



**North Roads Operations Centre Expansion
and Storm Water Management Pond
RFTC-1868-24-TR88179**

PREPARED FOR:

York Region

PREPARED BY:



Issued for Tender Addendum No. 05
July 31, 2025

1 GENERAL

- 1.1. This document is issued prior to close of tenders to revise or provide clarification of the work described in the Bid Documents.
- 1.2. The revisions described by this addendum shall be carried out in accordance with the requirements of the Contract Documents.
- 1.3. The items included in this addendum shall become part of the work of the Contract.
- 1.4. This addendum consists of **188** pages, not including the cover page.

2 ARCHITECTURAL

SPECIFICATIONS

2.1 Refer to Section 00 00 10 – Table of Contents

Add: 06 20 00 – Finish
Delete: 07 46 23 – Wood Siding and Soffit
Add: 23 51 10 – Breeching Chimneys and Vent Stacks
Add: 23 52 16 – Condensing Boilers
Add: 23 55 23 – Gas-Fired Radiant Heaters
Add: 23 58 10 – Electric Heat

2.2 Refer to Section 05 50 00 – Metal Fabrications

Add: Item 2.5.5
Revise: Item 2.7

2.3 Refer to Section 06 20 00 – Finish Carpentry

Add: Section 06 20 00 – Finish Carpentry in its entirety.

2.4 Refer to Section 07 52 00 – Modified Bituminous Membrane Roofing

Delete: Item 1.2.1.1.3
Delete: Item 2.7.2

2.5 Refer to Section 08 80 50 – Glazing

Revise: Item 2.4.2
Revise: Item 3.9.1
Revise: Item 3.9.2

2.6 Refer to Section 10 14 10 – Signage

Add: Item 1.1.2.2
Add: Item 2.7.1
Add: Item 3.2.6

2.7 Refer to Section 10 99 99 – Washroom Accessories Schedule

Add: MR-02, PD-01, WB-02, WB-01, SH-01, SP-02
Delete: PD-02

DRAWINGS

2.8 Refer to Drawing A001

Revise: Limiting Distance Calculations to account for mechanical louvers
Revise: Locations and sizes of mechanical louvers

2.9 Refer to Drawing A010

Revise: R2 and R3 roof assembly descriptions

2.10 Refer to Drawing A301

Revise: Locations and sizes of mechanical louvers

2.11 Refer to Drawing A603A

Revise: Wall Section - Exterior Wall at Exist. OH Door Typ.

2.12 Refer to Drawing A604

Revise: note for metal roofing system clip

Revise: note "EXTEND CAST-IN-PLACE CONCRETE WALL 200mm BELOW TOP OF INTERIOR SLAB, TYP."

2.13 Refer to Drawing A605

Revise: note "EXTEND CAST-IN-PLACE CONCRETE WALL 200mm BELOW TOP OF INTERIOR SLAB, TYP."

2.14 Refer to Drawing A606

Revise: note "EXTEND CAST-IN-PLACE CONCRETE WALL 200mm BELOW TOP OF INTERIOR SLAB, TYP."

2.15 Refer to Drawing A607

Revise: note "EXTEND CAST-IN-PLACE CONCRETE WALL 200mm BELOW TOP OF INTERIOR SLAB, TYP."

2.16 Refer to Drawing A610

Revise: Typ. OH Door Head – Section 2

2.17 Refer to Drawing A611

Revise: Framing at louvers

Add: Typical Louvre Head – Section 2

2.18 Refer to Drawing A851

Revise: Washroom accessory tag

2.19 Refer to Drawing A852

Add: LO-01, LO-02, LO-03 tags

3 STRUCTURAL

3.1 Refer to attached Structural Addendum No. 05

4 MECHANICAL

4.1 Refer to attached Mechanical Addendum No. 05

5 ELECTRICAL

5.1 Refer to attached Electrical Addendum No. 05

6 CIVIL

6.1 Refer to attached Civil Addendum No. 05

7 ATTACHMENTS

The following attachments are being issued with and form part of this addendum:

- 7.1 Specification Section 00 00 10 – Table of Contents – 7 Pages
- 7.2 Specification Section 05 50 00 – Metal Fabrications – 10 Pages
- 7.3 Specification Section 06 20 00 – Finish Carpentry – 5 Pages
- 7.4 Specification Section 07 52 00 – Modified Bituminous Membrane Roofing – 20 Pages
- 7.5 Specification Section 08 80 50 – Glazing – 14 Pages
- 7.6 Specification Section 10 14 10 – Signage – 5 Pages
- 7.7 Specification Section 10 99 99 – Washroom Accessories Schedule – 2 Pages
- 7.8 Architectural Addendum No. 05 – 12 Pages
- 7.9 Structural Addendum No. 05 – 4 Pages
- 7.10 Mechanical Addendum No. 05 – 95 Pages
- 7.11 Electrical Addendum No. 05 - 5 Pages
- 7.12 Civil Addendum No. 05 - 2 Pages
- 7.13 Appendix C (Part 6.15) 00 30 00 Summary of Salt-Impacted and Contaminated Soils July 30 2025 Engtec - 4 Pages

