, monitoring Generator Running and Generator General Trouble.
- 1.3.5. Emergency power feed from inverter(s) shall have three supervisory zones each, monitoring Inverter Running, Inverter on Bypass and Inverter General Trouble.
- 1.3.6. Fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital, and multiplexing techniques for data transmission.
- 1.3.7. System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general and two-stage alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.
- 1.3.8. Zoned, non-coded single stage or two stage, as indicated.
- 1.3.9. Modular in design to allow for future expansion.
- 1.3.10. Operation of system shall not require personnel with special computer skills.
- 1.3.11. System to include:

- 1.3.11.1. Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.
- 1.3.11.2. Data Gathering Panels/Transponders with stand-alone capabilities.
- 1.3.11.3. Power supplies.
- 1.3.11.4. Initiating/input circuits.
- 1.3.11.5. Indication/output circuits.
- 1.3.11.6. Auxiliary circuits.
- 1.3.11.7. Wiring.
- 1.3.11.8. Manual and automatic initiating devices.
- 1.3.11.9. Audible and visual signalling devices.
- 1.3.11.10. End-of-line resistors.
- 1.3.11.11. Local and remote annunciators.
- 1.3.11.12. Printer and event log memory chip.
- 1.3.11.13. Historic event recorder.
- 1.3.11.14. Isolation modules.
- 1.3.11.15. Central alarm monitoring.
- 1.3.11.16. Programmed features.

1.4. REQUIREMENTS OF REGULATORY AGENCIES

- 1.4.1. System components shall be listed by ULC/CSA and comply with applicable provisions of the building code, and meet requirements of local authority having jurisdiction.

1.5. SHOP DRAWINGS AND PRODUCT DATA

- 1.5.1. Submit Shop Drawings and product data in accordance with Section 26 05 04 – SUBMITTALS/SHOP DRAWINGS.
- 1.5.2. Include:
 - 1.5.2.1. Detail assembly and internal wiring diagrams for control units and auxiliary cabinets.
 - 1.5.2.2. Overall system riser wiring diagram identifying control equipment, initiating zones, signaling circuits; and identifying terminations, terminal numbers, conductors and raceways.
 - 1.5.2.3. Details for devices.
 - 1.5.2.4. Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.
 - 1.5.2.5. Step-by-step operating sequence, cross referenced to logic flow diagram.
 - 1.5.2.6. Submit battery sizing calculations and battery selection.

1.6. OPERATION AND MAINTENANCE DATA

- 1.6.1. Provide operation and maintenance data for fire alarm system for incorporation into the O&M manual.
- 1.6.2. Include:
 - 1.6.2.1. Instructions for complete fire alarm system to permit effective operation and maintenance.

- 1.6.2.2. Technical data - illustrated parts lists with parts catalogue numbers.
- 1.6.2.3. Copy of approved Shop Drawings with corrections completed and marks removed except review stamps.
- 1.6.2.4. List of recommended spare parts for system.
- 1.6.2.5. Detailed sequence of operation or operational matrix.
- 1.6.2.6. Full fire alarm verification inspection report.
- 1.6.2.7. USB stick, containing electronic version of fire alarm passive graphic both in PDF and CAD, as part of O&M manual.

1.7. MAINTENANCE MATERIALS

- 1.7.1. Include:
 - 1.7.1.1. Spare glass rods for manual pull stations, if applicable.
 - 1.7.1.2. Key for fire alarm panel, remote annunciator, and pull stations.
 - 1.7.1.3. Specialty tool for resetting sprinkler supervisory, if applicable.
 - 1.7.1.4. Spare fuses for control circuits.
 - 1.7.1.5. Beam detector calibrated test filters (if applicable).

1.8. WARRANTY

- 1.8.1. Provide a one year warranty including all materials, parts, and labour. Be responsible for correcting any deficiencies that are discovered during the one year warranty period, including any that are discovered by the Owner's first annual inspection and test to CAN/ULC-S536.

1.9. TRAINING

- 1.9.1. Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

PART 2 PRODUCT

2.1. MATERIALS

- 2.1.1. Equipment and devices: ULC listed, labelled and supplied by single manufacturer.
- 2.1.2. Power supply: to CAN/ULC-S524.
- 2.1.3. Audible signal devices: to ULC-S525.
- 2.1.4. Visual signal devices: to CAN/ULC-S526.
- 2.1.5. Control unit: to CAN/ULC-S527.
- 2.1.6. Manual pull stations: to CAN/ULC-S528.
- 2.1.7. Thermal detectors: to CAN/ULC-S530.
- 2.1.8. Smoke detectors: to CAN/ULC-S529.
- 2.1.9. Smoke alarms: to CAN/ULC-S531.
- 2.1.10. Signal Transmitting Units and Monitoring: to CAN/ULC-S559 and CAN/ULC-S561.

2.2. SYSTEM OPERATION: SINGLE STAGE SIGNALS ONLY

- 2.2.1. Actuation of any alarm initiating device to:

- 2.2.1.1. Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.
- 2.2.1.2. Indicate zone of alarm at central control unit and at the remote annunciator.
- 2.2.1.3. Cause audible signalling devices to sound continuously throughout building and at central control unit.
- 2.2.1.4. Transmit signal to fire department via central station.
- 2.2.1.5. Except for air handling systems providing make-up air to public corridors serving suites in Group C major occupancy High Buildings, cause air conditioning and ventilation fans serving more than 1 storey or 1 suite in a storey to shut down.
- 2.2.1.5.1. Air handling systems providing make-up air to public corridors serving suites in Group C major occupancy High Buildings shall only shutdown upon activation of the duct smoke detector(s) associated with that specific mechanical unit. On general alarms activated by other initiating devices (i.e. sprinkler, pull station, smoke/heat detector, etc.), the air handling unit shall continue to operate in order to maintain corridor pressurization.
- 2.2.1.6. For high rise buildings, provide manual 'OFF' switches at the main fire alarm panel in the CACF to manually stop air moving fan units that serves more than 2 storeys.
- 2.2.1.7. Cause supply and/or exhaust fans to function automatically to provide required control of smoke movement per the mechanical smoke control matrix.
- 2.2.1.8. Cause fire doors and smoke control doors, if normally held open, to close automatically.
- 2.2.1.9. Cause the release of all mag-lock devices on doors that are secured closed.
- 2.2.2. Emergency elevator recall:
 - 2.2.2.1. Actuation of any alarm initiating devices in elevator lobbies, elevator machine room, elevator pit, or top of hoistway to cause elevators to return to primary recall floor, or to alternate recall floor, as required. Elevator recall shall not be activated upon alarms from manual pull stations or on general fire alarm condition.
- 2.2.3. Acknowledging alarm: indicated at central control unit.
- 2.2.4. Actuation of supervisory devices to:
 - 2.2.4.1. Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.
 - 2.2.4.2. Indicate respective supervisory zone at central control unit and at remote annunciator.
 - 2.2.4.3. Cause audible signal at central control unit to sound.
 - 2.2.4.4. Activate common supervisory sequence.
- 2.2.5. Resetting of alarm or supervisory device shall not return system indications/functions back to normal until control unit has been reset.
- 2.2.6. Trouble on system to:
 - 2.2.6.1. Indicate circuit in trouble at central control unit.
 - 2.2.6.2. Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.
- 2.2.7. Trouble on system: suppressed during course of alarm.
- 2.2.8. Trouble condition on any circuit in system not to initiate alarm conditions.

2.3. SYSTEM OPERATION: TWO STAGE SIGNALS ONLY

- 2.3.1. Actuation of any alarm initiating device on first stage to:
 - 2.3.1.1. Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.
 - 2.3.1.2. Indicate zone of alarm at central control unit and at the remote annunciator.
 - 2.3.1.3. For low rise buildings:
 - 2.3.1.3.1. Cause audible devices throughout building to sound at 20 strokes per minute.
 - 2.3.1.4. For high rise buildings:
 - 2.3.1.4.1. Cause audible signaling devices to sound continuously in ALARM tone on floor of alarm, floor above, and floor below, at 20 strokes per minute in ALERT tone on other floors of building.
 - 2.3.1.5. Transmit signal to fire department via central station.
 - 2.3.1.6. Except for air handling systems providing make-up air to public corridors serving suites in Group C major occupancy High Buildings, cause air conditioning and ventilation fans serving more than 1 storey or 1 suite in a storey to shut down.
 - 2.3.1.6.1. Air handling systems providing make-up air to public corridors serving suites in Group C major occupancy High Buildings shall only shutdown upon activation of the duct smoke detector(s) associated with that specific mechanical unit. On general alarms activated by other initiating devices (i.e. sprinkler, pull station, smoke/heat detector, etc.), the air handling unit shall continue to operate in order to maintain corridor pressurization.
 - 2.3.1.7. For high rise buildings, provide manual 'OFF' switches at the main fire alarm panel in the CACF to manually stop air moving fan units that serves more than 2 storeys.
 - 2.3.1.8. Cause supply and/or exhaust fans to function automatically to provide required control of smoke movement per the mechanical smoke control matrix.
 - 2.3.1.9. Cause fire doors and smoke control doors, if normally held open, to close automatically.
 - 2.3.1.10. Cause the release of all mag-lock devices on doors that are secured closed.
- 2.3.2. Emergency elevator recall:
 - 2.3.2.1. Actuation of any alarm initiating devices in elevator lobbies, elevator machine room, elevator pit, or top of hoistway to cause elevators to return to primary recall floor, or to alternate recall floor, as required. Elevator recall shall not be activated upon alarms from manual pull stations or on general fire alarm condition.
- 2.3.3. Actuation of any alarm initiating device on second stage to:
 - 2.3.3.1. Cause audible signalling devices to sound in alarm tone throughout building.
- 2.3.4. If first stage alarm is not acknowledged within 5 min, system to automatically go into second stage.
- 2.3.5. Acknowledging alarm: indicated at central control unit.
- 2.3.6. Possible to silence signals by "alarm silence" switch at central control unit, after 60 s period of operation.
- 2.3.7. Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.
- 2.3.8. Actuation of any supervisory device to:
 - 2.3.8.1. Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.
 - 2.3.8.2. Indicate respective supervisory zone at central control unit and remote annunciator

- 2.3.8.3. Cause audible signal at central control unit to sound.
- 2.3.8.4. Activate common supervisory sequence.
- 2.3.9. Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit is reset.
- 2.3.10. Trouble on system to:
 - 2.3.10.1. Indicate circuit in trouble at central control unit.
 - 2.3.10.2. Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.
- 2.3.11. Troubles on system: suppressed during course of alarm.
- 2.3.12. Trouble condition on any circuit in system not to initiate alarm conditions.

2.4. CONTROL PANEL

- 2.4.1. Central control unit (CCU):
 - 2.4.1.1. Suitable for Data Communication Link style C (DCL-C) unless otherwise noted on the drawings: to CAN/ULC-S524.
 - 2.4.1.2. Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.
 - 2.4.1.3. Minimum capacity of 1000 addressable monitoring and 500 addressable control/signal points. Points may be divided between 2 communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other channel.
 - 2.4.1.4. System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.
 - 2.4.1.5. Integral power supply, battery charger and standby batteries.
 - 2.4.1.6. Basic life safety software: retained in non-volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (e.g. zone labels, priorities) and changing of system operation software.
 - 2.4.1.7. Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.
 - 2.4.1.8. Communication between CCU and remote DGP's/TPR's to be supervised, DCLA. Should communications fail between CCU and remote units, audible and visual trouble to be indicated at CCU. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 3,000 m.
 - 2.4.1.8.1. Communication between nodes in networked system to be supervised, DCLA. Should communications fail between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.
 - 2.4.1.9. Support up to 4 RS-232-C I/O ports. CCU output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC.
 - 2.4.1.10. Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.
 - 2.4.1.11. Software and hardware to maintain time of day, day of week, day of month, month and year.

- 2.4.1.12. On-board, 20-column, DC strip printer, thermal head with automatic paper take-up, and silent operation; operational while system is operating on standby power. Expanded font available for selected printing conditions.
- 2.4.1.13. Printer to record activities on system controlled by EIA RS-232-C link from within CCU.
- 2.4.1.14. Software to operate variable sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

2.5. DATA GATHERING PANELS (DGP'S) /TRANSPONDERS

- 2.5.1. Fire control modules: distributed throughout building complex in separately enclosed units (DGP'S) and interconnected to central control unit utilizing multiplex data transmission techniques.
- 2.5.2. Fire alarm integrated DGP's: microprocessor based, provide interface between standard alarm input/output devices and central control unit.
- 2.5.3. Each DGP: circuitry with ability to detect failure in communication with CCU resulting from faults in communication wiring. In event of loss of communication with CCU, DGP capable of operating in stand-alone mode. In this mode, DGP capable of reacting to connected input devices, and apply stand-alone programming to determine state of connected outputs. Stand-alone programming instructions: independent of, but capable of executing same type of algorithms as that of CCU.
- 2.5.4. Each DGP: self-contained unit, with integral power supply, battery charger and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.
- 2.5.5. Addressable DGP's:
 - 2.5.5.1. DGP's are to be of the addressable type which provide two-way data communication with up to 128 addressable devices/interface modules, utilizing digital poll/response protocol communication format. Each addressable device: uniquely identified by own address, set at time of installation.
 - 2.5.5.2. Addressable DGP's must have stand-alone operating capability.
 - 2.5.5.3. Interface modules: facilitate connection of non-addressable devices (e.g. flow switch) to addressable DGP; provided in different types for connection to monitoring devices (e.g. flow/tamper switch), signalling devices (e.g. bells, horns), and control functions (e.g. fan shutdown, door release); communicate with addressable DGP over minimum number of wires (specified by manufacturer).
 - 2.5.5.4. Possible to connect all 3 types of addressable interface modules (monitoring, signal and control) to same addressable communication loop.
 - 2.5.5.5. Possible to connect variable-sensitivity addressable smoke detectors together with other addressable devices to same addressable communication loop.

2.6. POWER SUPPLIES

- 2.6.1. 120V, 60 Hz as primary source of power for system. The circuit shall be labelled at the main power distribution panel as FIRE ALARM. The fire alarm disconnect must be locked, a locked electrical room or panel door does not constitute the lock for the disconnect.
- 2.6.2. Voltage regulated, current limited distributed system power.
- 2.6.3. Primary power failure or power loss (less than 102 V) will activate common trouble sequence.
- 2.6.4. Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

- 2.6.5. Abnormal operating conditions such as a fault in battery charging circuit, short or open in the battery leads, shall activate a common trouble sequence and standby power trouble indicator.
- 2.6.6. Standby batteries: 5 year NiCad sealed, maintenance free.
- 2.6.7. Continuous supervision of wiring for external initiating and alarm circuits are to be maintained for 24 hrs with capability of maintaining alarm activation for a minimum of 2 hrs, immediately following 24 hrs of supervision.

2.7. INITIATING/INPUT CIRCUITS

- 2.7.1. Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCL-C, as per CAN/ULC-S524, configuration to central control unit or DGP's/transponders.
- 2.7.2. Alarm receiving circuits (active and spare) are to be compatible with smoke detectors and open contact devices.
- 2.7.3. Actuation of alarm initiating device is to cause system to operate as specified in "System Operation".
- 2.7.4. Receiving circuits for supervisory devices are to be wired in DCL-A configuration to central control unit or DGP's/transponders.
- 2.7.5. Actuation of supervisory initiating device is to cause the system to operate as specified in "System Operation".
- 2.7.6. Sprinkler devices such as pressure switches and flow switches are to have the tamper switch wired after the switch and before the EOL, to create a trouble condition while still allowing the device to electrically initiate its respective zone.
- 2.7.7. Low room temperature devices are to be provided in sprinkler rooms whenever a dry sprinkler system is provided.

2.8. ALARM OUTPUT CIRCUITS

- 2.8.1. Alarm output circuits are to be connected to signals, wired in class B configuration to the central control unit or DGP's/transponders.
- 2.8.2. The signal circuits' operation is to be capable of sounding bells, horns as required. Each signal circuit: rated at 2 A, 24 VDC; fuse-protected from overloading/overcurrent.
- 2.8.3. Manual alarm silence, automatic alarm silence and alarm silence inhibit is to be provided by system's common control.
- 2.8.4. Separate circuits shall be provided for audible signal devices on each floor area.
- 2.8.5. Audible signal devices within dwelling units or suites of residential occupancy shall be wired on separate signal circuits from those not within suites of residential occupancy or dwelling units.
- 2.8.6. Provide 25% spare capacity in visual signal device circuits to allow for site adjustments of visual signal device candela ratings.

2.9. AUXILIARY CIRCUITS

- 2.9.1. Auxiliary contacts for control functions.
- 2.9.2. Actual status indication (positive feedback) from controlled device.
- 2.9.3. Alarm or supervisory trouble on system to cause operation of programmed auxiliary output circuits.
- 2.9.4. Five sets of separate contacts for elevator fire alarm recall, for each elevator or bank of elevators sharing a common shaft and common fire detectors:

- 2.9.4.1. Elevator recall to primary floor, from elevator lobby smoke detectors on all floors except primary recall floor.
- 2.9.4.2. Elevator top of shaft detection signal to elevator controller.
- 2.9.4.3. Elevator pit detection signal to elevator controller.
- 2.9.4.4. Elevator machine room detector signal to elevator controller.
- 2.9.4.5. Elevator recall to alternate floor, from elevator lobby smoke detector(s) at primary recall floor.
- 2.9.5. Upon resetting system, auxiliary contacts are to return to normal or to operate as pre-programmed.
- 2.9.6. Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system. Timing circuit: controlled by CCU.
- 2.9.7. Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected.