END OF ADDENDUM

Division 0 – Bidding Documents

00 00 10	Table of Contents
00 01 07	Specifications Authentication
00 30 00	Information Documents

Division 01 - General Requirements

01 11 00	Summary of Work
01 14 00	Work Restrictions
01 21 00	Allowances
01 31 19	Project Meetings
01 32 33	Photographic Documentation
01 33 00	Submittal Procedures
01 33 01	LEED V4 Submittal List
01 35 00	Delegated Design
01 35 22	LEED NC V4 Checklist
01 35 29	Health and Safety Requirements
01 35 43	Environmental Procedures
01 41 00	Regulatory Requirements
01 45 00	Quality Control
01 50 00	Temporary Facilities and Controls
01 51 00	Temporary Utilities
01 52 00	Construction Facilities
01 56 00	Temporary Barriers and Enclosures
01 57 00	Erosion and Sedimentation Control
01 57 00a	Erosion and Sedimentation Control - Checklist
01 61 00	LEED Product Requirements
01 62 00	Product Options and Substitutions
01 62 10	Substitute Product Request Form
01 65 00	Owner Supplied Products
01 71 00	Examination and Preparation
01 74 11	Cleaning
01 74 19	Construction Waste Management
01 74 19a	W1 Proposed Receiving Facilities Form
01 74 19b	W2 Waste Tracking Worksheet
01 77 00	Closeout Procedures
01 78 00	Closeout Submittals
01 79 00	Demonstration and Training
01 81 13	General LEED Requirements
01 81 19	Indoor Air Quality
01 81 19a	IAQ 1 Low-Emitting Materials Form
01 81 19b	IAQ 2 Management Inspection Form
01 81 19c	IAQ 3 Photo Documentation Checklist
01 91 13	General Commissioning (Cx) Requirements
01 91 13.13	Commissioning (Cx) Plan
01 91 13.15	Commissioning Plan
01 91 13.16	General Commissioning Forms

Division 02 - Existing Conditions

02 07 50	Cutting and Patching
02 20 10	Structural Alterations
02 41 13	Selective Site Demolition
02 41 13.13	Paving Removal
02 41 19	Demolition of Structure
02 50 00	Site Remediation
02 65 00	Underground Storage Tank Removal

Division 03 – Concrete

03 10 00	Concrete Forming
03 20 00	Concrete Reinforcement
03 30 00	Cast-In-Place Concrete
03 30 00.09	Cast-In-Place Concrete Short Form
03 35 00	Concrete Finishing

Division 04 – Masonry

04 22 00	Unit Masonry
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Division 05 - Metals

05 12 00	Structural Steel
05 12 13	Architecturally-Exposed Structural Steel
05 31 00	Steel Deck
05 41 00	Structural Metal Stud Framing
05 50 00	Metal Fabrications
05 51 29	Metal Stairs and Ladders

Division 06 - Wood, Plastics and Composites

06 10 00	Rough Carpentry
06 20 00	Finish Carpentry
06 40 00	Architectural Woodwork
06 63 00	Fiberglass Reinforced Plastics (FRP)

Division 07 - Thermal and Moisture Protection

07 05 20	Building Envelope Air Tightness
07 14 16	Cold Fluid Applied Waterproofing
07 21 13	Board Insulation
07 21 19	Foam-in-Place Insulation
07 21 29	Spray Applied Polyurethane Foam
07 27 13	Modified Bituminous Air and Vapour Barrier
07 27 19	Sheet Membrane Air and Vapour Barrier
07 42 00	Composite Metal Panels
07 42 13	Preformed Metal Cladding

07 42 43	Insulated Wall Panels
07 46 23	Wood Siding and Soffit
07 46 43	Composite Wood Siding and Soffit
07 52 00	Modified Bituminous Membrane Roofing
07 61 00	Sheet Metal Roofing
07 62 00	Sheet Metal Flashing and Trim
07 72 33	Roof Hatches
07 84 00	Firestopping and Smoke seals
07 92 00	Sealants

Division 08 - Openings

08 11 13	Steel Doors and Frames
08 11 16	Aluminum Doors and Frames
08 36 13	Sectional Metal Doors
08 44 13	Glazed Aluminum Curtain Walls
08 50 13	Aluminum Windows
08 71 00	Door Hardware
08 80 50	Glazing
08 87 53	Glazing Films

Division 09 – Finishes

09 21 16	Gypsum Board Assemblies
09 22 00	Non-Structural Metal Framing
09 30 13	Tiling
09 48 33	Acoustic Baffles
09 51 13	Acoustical Panel Ceilings
09 51 53	Direct-Attached Acoustical Ceilings
09 65 00	Resilient Flooring
09 67 23	Resinous Flooring
09 72 00	Vinyl Films
09 91 00	Painting
09 99 99	Materials List