2.10. WIRING

- 2.10.1. All fire alarm system wiring must be new.
- 2.10.2. Twisted copper conductors: 300 V CSA FAS minimum 105°C with FT4 rating and in mechanical protection i.e. EMT or flex as specified under Section 26 05 34 - CONDUITS, CONDUIT FASTENERS AND FITTINGS.
- 2.10.3. To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
- 2.10.4. To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
- 2.10.5. To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
- 2.10.6. All initiating circuits are to be wired in a DCL-C (i.e. Class A) configuration.
- 2.10.7. All output circuits are to be wired in a Class B configuration, unless otherwise shown on drawings.
- 2.10.8. All wiring between junction boxes and water flow switch, pressure switch, or supervisory switches will be in liquid tight flexible conduit.
- 2.10.9. Where a fire alarm transponder or annunciator located in one fire compartment is connected to a central processing unit or another transponder or annunciator located in a different fire compartment, the data communication link conductors connecting them shall be fire rated for at minimum one (1) hour. Where fire alarm system branch circuits connect transponders and individual fire alarm devices located on another storey, the branch circuits shall be fire rated for at minimum one (1) hour between the transponder and the first fire alarm device located on another storey than the transponder. Provide twisted, shielded pair Mineral-Insulated fire rated cables configured to eliminate interference and cross-talk, except where fire alarm riser diagram clearly illustrates another fire rating approach for particular conductors.

2.11. MANUAL ALARM STATIONS

- 2.11.1. Addressable manual pull station.
 - 2.11.1.1. Pull lever, break glass rod, semi-flush wall mounted type, single stage, or 2 stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.
 - 2.11.1.2. Provide two pole for direct disconnect of magnetic locking devices local to the devices.

2.12. AUTOMATIC ALARM INITIATING DEVICES

- 2.12.1. Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 deg. C., rate of rise 8.3 deg. C. per minute:

- 2.12.1.1. Electronics to communicate detector's status to addressable module/transponder.
- 2.12.1.2. Detector address to be programmed on site.
- 2.12.2. Addressable Smoke detector: photo electric:
 - 2.12.2.1. Twistlock plug-in type with fixed base.
 - 2.12.2.2. Wire-in base assembly with integral red alarm LED.
 - 2.12.2.3. Auxiliary output contact.
- 2.12.3. Addressable Duct type smoke detectors: photo-electric with sampling tubes:
 - 2.12.3.1. Twistlock plug-in type with fixed base.
 - 2.12.3.2. Wire-in base assembly with integral red alarm LED.
 - 2.12.3.3. Auxiliary output contact.
 - 2.12.3.4. Properly sized air sampling tubes.
- 2.12.4. Addressable Beam type detectors: long range and short range:
 - 2.12.4.1. Complete with transmitter and receiver.
 - 2.12.4.2. Short range operating distance of 9-30 meters.
 - 2.12.4.3. Long range operating distance of 30-100 meters.
 - 2.12.4.4. Operating temperatures shall be of -5 to 55 deg. C.
 - 2.12.4.5. The beam detector shall feature alignment LEDs on both the receiver and the transmitter and automatic gain control.
 - 2.12.4.6. Beam detector calibrated test filters, if applicable.
- 2.12.5. Addressable variable-sensitivity smoke detectors:
 - 2.12.5.1. Photo-electric type.
 - 2.12.5.2. Electronics to communicate detector's status to addressable module/transponder.
 - 2.12.5.3. Detector address to be set on detector head in field.
 - 2.12.5.4. Sensitivity settings: 3 settings determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.
 - 2.12.5.5. Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.
 - 2.12.5.6. Auxiliary output contact.
- 2.12.6. Water flow switches: lever and pressure type:
 - 2.12.6.1. Shall have a mechanical alarm transmitted delay adjustable from 0-60 seconds. Initial settings shall be 30-45 seconds. Times will be recorded and submitted to Engineer's Representative.
 - 2.12.6.2. The tamper switch located within the water flow switch shall be wired as per manufacturer's recommendations such that if the housing is open a latching trouble will be initiated.
- 2.12.7. Sprinkler and standpipe valve supervisory switches:
 - 2.12.7.1. The tamper switch located within the supervisory switch shall be wired as per manufacturer's recommendations such that if the housing is open a latching trouble will be initiated.
- 2.12.8. Smoke alarms: ionization and photo electric.
 - 2.12.8.1. Twistlock plug-in type with fixed base.

- 2.12.8.2. Wire-in base assembly with integral red and green LEDs for alarm/normal status.
- 2.12.8.3. Silence button to silence nuisance alarms.
- 2.12.8.4. Test button to verify circuitry and alarm operation.
- 2.12.8.5. Electrical Rating: 120VAC, 60Hz and Battery Backup
- 2.12.8.5.1. Battery capacity to provide power for minimum 7 days in normal condition, followed by 4 minutes of alarm.
- 2.12.8.6. Visual signal device light with the following performance requirements:
 - 2.12.8.6.1. The flash rate shall not exceed two flashes per second (2 Hz) nor be less than one flash every second (1 Hz) throughout the listed voltage range of the appliance.
 - 2.12.8.6.2. Maximum pulse duration in accordance with NFPA 72 "National Fire Alarm and Signaling Code."
 - 2.12.8.6.3. Shall be clear or nominal white and shall be minimum 175 cd but not exceed 1000 cd (effective intensity).
 - 2.12.8.6.4. The visual signal device light shall be synchronized where multiple smoke alarm visual signal devices are installed within the same area and/or viewpoint.
- 2.12.9. Combination Smoke/Carbon Monoxide alarms:
 - 2.12.9.1. Smoke Detection: ionization.
 - 2.12.9.2. Twistlock plug-in type with fixed base.
 - 2.12.9.3. Wire-in base assembly with integral red and green LEDs for alarm/normal status.
 - 2.12.9.4. Silence button to silence nuisance alarms.
 - 2.12.9.5. Test button to verify circuitry and alarm operation.
 - 2.12.9.6. Electrical Rating: 120 VAC, 60 Hz and Battery Backup
 - 2.12.9.6.1. Battery capacity to provide power for minimum 7 days in normal condition, followed by 4 minutes of alarm.
 - 2.12.9.7. Visual signal device with the following performance requirements:
 - 2.12.9.7.1. The flash rate shall not exceed two flashes per second (2 Hz) nor be less than one flash every second (1 Hz) throughout the listed voltage range of the appliance.
 - 2.12.9.7.2. Maximum pulse duration in accordance with NFPA 72 "National Fire Alarm and Signaling Code."
 - 2.12.9.7.3. Shall be clear or nominal white and shall be minimum 175 cd but not exceed 1000 cd (effective intensity).
 - 2.12.9.7.4. The visual signal device shall be synchronized where multiple smoke alarm visual signal devices are installed within the same area and/or viewpoint.

2.13. AUDIBLE SIGNAL DEVICES

- 2.13.1. Bells: flush or surface mounted, as indicated, single stroke, polarized, 24 V dc, 150 mm or 250 mm, as indicated.
 - 2.13.1.1. Vibrating type, gongs of special alloy steel, 24 V dc, 150 mm or 250 mm, as indicated.
- 2.13.2. Signal chimes: heavy duty, single stroke, 24 V dc, with solid striking plunger and resonating chamber.
- 2.13.3. Horns: 24 V dc, indoor horn type with compression driver, surface mounted.
 - 2.13.3.1. Corrosion, vibration and vermin resistant.

- 2.13.3.2. Taps: multiple, adjustable with maximum tap output sound level of 100 db at 3 m.
- 2.13.3.3. Frequency response: 400 to 4000 Hz.
- 2.13.4. Weatherproof Horns: 24 V dc, for use primarily in mechanical equipment areas, both indoor and outdoor. Horn type with compression driver, surface mounted.
- 2.13.4.1. Corrosion, vibration and vermin resistant.
- 2.13.4.2. Frequency response: 400 to 4000 Hz.
- 2.13.4.3. Complete with weatherproof box as recommended by manufacturer.
- 2.13.4.4. High output 40 mA @ 24 Vdc, Low output 20 mA @ 24 Vdc.
- 2.13.5. Residential, In-Suite, Mini-Horns: 24 V dc, horn type.
- 2.13.5.1. Complete with signal silence feature, including integral push button or touch to silence, and LED that indicates active signal circuit when lit. Provide signal silence feature that silences mini-horn for a period of not more than 10 minutes.
- 2.13.5.2. Mountable within a single-gang backbox.
- 2.13.5.3. Capable of continuous and temporal tones.