Division 10 – Specialties

10 14 10	Signage
10 14 54	Traffic Signage
10 21 13	Toilet Compartments
10 22 23	Moveable Partition System
10 28 10	Toilet and Bath Accessories
10 51 13	Metal Lockers
10 99 99	Washroom Accessories Schedule

Division 11 – Equipment

11 24 31	Roof Fall Arrest
11 31 00	Appliances

11 51 23 Metal Shelving

Division 20 - Common Mechanical Work Sections

20 01 10 Mechanical General Requirements
20 01 50 Mechanical Basic Materials And Methods
20 05 05 Mechanical Demolition
20 05 14 Mechanical Work in Existing Building
20 05 33 Electric Heat Tracing
20 05 48 Vibration Isolation
20 05 70 Motors, Motor Starters, Motor Control Centres, And Wiring
20 05 75 Variable Frequency Drives
20 05 95 Testing Adjusting And Balancing
20 07 13 Mechanical Ductwork Insulation
20 07 16 Mechanical Equipment Insulation
20 07 19 Mechanical Piping Insulation
20 08 10 Mechanical Commissioning

Division 21 - Fire Protection Sections

21 20 10 Fire Extinguishers

Division 22 - Plumbing and Drainage Sections

22 11 10 Potable Water Piping And Pumping Systems
22 13 10 Sanitary And Storm Water Drainage And Vent Piping And Pumping Systems
22 15 13 Compressed Air Systems
22 30 10 Plumbing Equipment And Specialties
22 40 10 Plumbing Fixtures And Drains

Division 23 - HVAC Sections

23 10 10 Fuel Systems
23 21 13 HVAC Piping Systems, Valves And Accessories
23 21 23 HVAC Pumps
23 23 10 Refrigerant Piping
23 25 10 HVAC Chemical Treatment Systems
23 30 10 HVAC Ductwork
23 33 10 Air Duct Accessories
23 35 10 Fans And Blowers
23 36 10 Air Grilles And Diffusers
23 37 10 Air Terminal Control Units
23 40 10 Air Filters
23 51 10 Breeching Chimneys and Vent Stacks
23 52 16 Condensing Boilers
23 55 23 Gas-Fired Radiant Heaters
23 57 10 HVAC Heat Exchangers
23 58 10 Electric Heat
23 72 10 Air To Air Recovery Systems

23 74 16	Packaged Rooftop Air-Conditioning Units
23 81 26	Split System Air Conditioning Units
23 81 29	Variable Refrigerant Flow Systems
23 81 43	Air Source Heat Pump Flow Systems
23 82 10	Terminal HVAC Equipment
23 83 15	Radiant Floor Heating and Snow Melting Systems
23 84 13	Humidifiers

Division 25 Building Automation System (BAS) And Controls Sections

25 05 10	BAS General Requirements
25 10 10	BAS Control Network
25 30 10	BAS Instrumentation and Devices
25 56 26	Integrated Lighting System Controls

Division 26 – Electrical

26 05 00	Electrical General Requirements
26 05 01	Shop Drawings, Product Data And Samples
26 05 03	Electrical Systems Commissioning
26 05 05	Basic Materials And Methods
26 05 08	Firestopping
26 05 10	Electrical Identification
26 05 11	Testing And Coordination Study Of Distribution
26 05 12	Arc Flash Hazard Study
26 05 14	Work In Existing Building
26 05 21	Wire And Cable Up To 600 Volts
26 05 27	Grounding And Bonding
26 05 29	Hangers And Supports
26 05 31	Splitter Trough
26 05 33	Raceways And Boxes
26 09 23	Digital Metering System
26 11 10	Electrical High Voltage Service
26 12 16	Low Voltage Dry Type Transformers
26 24 01	Service Entrance Lv Switchboard
26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 13	Fuses
26 28 23	Safety Switches
26 28 33	Quick Connect Switches
26 29 01	AC Contactors
26 32 13	Gas Generator (SU)
26 36 23	Automatic Transfer Switches
26 50 00	Lighting Luminaires
26 80 00	Electric Vehicle Charger
	APPENDIX A YRND – Lighting Standard
	APPENDIX B YRND – Receptacle And Circuit Labelling Standard
	APPENDIX C YRND – Electrical Power Monitoring Standard
	APPENDIX D YRND – Electrical & ICAT Works Proposed Phasing

APPENDIX E YRND – Proposed Phasing

Division 27 & 28 Information, Communications, Automation & Technology (ICAT)