2.14. VISUAL ALARM SIGNAL DEVICES

- 2.14.1. Visual signal device type: white flashing light, wall mount or ceiling mounted as per drawings.
- 2.14.1.1. Synchronized at one flash per second.
- 2.14.1.2. Flash tube enclosure in clear LEXAN.
- 2.14.1.3. "FIRE" installed red letters.
- 2.14.1.4. Operating on 20-24 V dc.
- 2.14.1.5. Field adjustable for 15 cd, 30 cd, 75 cd, 95 cd, 110 cd, and 115 cd, unless specified otherwise.
- 2.14.2. Fire do not enter signs and their accessories:
- 2.14.2.1. Compliant with CAN/ULC-S527 "Standard for Control Units for Fire Alarm Systems" and/or CAN/ULC S526 "Standard for Visual Signal Devices for Fire Alarm and Signaling Systems, Including Accessories."
- 2.14.2.2. Powered by fire alarm system; operating on 24 V dc.
- 2.14.2.3. Fire alarm signaling device.

2.15. COMBINATION AUDIBLE AND VISUAL SIGNAL DEVICES

- 2.15.1. Combination Horn Strobes, complying with the requirements noted above for: Audible Signal Devices and Visual Alarm Signal Devices.

2.16. END-OF-LINE DEVICES

- 2.16.1. End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.17. REMOTE ANNUNCIATORS

- 2.17.1. LED type, with designation cards to indicate zones.
- 2.17.2. Display:
- 2.17.2.1. Alarms for alarm initiating circuits.

- 2.17.2.2. Common supervisory alarm for supervisory initiating circuits.
- 2.17.2.3. Common system trouble.
- 2.17.3. Trouble buzzer:
 - 2.17.3.1. Acknowledging trouble at main panel to silence trouble buzzers in system.
- 2.17.4. Supervised, with LED test button.
- 2.17.5. Interconnected with main fire alarm panel at minimum.

2.18. REMOTE PRINTER

- 2.18.1. System printer: to give a hard copy record of system events c/w following features:
 - 2.18.1.1. 120V ac, 60 Hz.
 - 2.18.1.2. 80 columns.
 - 2.18.1.3. 160 cps.
 - 2.18.1.4. Utilizes fan fold paper.
 - 2.18.1.5. Connected to RS-232 output at central control panel.

2.19. ISOLATION MODULE

- 2.19.1. Provide isolation modules in accordance with CAN-ULC-S524.
 - 2.19.1.1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an DCL-C branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the DCL segment branch.
 - 2.19.1.2. If a wire-to-wire short occurs, the isolator module shall automatically disconnect the DCL-C segment. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
 - 2.19.1.3. The isolation module will provide a single LED that flashes to indicate the isolation module is operating and illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.20. CENTRAL ALARM MONITORING

- 2.20.1. Provide Signal Transmitting Unit that utilizes internet connection as primary communications method and cellular network as secondary (back-up) communications method.
 - 2.20.1.1. Provide remote antenna for cellular network reception for Signal Transmitting Unit, if location of Signal Transmitting Unit in the building does not facilitate adequate cellular network strength.
- 2.20.2. Provide a demarcation point; refer to CAN-ULC-S524 Annex E.
- 2.20.3. Provide monitoring of the system including alarm zones, supervisory zones, and trouble signals.

2.21. PROGRAMMED FEATURES:

- 2.21.1. By-pass feature for signalling devices:
 - 2.21.1.1. Bypassing of audible devices shall be provided through the programmable keys. The use of the feature is intended for personnel with programming access.
- 2.21.2. Evacuation feature.
 - 2.21.2.1. Evacuation key will be programmed and accessible for any personnel working on the fire alarm panel.

2.22. REMOTE TERMINAL

- 2.22.1. CRT screen: 120 V, 60 Hz, to incorporate 100% solid state circuitry, with 30 cm screen and front mounted controls for brightness, contrast, vertical and horizontal hold and power ON/OFF switch.

2.23. FIRE ALARM ZONE PASSIVE GRAPHIC DISPLAY:

- 2.23.1. Layout
- 2.23.1.1. The fire alarm zone passive graphic display shall be completed in the latest version of AutoCAD. The drawing shall indicate all the building floor plans and respective fire alarm zones with the description corresponding to the zone indication at the fire alarm control panel and annunciator.
- 2.23.1.2. The fire alarm zones indicated for each floor shall be clearly defined with borders to indicate zone separation.
- 2.23.1.3. The general font style shall be Helvetica upper case. Text size:
- 2.23.1.3.1. 6 mm in height for building name and 4.5 mm for municipal address and floor plans all coloured green.
- 2.23.1.3.2. Main entrance arrow and text shall be Romans forward slant style 3 mm in height coloured cyan.
- 2.23.1.3.3. Fire alarm zones and equipment notes shall be 3 mm in height coloured red.
- 2.23.1.3.4. Fire hose cabinets shall be Romans forward slant style 3 mm in height coloured cyan.
- 2.23.1.4. Graphic display colours.
- 2.23.1.4.1. Outline of building plan to be black line on white background.
- 2.23.1.4.2. All egress corridors shall be clearly defined with Red colour #13 solid hatch pattern.
- 2.23.1.4.3. All stairs and elevators shall be indicated using yellow solid hatch pattern.
- 2.23.1.5. Include the following information on the graphic display:
- 2.23.1.5.1. A north arrow on the upper left corner of the zone graphic.
- 2.23.1.5.2. "You are here" location in Red and properly orientated to the viewer when standing in front of the graphic.
- 2.23.1.5.3. A drawing scale graph and drawing file number located in the lower right of the zone graphic.
- 2.23.1.5.4. Building name and number at the bottom centre of the graphic display with municipal address indicated on the next line below.
- 2.23.1.5.5. The main building entrance and street reference.
- 2.23.1.5.6. Location of fire alarm control panel and annunciators, fire department connections, fire pumps, fire hose cabinets and associated standpipe and sprinkler valves.
- 2.23.1.5.7. Location of main gas valve, suppression systems, chemical storage vaults, major mechanical equipment and duct smoke detectors indicating zone number.
- 2.23.1.5.8. Substation and transformer locations indicating primary and secondary voltages.
- 2.23.2. Construction
- 2.23.2.1. The graphic display shall be:
- 2.23.2.1.1. Printed on white heavy weight 40lb. coated bond with colour UV inks, laminated on 1.5 mm styrene board and covered with clear Lexan.
- 2.23.2.1.2. Standard passive graphic display size ranges from 8.5"x11" to 23"x35". The final size of the graphic may vary depending on the layout requirements and site conditions.
- 2.23.2.2. Trim to be No. 4 stainless steel finish.

- 2.23.3. Location
- 2.23.3.1. Install graphic display adjacent to each fire alarm annunciator panel and the fire alarm control panel.
- 2.23.3.2. Graphic display to be fixed to the building structure or fire alarm control panel enclosure using tamper proof screws at each corner and at the midpoint on all four sides.
- 2.23.4. Approval Drawings
- 2.23.4.1. Submit three full colour print copies of the passive display graphic for review by the Owner, the Engineer's Representative and the local fire department.
- 2.23.4.2. Include the final approved zone graphic drawing in electronic format with the as-built drawings.

2.24. ANCILLARY DEVICES

- 2.24.1. Remote relay unit to initiate fan shutdown, magnetic door locks and door hold open devices.

2.25. STI STEEL WEB STOPPERS, DETECTOR COVERS.

- 2.25.1. Provide STI 9600 series detector cover for areas where sporting events or similar activities avail.
STI STOPPER 2 & WEATHER PROOF STOPPER 2, COVERS FOR MANUAL STATIONS.
- 2.26.1. Provide STI Stopper 2 1100 series manual station covers for all vandal resistant locations identified on the electrical and architectural drawings.
- 2.26.2. Provide Weather Proof Stopper 2 1200 (flush mount) or 3100 (surface mount) series manual station covers for all weather proof locations and outdoor applications identified on the electrical and architectural drawings.

2.27. RELAY BASE, FOR FIRE DETECTORS.

- 2.27.1. Provide power along with the relay base detector such that the device that is being controlled with the normally open or normally closed relay base may operate or function. Power requirements and relay condition to be determined on site.

2.28. MANUFACTURERS

- 2.28.1. The following are acceptable manufacturers:
 - 2.28.1.1. Chubb Edwards.
 - 2.28.1.2. Simplex.
 - 2.28.1.3. Mircom.
 - 2.28.1.4. Siemens.

PART 3 EXECUTION

3.1. INSTALLATION

- 3.1.1. Install systems in accordance with CAN/ULC-S524.
- 3.1.2. Install central control unit and connect to ac power supply.
- 3.1.3. Install manual alarm stations and connect to alarm circuit wiring.