27 05 00	Communications General Requirements
27 05 01	ICAT Shop Drawings, Product Data And Samples
27 05 26	Grounding And Bonding
27 05 29	hangers and supports
27 05 32	Firestopping
27 05 53	Identification
27 10 00	Testing And Documentation
27 11 16	Cabinets, Racks, Frames And Enclosures
27 11 19	Termination Blocks And Patch Panels
27 13 23	Optical Fiber Backbone Cabling
27 15 13	Copper Horizontal Cabling
27 15 43	Copper Jack Information Outlets And Connectors
27 15 45	Fiber Connectors, Adapters And Adapter Panels
27 15 49	Work Area Faceplate-Wall Plates And Surface Mount Boxes
27 16 15	Copper Patch Cords
27 16 17	Multimode Optical Fiber Cords And Pigtailed
27 16 19	Singlemode Optical Fiber Cords And Pigtailed
28 05 00	Security General Requirements
28 13 00	Security Systems
28 15 00	Intercom System
	APPENDIX A YRND – ITS Standards And Guidelines
	APPENDIX B YRND – Security System Specifications

Division 31 – Earthworks

31 05 16	Aggregates for Earthwork
31 23 00	Excavation and Fill
31 23 33.01	Excavating, Trenching and Backfilling

Division 32 – Exterior Improvements

32 01 00.01	Pavement Cleaning and Marking Removal
32 12 10	Marchall Immersion Test for Bitumen
32 12 13.16	Asphalt Tack Coats
32 12 16	Asphalt Paving
32 13 13	Concrete Paving, Sidewalks, Curbs, and Gutters
32 15 40	Crushed Stone Surfacing
32 17 23	Pavement Markings
32 31 13	Pavement Coatings
32 33 00	Site Furnishings
32 91 19.13	Topsoil Placement and Grading
32 92 19.16	Hydraulic Seeding
32 93 10	Trees, Shrubs and Ground Cover Planting

Division 33 – Utilities

33 05 16	Maintenance Holes and Catch Basin Structures
33 41 00	Storm Utility Drainage Piping
33 46 17	Subgrade Drainage Network

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section Includes Metal Fabrications as indicated on drawings.
- .2 Related Requirements:
 - .1 Section 01 35 00 – Delegated Design
 - .2 Section 03 30 00 – Cast-in-Place Concrete
 - .3 Section 04 22 00 – Unit Masonry
 - .4 Section 05 31 00 – Steel Deck
 - .5 Section 05 51 29 – Metal Stairs and Ladders
 - .6 Section 06 10 00 – Rough Carpentry
 - .7 Section 06 40 00 – Architectural Woodwork
 - .8 Section 09 21 16 – Gypsum Board Assemblies
 - .9 Section 09 91 00 – Painting

1.2 REFERENCES

- .1 Reference Standards:
 - .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A53/A53M-22, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A153/A153M-23, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM A269/A269M-22, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .5 ASTM A276/A276M-24, Standard Specification for Stainless Steel Bars and Shapes.
 - .6 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .7 ASTM A385/A385M-22, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
 - .8 ASTM A500/A500M -23: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - .9 ASTM A501/A501M -21: Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - .10 ASTM A570-79, Standard Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality. (Withdrawn)
 - .11 ASTM A591/A591M-98, Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight [Mass] Applications. (Withdrawn 2005)

- .12 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .13 ASTM A666-23, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.
- .14 ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- .15 ASTM B177/B177M-11(2021), Standard Guide for Engineering Chromium Electroplating.
- .16 ASTM B221-21, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .17 ASTM B221M-21, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .18 ASTM B632/B632M-18, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
- .19 ASTM E935 -21: Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
- .20 ASTM F593-22, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- .21 ASTM F3125/F3125M-23, 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, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- .2 Canada Green Building Council (CaGBC):
 - .1 LEED Canada V4 – Building Design and Construction (BD+C).
- .3 Canadian Standards Association (CSA Group):
 - .1 CSA G40.20-13/G40.21-13(R2023), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel. Includes Update No. 1 (2014)
 - .2 CSA G164-18 (R2023), Hot Dip Galvanizing of Irregularly Shaped Articles, Includes Update No. 1 (2020).
 - .3 CSA G189-1966(R2003), Sprayed Metal Coatings for Atmospheric Corrosion Protection.
 - .4 CSA S16:19, Design of Steel Structures, Includes Errata (2019) and Errata (2023).
 - .5 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W48:23, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W55.3-08 (R2023), Certification of companies for resistance welding of steel and aluminum.
 - .8 CSA W59-18 (R2023), Welded Steel Construction, Includes Errata (2020).
 - .9 CSA W178.1-18 (R2023), Certification of Welding Inspection Organizations.

- .10 CSA W178.2-18 (R2023), Certification of Welding Inspectors.
- .4 National Association of Architectural Metal Manufacturers (NAAMM):
 - .1 NAAMM AMP 500-06, Metal Finishes Manual.
 - .2 NAAMM AMP 521-01 (R2012), Pipe Railing Manual.
 - .3 NAAMM AMP 555-92, Code of Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).
- .5 Naval Publications and Form Center (NPFC):
 - .1 NPFC-MIL-P-21035, Paint High Zinc Dust Content, Galvanizing Repair (Metric) (2021).
- .6 Process Industry Practices: PIP STF05501, Fixed Ladders and Cage Fabrication Details
- .7 The Society for Protective Coatings (SSPC) / National Association of Corrosion Engineers (NACE International):
 - .1 Surface Preparation Guidelines:
 - .1 SSPC SP3, Power Tool Cleaning (2018).
 - .2 SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.
 - .3 SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.
 - .4 SSPC-SP7/NACE No. 4, Brush off Blast Cleaning.
- .8 Underwriters Laboratories ECOLOGO Certification Program (UL):
 - .1 UL 2760, Surface Coatings - Recycled Water-Borne Coatings (formerly CCD-048).
 - .2 UL 2768, Architectural Surface Coatings (formerly CCD-047).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting in accordance with Section 01 31 19 – Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Provide one electronic copy of WHMIS SDS - Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada and indicate VOC content for:
 - .1 Finishes, coatings, primers and paints.
- .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

- .1 Indicate materials, finishes, profiles, core thicknesses, connections, joints, sizes of sections, method of anchorage, number of anchors, supports, fasteners, rivets, welds, reinforcement, details, and accessories.
- .2 For items where design is delegated to fabricator, provide shop drawings signed and sealed by the professional engineer registered in Province of Work, responsible for the design as indicated in Section 01 35 00 - Delegated Design.
- .3 Submittals shall bear the seal of a professional engineer registered in the Province of the Work.
- .4 Submit delegated design professional engineer's design notes and calculations upon request of the Consultant.
- .5 Submit Letter of Commitment, signed and sealed by the professional engineer required by the Work of this Section in compliance with Section 01 35 00 – Delegated Design Submittals; professional engineer shall define applicable responsibilities in the completed Letter of Commitment and Letter of Compliance in compliance with the intent of the Building Code. Submit in conjunction with Shop drawings.
- .6 Submit evidence of welder qualifications specified in this Section.
- .7 Prior to declaration of Substantial Performance, submit subcontractor's design engineer to certify substantial compliance with the system design by submitting a Letter of Compliance, signed and sealed by the retained professional engineer required by the Work of this Section in compliance with Section 01 35 00 – Delegated Design Submittals.
- .8 LEED Submittals: provide LEED submittals in accordance with Section 01 61 01 - LEED Product Requirements.

1.5 QUALITY ASSURANCE

- .1 Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- .2 Welding: Qualify procedures and personnel according to the following:
 - .1 Welders shall be qualified by Canadian Welding Bureau for classification of work being performed.
 - .2 The fabricator shall be certified to CSA W47.1, Division 1 or 2.1.
 - .3 Do welding inspection to CSA W178.1 and W178.2.
 - .4 Resistance welding: to CSA W55.3.
 - .5 Fusion welding: to CSA W59.
- .3 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .4 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 555.

- .6 Perform Work to the highest standard of modern shop and field practice, by personnel experienced in this Work. Accurately fit joints and intersecting members in true planes with adequate fastening. Build and erect the Work plumb, true, square, straight, level, accurate to the sizes shown, and free from distortion or defects.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Exercise due care in storing, handling and erecting all materials and support all materials properly at all times so that no piece will be bent, twisted or otherwise damage structurally or visibly.
- .2 Correct damaged material and where the Consultant deems damage irreparable, replace the affected items at no additional expense to the Consultant or Owner.
- .3 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed.
- .4 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.
- .5 Packaging Waste Management:
 - .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management.

1.7 SITE CONDITIONS

- .1 Coordinate this Work with the remainder of the Work and exercise the necessary scheduling to ensure that all Work is carried out and all items incorporated during the appropriate construction phase.
- .2 Provide instructions and drawings to other trades for setting bearing plates, anchors bolts, and other members that are built in to work of other trades.
- .3 Protect other Sections of the Work from damage by this Section of the Work.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CSA-G40.20/G40.21, Grade 300W.
- .2 Hollow Structural Sections: In accordance with CSA G40.20/G40.21, Grade 350W, Class C.
- .3 Steel pipe: to ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads, galvanized finish.
- .4 Steel Tubing: ASTM A500/500M, Grade B or ASTM A501/501M.
- .5 Welding materials: to CSA W59.
- .6 Welding electrodes: to CSA W48 Series.
- .7 Fasteners: Bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws, and machine bolts.

- .1 Unfinished fasteners: In areas not exposed to public, use unfinished bolts conforming to ASTM A307, Grade A, with hexagon heads and nuts. Supply bolts of lengths required to suit the thickness of the material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
- .2 Finished fasteners:
 - .1 In areas exposed to public use, bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws and machine bolts to be hot dip galvanized in accordance with ASTM A153/A153M or CSA-G164.
 - .2 For joining stainless steel components use stainless steel fasteners of same type.
- .8 Structural bolts: to ASTM F3125/F3125M.
- .9 Stainless steel fasteners, washers and nuts: to ASTM F593, 18-8 austenitic stainless steel (Grade 8 - B8/B8A), sized as required for purpose intended, or as otherwise indicated. Cold finished: Condition B, cold worked, per ASTM A276/A276M.
- .10 Grout: non-shrink, non-metallic, non-corrosive flowable, 15 MPa at 24 hours.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat, round, or oval headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications to provide corrosion protection in accordance with CSA S16.
- .5 Welding is to conform to CSA W59 and the fabricator certified to CSA W47.1. Include for welding inspection in the Contract.
- .6 File or grind all exposed welds smooth and flush. Repair or fill all pits, cracks and holes. Grind and polish all handrails to a smooth, even surface. Smooth all inside corners, returns.
- .7 Insulate when necessary to prevent electrolysis due to metal to metal contact or metal to masonry or concrete contact. Use bituminous paint or other approved method.
- .8 Provide fastenings, including anchor bolts, bolts, lag screws, expansion bolts, straps, brackets, etc. required for the fabrication and erection of work of this Section.