- 3.1.4. Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts. Install duct type detectors complete with sampling tubes. Ensure duct type smoke detectors are installed far enough away from humidifiers to avoid false alarms; coordinate location of duct type smoke detector with Mechanical Contractor. If false alarms occur, relocate duct type smoke detector at no cost to the Owner.
- 3.1.5. Connect alarm circuits to main control panel.
- 3.1.6. Install bells, horns and visual signal devices and connect to signalling circuits.
- 3.1.7. Connect signalling circuits to main control panel.
- 3.1.8. Adjust visual signal device candela ratings upward, where required to meet coverage. Utilize spare visual signal device circuit capacity required in Part 2.
- 3.1.9. Install end-of-line devices.
- 3.1.10. Install remote annunciator panels and connect to annunciator circuit wiring.
- 3.1.11. Install door releasing devices.
- 3.1.12. Install remote relay units to control fan shut down.
- 3.1.13. Where smoke dampers or combination smoke and fire dampers are shown, terminate damper position monitoring wiring for both fire alarm system and building automation system on damper actuator position end switches. Building automation system wiring to damper location will be provided by Mechanical Division.
- 3.1.14. Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- 3.1.14.1. Sprinkler devices should be wired such that opening of a device will cause a trouble on an alarming device or a supervisory on a supervising device.
- 3.1.14.2. Where mechanical/sprinkler contractor makes revisions to the base design, electrical contractor shall coordinate any revisions to fire protection system directly with the mechanical/sprinkler contractor at no cost to the owner and update as-built drawings accordingly.
- 3.1.15. Room detection system (where applicable):
 - 3.1.15.1. Install detectors. Make necessary connections between room detection panel and main fire alarm panel.
 - 3.1.15.2. Locate and install audible signals and visual alarms.
 - 3.1.15.3. Locate and install detectors under raised floor. Fasten to steel brackets approximately 300 mm above sub-floor level to clear cables and conduits.
- 3.1.16. Connect fire suppression systems to control panel.
- 3.1.17. Splices are not permitted.
- 3.1.18. For audible and visual signal devices in spaces subject to future tenant renovations, install devices in surface mounted boxes and leave 3 m of extra wiring coiled up in the box to allow the devices to be lowered / relocated to suit the tenant fit up ceiling and wall locations.
- 3.1.19. Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- 3.1.20. Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- 3.1.21. Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.
- 3.1.22. Install smoke and smoke/CO alarm in accordance with CAN/ULC-S553.

- 3.1.22.1. Where more than one smoke (or smoke/CO) alarm is installed within a dwelling unit, interconnect the wiring such that actuation of one smoke (or smoke/CO) alarm will cause all the smoke (or smoke/CO) alarms within the dwelling unit to sound.
- 3.1.23. Where devices are to be installed in environments where the temperature can drop below 0°C (or below the addressable device temperature rating), an appropriately rated conventional device is to be installed.
- 3.1.23.1. Provide and install an addressable input module remotely located in a conditioned environment suitable for the device temperature rating.
- 3.1.23.2. Connect the conventional device(s) to addressable input module(s) as necessary to monitor the status of the conventional device.
- 3.1.23.3.
- 3.1.24. Where shown on Drawings, install "Fire do not enter signs" in accordance with the requirements of CAN/ULC-S524.

3.2. FIELD QUALITY CONTROL AND COMMISSIONING

- 3.2.1. Perform tests and verification in accordance with Section 26 08 01 - TECHNICAL SERVICES DIVISION STARTUP SERVICE.
- 3.2.2. The installing contractor is responsible for hiring and coordinating with the manufacturer to perform the following:
 - 3.2.2.1. Testing of system to CAN/ULC-S536 prior to performing verification.
 - 3.2.2.2. Partial verification inspection to CAN/ULC-S537 and reports as required for partial occupancy.
 - 3.2.2.3. Complete an entire building test to CAN/ULC-S536 and provide detailed report. Provide a full verification inspection and test report at the end of the project. Cumulative partial verification reports do not constitute a full verification.
- 3.2.3. All fire alarm test and verification reports are to be submitted with a covering letter from the manufacturer clearly stating that there are no deficiencies with the installation prior to releasing the respective area for occupancy.

3.3. LIFE SAFETY INTEGRATION TESTING

- 3.3.1. The fire alarm contractor and fire alarm manufacturer shall participate in the coordination and testing work associated with the Integrated Testing Plan (ITP), as described in more detail in Section 26 05 01 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS. All work shall be coordinated with the Integrated Testing Coordinator (ITC). The work shall include but not be limited to:
 - 3.3.1.1. Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.
 - 3.3.1.2. Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.
 - 3.3.1.3. Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001.
 - 3.3.1.4. Provide fire alarm verification report along with all other documentation requested by the ITC as it relates to the electrical systems in conformance with CAN/ULC-S1001.

3.4. CENTRAL ALARM MONITORING

- 3.4.1. Locate Signal Transmitting Unit in same room as main fire alarm panel or in CACF room, unless shown otherwise on Drawings.

- 3.4.2. Provide a data connection from the Owner's network for internet access for central monitoring.
- 3.4.3. Coordinate with the Owner's Fire Alarm Monitoring Company and install power, conduit and wiring to the Signal Transmitting Unit in compliance with CAN/ULC-S559 and CAN/ULC S561.
- 3.4.4. Facilitate conversation between Owner and Owner's preferred fire alarm central alarm monitoring service to ensure that central monitoring service is provided in time for completion of fire alarm scope and Project occupancy.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. The work covered by this section includes the furnishing of all labor, materials, equipment and incidentals for the inspection and construction of concrete paving and curbing as shown on the Construction Drawings and as described by the Contract Specifications.
- 1.1.2. Comply with the requirements of the Tender Document and General Conditions.

1.2. QUALITY ASSURANCE

- 1.2.1. The contractor must have a minimum of 5 years' experience in concrete work.
- 1.2.2. All materials must conform to CSA A23.1-94. A copy must be kept on site at all times during construction.
- 1.2.3. Furnish the Landscape Architect with a certificate prepared by the Ready-Mix concrete suppliers stating that all requirements regarding strength, slump, air entrainment, mix, materials, and ratio have been met and maintained.
- 1.2.4. Prior to pouring concrete, obtain the approval of the Landscape Architect of all form work, placement of reinforcing steel, consolidation of subgrade and placement and consolidated of granular base.
- 1.2.5. When required by the Landscape Architect, have all concrete tested for compressive strength, slump, and air content, in accordance with CSA A23.2-94. Submit test reports in duplicate and pay all costs incurred.
- 1.2.6. Ensure work complies with the Ontario Building Code and all pertinent local by-laws and regulations. These shall govern in case of conflict with the specification. Obtain and pay for all necessary permits before starting work.

1.3. PRODUCT DELIVERY, STORAGE AND HANDLING

- 1.3.1. Store all materials in accordance with CSA A23.1-94 latest edition.
- 1.3.2. Store reinforcing steel on racks or skids. Protect from contamination by dirt or other materials.
- 1.3.3. Store forms off the ground and sufficiently supported to prevent warping or distortion. Protect from contaminations by oil, grease, water, earth, etc.
- 1.3.4. All concrete is to be ready mixed at plant and transported to the site by truck in accordance with CSA A23.1-94. Hand mixed concrete is not allowed unless approved in writing by the Landscape Architect prior to the start of work.
- 1.3.5. Convey concrete from the mixer to the place of final deposit as rapidly as possible, with as little rehandling as is practical. Avoid segregation and/or loss of material.
- 1.3.6. Place concrete in final position and at such a rate that it remains plastic at all times and flows readily between reinforcement, into all corners and crevices and around all embedded fixtures. Pour in a continuous operation between expansion joints.
- 1.3.7. Thoroughly clean all equipment, used for mixing or transporting of concrete, of all hardened concrete and foreign material prior to placing concrete.
- 1.3.8. Do not allow concrete to be contaminated by foreign materials. Do not use retempered concrete unless approved in writing, by the Landscape Architect.
- 1.3.9. Obtain the approval of the Landscape Architect of the type, number and method of use of mechanical vibrators. Do not operate a vibrator for longer than 10 seconds in any one location.
- 1.3.10. Maintain constant control to ensure that finished concrete is dense, uniform, free of air holes or honeycombs and that no segregation of aggregates and cement paste occurs.

1.4. JOB CONDITIONS

- 1.4.1. Protect all concrete surfaces from damage or harmful effects of weather, water, mechanical shock or trespassers until concrete is properly cured.
- 1.4.2. If temperature is expected to drop below 5°C, place and protect concrete in accordance with AC1.605.

1.5. INSPECTION

- 1.5.1. Obtain the approval of the Landscape Architect of the layout, compacted sub-grade, compacted granular base, formwork and reinforcing before proceeding with subsequent work.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Granular A and Granular B: granular material conforming in all respects to OPSS 1010, latest edition.
- 2.1.2. Portland cement: standard grey portland cement, conforming to CAN/CSA-A5/A8/A362-93 type 10 normal.
- 2.1.3. Aggregates: nominal size as specified and conforming to CSA A23.1-94.
- 2.1.4. Water: clear and free of deleterious substances or efflorescing salts.
- 2.1.5. Air entraining admixtures: conforming to ASTM C 260-94 and of approved manufacturer.
- 2.1.6. Reinforcing steel: conforming to CSA G-30.12-M77 for bars, CSA G30.5-M83 for welded steel wire mesh and OPSS 1440.
- 2.1.7. Expansion joint filler: premoulded bituminous impregnated fiber board conforming to ASTM D1751-73 of thickness and depth specified.
- 2.1.8. Curing Compounds: clear liquid chlorinated rubber to ASTM C309 and OPSS 1315.
- 2.1.9. Formwork: conforming to CSA A23.1-94 and AC1- 347 and of sound wood, in good condition and equal or better than No. 2 grade construction spruce and/or 19mm Douglas Fir plywood, with the surface treated to produce a smooth concrete finish. Plywood to be CSA 0/2/.

2.2. MIXES

- 2.2.1. Mix concrete materials in accordance with CSA CAN3-A23.1M-77, in the proper proportions and ratios to provide a finished product as specified. Concrete mix shall meet the following requirements: Minimum compressive strength 32 MPa at 28 days; 100mm slump at point of deposit; air entrainment 6% (+ or - 1%). Unless noted otherwise on the drawings or details, all concrete is to be a minimum 32 MPa strength.
- 2.2.2. With the exception of air entraining agents, other mixtures may only be used with the written approval of the Landscape Architect. The use of agents to lower the freezing point of the mix will not be permitted.

PART 3 - EXECUTION

3.1. PREPARATION

- 3.1.1. Excavate to the minimum specified depths, after compaction, as shown on the drawings. Maintain sub-grade parallel to finished grade in all cases.
- 3.1.2. Fine grade subgrade eliminating uneven areas and filling low spots. Remove all debris. Excavate all soft and unstable areas in subgrade and backfill with Granular "B".
- 3.1.3. Compact subgrade uniformly to minimum ninety-eight percent (98%) Standard Proctor Density. Arrange for testing of fill materials and compaction. When required and as directed by the

Landscape Architect, the Contractor shall, at his own expense, sprinkle water to assist in compaction.

- 3.1.4. The Granular "B" base shall be applied in maximum 74mm (3 inches) layers, graded, rolled and compacted in accordance with OPSS Division 3.
- 3.1.5. In the event of delay between completion of subgrade and commencement of application of stone base, the Contractor shall re-grade and re-compact subgrade at his own expense if so ordered.
- 3.1.6. Keep materials clean and free of deleterious materials at all times.
- 3.1.7. Maintain final grade of granular base course parallel to finished grade.
- 3.1.8. Submit written test reports.
- 3.1.9. Contractor to ensure that all concrete columns are vibrated to eliminate all voids.

3.2. GRANULAR BASE

- 3.2.1. Spread the specified granular materials in horizontal layers not exceeding 100mm loose depth and compact to 95% Standard Proctor Dry Density. In areas where compaction by roller is not possible, compact with approved mechanical or hand tamping devices to the specified density.
- 3.2.2. Build up thickness of each material to the minimum compacted thickness as specified on the drawings.
- 3.2.3. Ensure that granular does not become contaminated by deleterious material.
- 3.2.4. Correct all irregularities or depressions resulting from rolling and compact until the granular surface is smooth, uniform and true to line and grade.
- 3.2.5. When required by the Landscape Architect, have the compaction of the granular materials tested by an approved, independent testing firm. Submit 2 copies of the test results to the Landscape Architect and obtain his approval prior to pouring concrete. Pay testing costs incurred.

3.3. FORM WORK

- 3.3.1. Erect forms in such a manner as to facilitate dismantling and removal without damaging concrete.
- 3.3.2. Erect forms true to line and level in accordance with the drawings, and sufficiently braced to maintain their form and alignment when concrete is placed.
- 3.3.3. Prior to each pouring operation, coat affected form surfaces with an approved form separating material.
- 3.3.4. Provide for all openings, sleeves, hangers, anchors and ties to be cast into the concrete.
- 3.3.5. Do not use treated plywood for exposed surfaces more than 5 times. Do not use plywood if surface is damaged.
- 3.3.6. Obtain the approval of the Landscape Architect of all form work before proceeding.

3.4. REINFORCEMENT

- 3.4.1. Before placing reinforcement, clean all loose scale, dirt and any other coating that would destroy or reduce bonding to concrete.
- 3.4.2. Place all reinforcement accurately in accordance with the drawings and/or approved shop drawings. Use approved chairs, spacers, hangers or ties to secure the reinforcing in position.
- 3.4.3. Unless directed otherwise, provide the following minimum concrete cover over reinforcing:
 - a) 75mm where concrete is deposited against soil.
 - b) 50mm for bars larger than 10m and 40mm for bars smaller than 10m where concrete is exposed to weather.
- 3.4.4. Obtain the approval of the Landscape Architect of all reinforcing before proceeding.

3.5. JOINTS

- 3.5.1. Locate expansion joints as shown on the drawings or at max. intervals of 6.0m, between new concrete and all new or existing rigid structures, and either side of all driveway sections. Joints must be cast in place.
- 3.5.2. Execute construction joints in accordance with AC1-301 and as detailed on the drawings. Thoroughly clean the joint surface of all laitance and wet thoroughly and slush with a coat of cement grout immediately before placing new concrete.
- 3.5.3. Except for expansion joints, continue reinforcing uninterrupted through joints, unless shown otherwise on the drawings or directed by the Landscape Architect.
- 3.5.4. Stop reinforcing on each side of expansion joints. Where dowels are indicated, cast one half into one side of the joints. The exposed half shall be machined smooth and heavily greased before placing adjoining sections.
- 3.5.5. Locate control joints as shown on the drawings or at a max. spacing of 2.0m. Ensure joints are to a minimum depth of 1/4 the thickness of the concrete. Make joints by one of the following methods:
 - a) Sawed joints
 - b) Hand formed and hand tooled
 - c) Inset joints placed in plastic concrete
- 3.5.6. No offsets will be allowed between adjacent sections of joint fillers and no plugs of concrete will be permitted anywhere within an expansion joint.
- 3.5.7. Apply joint sealant in accordance with the manufacturer's directions. Ensure joints are clean and free of any foreign substances before sealing. Clean any sealant spilled on concrete surface immediately.

3.6. PLACING OF CONCRETE

- 3.6.1. Place concrete by approved means and using approved equipment.
- 3.6.2. Do not place concrete until formwork and grades have been inspected by the Owner or Landscape Architect.
- 3.6.3. Transport concrete from mixer to point of deposit, and place in final position as quickly as possible to prevent separation and loss of materials.
- 3.6.4. While placing concrete, compact thoroughly and uniformly by approved means to ensure a dense homogeneous structure free of air pockets, and honeycombs and closely bonded with reinforcement.

3.7. FINISHING

- 3.7.1. Treat and finish all surfaces as directed or specified and in accordance with CSA CAN3-A23-1-M77.
- 3.7.2. Strike off and float all exposed paving surfaces as soon as possible after consolidation and in accordance with recommendations of the Portland Cement Association. Execute final finishing as specified on the drawings or as directed by the Landscape Architect.
- 3.7.3. Ensure finished surface is true to line and level as shown on the drawings. Walks are to be sloped as per grading plans.
- 3.7.4. All irregularities greater than 6mm under a 3000mm straight edge, operated parallel to the centre line, must be repaired.
- 3.7.5. Obtain the approval of the Landscape Architect of finished surfaces before starting curing operations.

- 3.7.6. Immediately after stripping formwork, obtain the approval of the Landscape Architect before commencing patching, finishing or curing operations.
- 3.7.7. The extent, method and type of mix for patching shall have the approval of the Landscape Architect before commencing work. Ensure patching mix contains an approved bonding and waterproofing agent and that it is installed in accordance with the manufacturer's specifications.

3.8. CURING

- 3.8.1. Keep concrete moist for at least 3 days after placement, in accordance with CSA CAN-A231-M77.
- 3.8.2. Method of curing shall be as specified or by one of the following approved methods if not specified:
- a) Moist curing
 - b) Waterproofing paper or white polyethylene sheeting
 - c) White liquid membrane compound
 - d) Combination of above methods
- 3.8.3. Moist curing: use burlap or approved equal. Ensure it is thoroughly wet when applied and kept continuously wet and in full contact with the surface during the curing period.
- 3.8.4. Waterproof paper or white polyethylene sheeting: ensure sheet is large enough to cover entire concrete surface. Secure to prevent displacement during curing period. Immediately repair any tears or holes.
- 3.8.5. White liquid membrane compound: apply at the rate of 1 litre per 5 square meters after final finishing and all free water has disappeared. Keep membrane compound agitated to prevent settling of compound. Apply membrane compound to edges immediately after formwork is removed. Ensure a continuous and unbroken membrane cover is applied.