2.3 FINISHES

- .1 Provide LEED compliant coatings for VOC ratings.
- .2 Prior to priming steel, prepare all surfaces in conformance with SSPC SP-3 – Power Tool Cleaning for non-exposed locations and any overhead steel not subject to contact, SSPC SP-5 – White-metal Blast Cleaning for exposed

architectural finished locations, and SSPC SP7- Brush of Blast Cleaning for hand and guard rails. Adjust blast grit to suit primer coat thickness specified in Section 09 91 00 – Painting.

- .3 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A123/A123M, minimum zinc coating of 600 g/m². (Severe, unprotected exposures).
- .4 Electrolytic galvanizing: galvanize steel, where indicated, to ASTM A591/A591M, minimum zinc coating of 180 g/m². (Non-severe, unprotected exposures).
- .5 Wipe coat galvanizing: galvanize steel, where indicated to CSA G189, minimum zinc coating of 75 g/m². (Non-severe, protected exposures)
- .6 Shop Primers: Provide primers that are compatible with paint systems specified.
- .7 Touch up galvanized surfaces with zinc rich coating, to ASTM A780/A780M: NPFC-MIL-P-21035 zinc rich paint, minimum DFT 8 mils.
- .8 Zinc Rich Paint: Conforming to NPFC-MIL -P-21035 zinc rich paint.
 - .1 Clean metal to equivalent of commercial sand blast SSPC-SP6, remove sandblast in residue.
 - .2 Apply one coat of zinc rich paint to surfaces exposed after assembly to minimum dry film thickness of 60 µm (2.5 mil). Apply coating immediately after cleaning and over primer.
- .9 Isolation Coating: Apply an isolation coating to contact surfaces in contact with cementitious materials, wood materials and dissimilar metals except stainless steel.
- .10 Paint: Prepare the Work and paint in accordance with CSA-S16, primed ready for site finish as specified in Section 09 91 00 – Painting. Leave surfaces to be welded unpainted.

2.4 ROUGH HARDWARE

- .1 Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required. Fabricate items to sizes, shapes, and dimensions required.

2.5 MISCELLANEOUS FABRICATIONS

- .1 Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated that are not a part of structural steel framework, as required to complete work.
- .2 Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitred joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- .3 Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

- .4 Miscellaneous Steel Trim: Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination for assembly and installation with other work.

.5 Thermal Break: structural neoprene thermal break:

- .1 Flexural Strength: 25000 psi**
- .2 Tensile Strength: 11000 PSA**
- .3 Thermal Resistance: R value of 0.90**
- .4 Compressive Strength: 48000 PSA**
- .5 Basis of Design Materials:**
 - .1 STB-1, Benchmark Group**

2.6 PIPE BOLLARDS

- .1 Fabricate pipe bollards from Schedule 40 steel pipe and as indicated on Drawings.
- .2 Concrete Fill: comply with requirements of Section 03 30 00 - Cast-in-Place Concrete.
- .3 Fabricate interior bolt down pipe bollards from 152 mm nominal outside diameter, Schedule 40 steel pipe.
- .4 Paint bollards after fabrication, colour as indicated on Drawings.
- .5 Provide dome top bollard covers for exterior bollards.
 - .1 Material: 3.2 mm thick high density polyethylene (HDPE).
 - .2 Colour: as indicated on Drawings.
 - .3 Acceptable Materials:
 - .1 Post Guard, Sure Guard.

2.7 GUARDRAIL AND POSTS

- .1 Guardrail and Posts: as indicated on Civil Drawings: detail OPSD 912.186/ C-13.**
Fabricate guardrails from 3.43 mm thick 305 mm wide x 76 mm deep galvanized steel w-beam with post bolt slots at 3810 mm o.c. or as required by Manufacturer. Flare end sections and offset support blocks as required by Manufacturer.
- .2 Provide W150 x 14 posts galvanized steel and as indicated on Drawings.**
- .3 Coordinate with Electrical to provide exterior receptacles for block heaters.**
- .4 Basis of Design Materials:**
 - .1 W-Beam Rail and Post and Offset Block, Ontario Bollards, Total Protection Specialists**

Part 3 Execution

3.1 INSTALLATION

- .1 Install Work in accordance with manufacturer's/fabricator's written instructions and Contract Documents.
- .2 Do welding work in accordance with CSA W59 unless specified otherwise.
- .3 Supply finished items to be built in to those trades along with instructions for proper installation.
- .4 Apply architectural metal work using hidden mechanical fasteners. Installation shall be by skilled Architectural metal workers experienced in highest quality work.
- .5 Fasteners to draw adjoining sections together in proper, true alignment, and are capable of field adjustment.
- .6 All fasteners, mountings to be non-loosening and installed so that they will be hidden at completion.
- .7 Install all Work to true, straight lines, accurate to profile, all properly aligned.
- .8 Isolate dissimilar metals in a manner approved by the Consultant to prevent electrolytic action or corrosion.
- .9 Install finish hardware supplied under other Sections required for completion of components of this Section.
- .10 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .11 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .12 Make field connections with high tensile bolts to CSA-S16 and weld to prevent loosening.
- .13 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .14 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .15 Repair galvanized areas damaged by welding, flame cutting or during handling, transport or erection in accordance with ASTM A780/A780M. Touch-up with organic zinc-rich paint to NPFC-MIL-P-21035 zinc rich paint, minimum DFT 8 mils.

3.2 PIPE BOLLARDS

- .1 Anchor exterior bollards in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.
- .2 Fill bollards solidly with concrete, mounding top surface.
- .3 Install bollard covers on exterior bollards.
- .4 Anchor interior bollards in place with bolt anchors.

3.3 GUARDRAILS AND POSTS

- .1 Install guardrails and posts as indicated on Drawings.
- .2 Set posts in concrete as indicated on Drawings.

3.4 MISCELLANEOUS ITEMS

- .1 Provide steel angle frame, hanging rods and bracing for supporting bulkheads and shelving.
- .2 Provide bracket backing supports for vanities.
- .3 Steel angle masonry supports as detailed.
- .4 Supply and install miscellaneous metal items as indicated or specified, or as otherwise required for a complete job, in accordance with the design intent of the project.

3.5 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 The work of this section includes the supply, fabrication, and delivery to the job site finishing, and installation of site manufactured finish carpentry indicated on the drawings and as specified.
- .2 Finish carpentry work shall include all clear, kiln dried, dressed, or resawn material exposed to view in a finished building interior and exterior, including running and standing trim, wall bases, door frames, panelling, trim and other trim related products.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 06 40 00 – Architectural Woodwork
- .3 Section 09 91 00 - Painting

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM F1667-17, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
 - .1 North American Architectural Woodwork Standards, Most Recent Edition.
- .3 California Air Resources Board (CARB)
 - .1 Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products (2007)
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974 (2003), Wire Nails, Spikes and Staples
 - .2 CSA Z760-94 (R2001), Life Cycle Assessment.
- .5 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2007.
- .6 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
 - .1 SCAQMD Rule 1113-16, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.
- .7 Western Red Cedar Lumber Association (WRCLA)

1.4 ADMINISTRATION REQUIREMENTS

- .1 Coordination
 - .1 Coordinate provision of concealed blocking or supports.

- .2 Ensure that back-priming of finish carpentry surfaces concealed after installation, has been performed as specified in Section 09 91 00 – Painting, prior to installation.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures
 - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .2 Indicate materials, thicknesses, finishes and hardware.
- .2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit 100 mm x 300 mm samples of cedar to receive finish, to the Consultant for review.
 - .2 Reviewed samples shall become the standard for the work.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide operations and maintenance data in accordance with Section 01 78 00 – Operation and Maintenance Manuals.

1.7 QUALITY ASSURANCE

- .1 Architectural Woodwork Standards (NAAWS) published by the Architectural Woodwork Manufacturers Association of Canada, together with authorized additions and amendments will be used as a reference standard and shall form part of this project specification. Where differences occur between the drawings and specifications requirements and the NAAWS, the more restrictive requirement shall prevail.
- .2 Any reference to Custom or Premium grade in this specification shall be as defined in the NAAWS.
- .3 Any item not given a specific quality grade shall be Custom grade as defined in the NAAWS.
- .4 A copy of the NAAWS shall be made readily available for reference purposes on the job site.
- .5 References in this specification to part and item numbers mean those parts and items contained within the NAAWS.
- .6 Materials and installation shall be in Metric measurements as specified.
- .7 Guarantee and Inspection Service (GIS)
 - .1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC Architectural Woodwork Standards and shall be subject to an inspection at the factory and/or site by an appointed AWMAC Certified Inspector. Inspection costs shall be included in the tender price for this project. (Contact your local AWMAC Chapter for details of inspection costs). Shop drawings shall be submitted to the AWMAC Chapter office for review before work commences. Work that does not meet the AWMAC Architectural Woodwork Standards, as specified, shall

be replaced, reworked and/or refinished by the architectural woodwork contractor, to the approval of AWMAC, at no additional cost to the owner.