3.9. CLEAN-UP

- 3.9.1. Clean and remove all concrete spills from the site and make good any disturbance.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. The work covered by this section includes the furnishing of all labour, materials, equipment and incidentals for the design, inspection and construction of unit paving as shown on the Construction Drawings and as described by the Contract Specifications.

1.2. RELATED WORK

- 1.2.1. Cut, fill and subgrade preparation:
1.2.2. Subsurface structure
1.2.3. Precast concrete

1.3. SAMPLES

- 1.3.1. Submit full size sample of each type of paving unit required for all surfaces to Landscape Architect prior to commencement of work.

1.4. SHOP DRAWINGS

- 1.4.1. Submit shop drawings in accordance with specification requirements as shown on details and plans.
1.4.2. Indicate layout, pattern, and relationship of paving joints to fixtures and project formed details.
1.4.3. Include manufacturer's test data.

PART 2 - PRODUCTS

2.1. MATERIALS

- 2.1.1. Precast Unit Pavers to be uniform in material, color, size and from one manufacturer. Color, size, model and pattern to be as per the Unit Price Contract or detail drawings.
2.1.2. Crushed stone or gravel: hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material, and other deleterious materials. Size as shown on details.
2.1.3. Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material, and other deleterious materials. Size and type as shown on detail drawings.
2.1.4. Sand to CSA A82.56-M1976, hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
2.1.5. Polymeric Sand to be from our established manufacturer. Color as per the detailed drawings or by direction of Landscape Architect.

PART 3 - EXECUTION

3.1. SUBGRADE

- 3.1.1. Ensure that subgrade preparation conforms to levels required to allow for installation of granular base.
3.1.2. Where paving over underground structures, refer to architectural specifications for roofing structure.

3.2. FILTER FABRIC

- 3.2.1. Refer to detail drawings for location and type of fabric.

3.3. GRANULAR BASE

- 3.3.1. Sub-base minimum thickness indicated on detail.
- 3.3.2. Spread and compact crushed stone or gravel in uniform layers not exceeding 100mm. compacted thickness.
- 3.3.3. Compact to a density of not less than maximum dry density in accordance with ASTM D698-78
- 3.3.4. Shape and roll alternately to obtain a smooth, even and uniformly compacted granular base and ensure conformity of grades with finish surface over all under ground structures.
- 3.3.5. Apply water as necessary during compaction to obtain specified density. If granular base is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
- 3.3.6. In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.
- 3.3.7. Ensure top of granular base does not exceed plus or minus 10mm. of finished grade less combined thickness of granular laying course less surface course.

3.4. EDGING

- 3.4.1. Install edging true to grade, in location, layout and pattern as indicated.

3.5. GRANULAR LAYING COURSE

- 3.5.1. Place screenings to a compacted thickness as indicated on details.

3.6. SURFACE COURSE

- 3.6.1. Ensure granular laying course is dry (4-8% moisture content) prior to placement of unit pavers.
- 3.6.2. Install unit paving true to grade, in location, layout and pattern as indicated.
- 3.6.3. Where required, cut units accurately without damaging edges.
- 3.6.4. Interlocking precast concrete pavers.
 - .1 Install pavers with butt joints.
 - .2 Tamp down and level pavers with mechanical plate vibrator on minimum 19mm thick plywood unit pavers are true to grade and free of movement. Except for areas over underground structure where base must be rolled in 50mm layers.
 - .3 Fill spaces between pavers by sweeping in fine brick sand or Polymeric Sand as specified in the detailed drawings.
 - .4 Pass mechanical plate vibrator on sand cushion over surface course to achieve compaction of sand in joints.
 - .5 If Polymeric Sand is specified, install as per manufacturer's specifications.
- 3.6.5. Sweep all surfaces clean.

END OF SECTION

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. The work covered by this section includes the furnishing of all labor, materials, equipment and incidentals for the inspection, maintenance and planting of trees, shrubs, ground covers and perennials as shown on the Construction Drawings and as described by the Contract Specifications.
- 1.1.2. Comply with all requirements of the General Requirements – Section 01 00 00.

1.2. QUALITY ASSURANCE

- 1.2.1. Planting work is to be carried out by experienced personnel under the direction of skilled foreman and in strict accordance with the Specifications and best horticultural practice.

1.3. PRODUCT, DELIVERY, STORAGE AND HANDLING

- 1.3.1. Supply manufactured items such as super phosphate, fertilizer tablets, mulch, etc., in standard containers, clearly indicating contents, weight, component analysis, and the name of the manufacturer.
- 1.3.2. Store manufactured materials, subject to deterioration, in a weatherproof place on site and in such a manner that their effectiveness is not impaired.
- 1.3.3. Supply plant materials as specified on the plant list. Confirm quantities as specified on the drawings, plant list and bid form. Report any discrepancies.
- 1.3.4. Dig materials specified "B.R." (bare root) on the plant list, while in a dormant state and with the majority of the root system intact. Immediately after digging, wrap the roots in wet burlap and keep burlap wet during transport and storage.
- 1.3.5. Provide all material, specified "B. & B." (balled and burlapped) on the plant list, with a solid, earth root ball, wrapped in burlap.
- 1.3.6. Provide all material, specified "WB" (wire basket) on the plant list, with a solid, earth root ball, bound by a wire basket.
- 1.3.7. Do NOT plant material with broken or abraded trunks or branches, or with broken or cracked root balls, or plants which are strongly desiccated, as they will be subject to rejection upon arrival on the project site.
- 1.3.8. Provide root balls of the following minimum sizes to meet the corresponding tree size. Ensure the root ball is large enough to accommodate at least 75% of the fibrous root system.

| Deciduous Trees Caliper | Minimum Root Ball Diameter |
|-------------------------|----------------------------|
| 50 mm | 75 cm |
| 60 mm | 80 cm |
| 70 mm | 85 cm |
| 80 mm | 90 cm |
| 90 mm | 100 cm |
| 1.00 m | 60 cm |
| 1.50 m | 60 cm |

| Coniferous Tree Height | Minimum Root Ball Diameter |
|------------------------|----------------------------|
| 1.75 m | 65 cm |
| 2.00 m | 70 cm |
| 2.25 m | 75 cm |
| 2.50 m | 80 cm |

- 1.3.9. Cut all roots cleanly when digging plants. Split roots are not acceptable. Cut roots even with the edges of the root ball.
- 1.3.10. Protect all plant material from damage and breakage. Protect all parts of the plant material from drying out from the time of digging until they are installed.
- 1.3.11. Do not transport plant material in an open truck unless it is adequately protected from sun and wind.
- 1.3.12. Carefully tie in all branches before transporting.
- 1.3.13. Pad all points of contact between plant material and equipment.
- 1.3.14. Heel in any plant material that cannot be planted during the current day's operations.
- 1.3.15. Keep all roots and root balls moist prior to planting.
- 1.3.16. Do not remove labels attached to plants, until after final inspection.

1.4. SOIL TESTING

- 1.4.1. If required by the Landscape Architect, the soil shall be tested for N, P, K and minor element values, soluble contents, organic matter and pH value.
- 1.4.2. Arrange for, and assume all costs for such testing. Testing shall be carried out by a reputable firm, approved by the Landscape Architect.
- 1.4.3. The Contractor shall submit the soil analysis report to the Consultant prior to the commencement of work. When the source of such topsoil is exhausted, topsoil from a new source shall not be used until it is tested and approved by the Landscape Architect.

1.5. JOB CONDITIONS

- 1.5.1. Proceed with planting operations during suitable weather conditions.

1.6. SUBSTITUTIONS

- 1.6.1. Supply and install plant material as specified on the plant list. Substitutions with other plant material will only be allowed with the written approval of the Landscape Architect.
- 1.6.2. Give timely notice, in writing, to the Landscape Architect when applying for substitutions.

1.7. INSPECTIONS

- 1.7.1. Make plant material available for inspection at source of supply and/or upon arrival on the site by the Landscape Architect. Notify Landscape Architect of delivery date and notify prior to shipment.
- 1.7.2. Approval of plant material at source will not impair the right of the Owner or Landscape Architect to inspect plants upon arrival on the site or during the course of construction and to reject plants which have been damaged, or which, in any way, do not conform to the specifications.
- 1.7.3. If partial acceptance is desired, give timely notice to the Landscape Architect in writing.
- 1.7.4. Partial acceptance will be given when planting work has been delayed due to circumstances beyond the control of the contractor or where planting would be in conflict with good horticultural practices and would jeopardize the performance.

- 1.7.5. Planting of materials, prior to inspection by the Landscape Architect will be the Contractor's responsibility.
- 1.7.6. Remove all rejected materials from the site immediately.
- 1.7.7. Furnish all inspection certificates as may be required by federal, provincial and other applicable regulations.
- 1.7.8. Labels shall indicate variety, grade and size of each plant specimen or bundle. Do not remove any labels from plants until final or partial approval by the Landscape Architect, or as directed.
- 1.7.9. Final inspection of all plant material will be made at the end of the specified guarantee period. All plants must be in a healthy growing condition at the time of this inspection.
- 1.7.10. The contractor is to provide the Landscape Architect with a full scale marked plan showing any substitutions or changes in color.

1.8. MAINTENANCE

- 1.8.1. Prepare and present to the Landscape Architect, two copies of a maintenance schedule prior to the beginning of the guarantee period.
- 1.8.2. All plant materials shall be maintained by the Contractor immediately after any planting has been installed and shall continue until the date of final acceptance.
- 1.8.3. Maintenance shall include all measures necessary to establish and maintain all plants in a vigorous and healthy growing condition, including but not limited to:
 - a) Weeding of planting beds and tree pits. Use herbicides in accordance with the manufacturer's directions. Make good any damage, resulting from herbicide use at no extra cost.
 - b) Watering when required and in sufficient quantities to saturate the root system.
 - c) Pruning, including the removal of dead or broken branches, and treatment of pruning wounds with approved dressing.
 - d) Disease and insect control when required. Use chemical methods in accordance with the manufacturer's directions. Make good any damage at no extra cost.
 - e) Keep all accessories in good condition and properly adjusted. Repair or replace accessories when required at no extra cost.
- 1.8.4. The Contractor shall be responsible for making monthly inspections of all plantings during the guarantee period and submit a written report of each inspection to the Landscape Architect.
- 1.8.5. The Contractor shall instruct the Landscape Architect in writing of any corrective or preventative measures necessary to ensure healthy plant growth. Any damage to plants shall be reported in writing to the Landscape Architect.
- 1.8.6. At the time of acceptance, all material must be in a healthy vigorous growing condition. Beds and tree pits must be free of weeds, rubbish, or debris.

1.9. GUARANTEE

- 1.9.1. Submit written guarantee that all caliper plant materials shall be guaranteed for a period of twenty-four (24) months (or as specified in the warranties section, whichever is greater), commencing on the date of acceptance of substantial performance or client acceptance, whichever is later.
- 1.9.2. The guarantee period for approved "collected plants" shall be for a period of two (2) years, same as the period stated above.
- 1.9.3. During the guarantee period, the Contractor shall make monthly inspections and replace all plants which are dead, missing or which are not in a healthy vigorous growing condition.

- 1.9.4. Supply and plant all replacements in strict accordance with Contract Documents and guarantee replacement as specified.
- 1.9.5. Tag or mark, in a permanently visible manner, all replacement plant material and notify the Landscape Architect, in writing of the date on which replacements were planted. Include a sketch showing location of replaced plants.
- 1.9.6. Plant replacements at a time which is in accordance with good horticultural practice.
- 1.9.7. Remove all accessories and cut at grade, those trees which are to be replaced at a later date. Remove plants, which are to be replaced, when found, or when notified by the Landscape Architect.

PART 2 - PRODUCTS

2.1. PLANT MATERIAL

- 2.1.1. All plant material must be nursery grown and meet the specifications set out in the latest Guide Specifications for Nursery Stock prepared by the Canadian Nursery Trade Association (CNTA) for quality and method of cultivation.
- 2.1.2. Nomenclature of specified plants shall conform to the International Code of Nomenclature for Cultivated Plants and the latest edition of Standardized Plant Names.
- 2.1.3. Any plant material not conforming to 2.1.1 above will be designated as collected plants.
- 2.1.4. Collected plants may only be used when approved in writing, by the Landscape Architect.
- 2.1.5. Plant Material: true to name and type, structurally sound, well branched; healthy and vigorous and free from disease, insect infestations, rodent damage, sun scald, frost cracks, and other abrasions to the bark and densely foliated with a healthy, well developed root system. Pruning wounds must show vigorous bark on all edges and all parts must show live and green cambium tissue when cut.
- 2.1.6. All material must conform to the sizes shown on the plant list, except that larger material may be used when approved by the Landscape Architect. Use of larger plants will not increase the contract price.
- 2.1.7. Plant material sizes must conform to the following standards:
 - a) caliper – diameter of the trunk measured 150 mm above the normal grade around the plant.
 - b) height – measured from the normal grade around the plant to the top of the main foliage mass.
 - c) spread – the diameter of the main foliage mass, at its widest point.

2.2. OTHER MATERIAL

- 2.2.1. Topsoil: a fertile, friable, natural loam; mechanically screened, containing not less than 4% organic matter for clay loams and not less than 4% organic matter for sandy loams to a maximum of 15% and capable of sustaining vigorous plant growth, free of subsoil contamination, roots and stones over 25mm diameter, reasonably free of weeds (as determined by the Landscape Architect) and having a pH ranging from 6.0 to 7.5.
- 2.2.2. Peat moss: partially decomposed fibrous form of cellular stems and leaves of sphagnum moss, free of woody substance and harmful mineral matter, having a pH range of 4.5 to 6.0 and furnished in air dry state packed in standard bags of bales showing the name of the manufacturer.
- 2.2.3. Tree Wrap: 225 g burlap supplied in strips 150 mm minimum to 250 mm maximum width or heavy, waterproof crepe paper 100 mm to 150 mm wide.

- 2.2.4. Anchor stakes: metal 'T' bars: 51 x 51 x 5mm – 2500mm long, or
Wood stakes: 50 x 50mm - 2130mm long (as specified)
- 2.2.5. Wire: #10 galvanized wire for trees 75mm caliper or larger and #11 gauge galvanized wire for smaller trees. Alternative: Use 19mm (3/4") Hemp Rope if specified.
- 2.2.6. Hose: two ply, reinforced, 20mm diameter, new, black rubber garden hose.
- 2.2.7. Mulch: as specified on details.
- 2.2.8. Rodent Guards: 300mm Big 'O' pipe, 200mm MIN Height.
- 2.2.9. Rodent Wrap Tree Protectors: spiral, plastic tree wrap.
- 2.2.10. Fertilizer Tablets: as per details.

2.3. MIXES

- 2.3.1. Provide standard planting soil mix as follows: 6 parts dark loam topsoil, to 2 parts well-rotted cow manure and 1 part peat moss. (Mix thoroughly and provide sample prior to planting.)
- 2.3.2. Add bone meal at the rate of .58 kg per cubic meter and mix thoroughly for each tree or planting bed.
- 2.3.3. Be prepared to adjust the above rate in response to the soil analysis report.

2.4. PLANTER SOIL MIX

- 2.4.1. Provide soil mix equal as per drawings, or approved.

PART 3 - EXECUTION

3.1. PREPARATION

- 3.1.1. Obtain the approval of the Landscape Architect of all planting excavations.
- 3.1.2. Apply topsoil to a depth of 450 mm for shrub and ground cover beds.

3.2. INSTALLATION OF PLANT MATERIAL

- 3.2.1. Planting shall be done during periods suitable with respect to weather conditions and locally accepted practice and to the Landscape Architect's approval.
- 3.2.2. Ensure width of all planting excavations is 3 times the diameter of the root ball.
- 3.2.3. Place plant plumb in the centre of the planting pit with a minimum of 150mm of compacted planting soil mixture under the root ball. Face the plant to give the best appearance or relationship to adjacent structures. Cut away any ropes which might girdle the tree. Remove all rope, wire, and burlap from top 1/3 of the root ball.
- 3.2.4. Place bare root plants so that the roots lie in a natural position.
- 3.2.5. Backfill with planting soil in 150mm layers and firmly tamp each layer to ensure the plant remains plumb. Ensure no air pockets remain around the roots.
- 3.2.6. Water thoroughly when hole is 1/2 full of tamped soil mixture and again when the operation is complete.
- 3.2.7. Except for plants in planting beds, construct an earth saucer around each plant equal to the diameter of the root ball and 100mm minimum depth to retain water around the roots.

3.3. INSTALLATION OF PLANTING ACCESSORIES

- 3.3.1. Wrap all trees over 50mm caliper. Apply wrapping in a spiral manner from grade to above the second branch. Secure wrapping with suitable cord.
- 3.3.2. Stake or guy all trees as outlined in the drawings and detail.

3.4. PRUNING

- 3.4.1. Prune plants after planting to compensate for root loss and in such a manner that the natural shape and character are retained. Do not cut a leader. Use only clean and sharp tools, conforming to proper horticultural practice.

3.5. MULCHING

- 3.5.1. Where a mulch is called for, place a minimum 100mm depth of shredded bark mulch over the planting area. Use only specified mulch. No other type of mulch is acceptable unless approved in writing by the Landscape Architect.
- 3.5.2. Cut and spread a 1200 x 1200 mm piece of approved landscape cloth around the base of each tree and shrub before mulch is spread.

3.6. CLEAN UP

1. At the completion of planting operations, remove all surplus material from the site at no extra cost.
2. Make good all damage resulting from planting operations at no extra cost.
3. Maintain all areas neat and tidy at all times until final acceptance.

END OF SECTION