- .2 If the woodwork contractor is an AWMAC Manufacturer member in good standing, a two year AWMAC Guarantee Certificate will be issued. The AWMAC Guarantee shall cover replacing, reworking and/or refinishing deficient architectural woodwork due to faulty workmanship or defective materials supplied and/or installed by the woodwork contractor, which may appear during a two year period following the date of issuance.
- .3 If the woodwork contractor is not an AWMAC Manufacturer member they shall provide the owner with a two year maintenance bond, in lieu of the AWMAC Guarantee Certificate, to the full value of the architectural woodwork contract.
- .4 For more information about AWMAC and the GIS Program visit the AWMAC website at www.awmac.com and contact the Ontario AWMAC Chapter office.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 The Architectural Woodwork Manufacturer and the Contractor shall be jointly responsible to make certain that architectural woodwork is not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content.
- .2 Architectural woodwork delivery, storage and handling shall be in accordance with Section 2 Care and Storage of the NAAWS.
- .3 Delivered materials which are damaged in any way or do not comply with these specifications will be rejected by the Consultant and shall be removed from the job site and replaced with acceptable materials.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

1.10 SITE CONDITIONS

- .1 Environmental Conditions: Comply with the NAAWS Section 2 – Care & Storage for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized.

1.11 WARRANTY

- .1 Provide two year AWMAC GIS Guarantee or Maintenance Bond.

Part 2 Products

2.1 LUMBER MATERIAL

- .1 Cedar
 - .1 Western Red Cedar graded to meet NLGA Grading Standards, paragraph 200 and WRCLA.

- .1 Grade: A clear and better (NLGA paragraph 200b).
- .2 Size: as indicated on Drawings.
- .3 Texture: smooth as directed by Consultant.
- .4 Finish: Water repellent, fungus and mildew resistant, resistant to ultraviolet (UV) light and as follows:
 - .1 Confirm finish with Consultant.
- .2 Moisture Content: kiln dried to less than 15% moisture content, confirm moisture content and provide testing results to Consultant prior to application.

2.2 PERFORMANCE / DESIGN CRITERIA FOR WALL MOUNTED WOOD

- .1 Surface Performance Characteristics: Tested in accordance with ULC 102.2.
 - .1 Flame Spread: 150 or less.
 - .2 Smoke Developed: 300 or less.
- .2 Attachment Devices: Size for five times design load indicated in ASTM C635, Table One, Direct Hung.

2.3 SITE FABRICATION

- .1 Fabricate items rigid, plumb and square, as detailed, with tight, bevelled, hairline joints. Sand work smooth, set all nails and screws.
- .2 Countersink bolts and washers, fill holes with matching wood plugs.

2.4 ACCESSORIES

- .1 Fasteners: to suit size and nature of components being fastened. Provide stainless steel fasteners to ASTM F1667, No. 316 for cedar lumber.
- .2 Splines: wood or plastic.
- .3 Adhesive: recommended by manufacturer.
 - .1 Adhesives: maximum VOC limit 30 g/L in accordance with SCAQMD Rule 1168 - Adhesives and Sealants Applications.

Part 3 Execution

3.1 EXAMINATION

- .1 Contractor, Owner, and Consultant to visit site at 80% completion and note state of Work and finishes in the various areas in which cabinet and millwork to be installed.
- .2 Ensure surfaces are ready to receive Work. All surfaces of other Work to be finished and painted before being built-over or covered in any way or millwork installed.

3.2 INSTALLATION

- .1 Do finish carpentry to Quality Standards of the NAAWS, except where specified otherwise.

- .2 Scribe and cut as required to fit abutting walls, and surfaces, to fit properly into recesses and to accommodate intersecting or penetrating objects; secure materials and components in place, rigid, plumb and square, with tight, hairline joints to locations indicated on Drawings and in accordance with NAAWS, and as follows:
 - .1 Form joints to conceal shrinkage
 - .2 Set finishing nails to receive filler
 - .3 Countersink screws in round cleanly cut hole and plug with wood plug matching material being secured
 - .4 Match wood pieces end to end for consistent colour and grain appearance; space and centre joints evenly in runs.

3.3 CONSTRUCTION

- .1 Fastening:
 - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
 - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
 - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
 - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Standing and running trim:
 - .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
 - .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
 - .3 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.
 - .4 Install door and window trim in single lengths without splicing.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for insulated modified bituminous roofing system over steel deck as follows:
 - .1 Deck sheathing
 - .2 Vapour retarder
 - .3 Insulation and insulation overlay
 - .4 Adhesive applied base sheet
 - .5 Adhesive applied cap sheet
 - .2 Products supplied for Work of this section must be from a single manufacturer and compatible with adjacent products.
- .2 Related Requirements:
 - .1 Section 03 30 00 – Cast-in-Place Concrete
 - .2 Section 05 31 00 – Steel Decking
 - .3 Section 06 10 00 – Rough Carpentry
 - .4 Section 07 21 13 – Board Insulation
 - .5 Section 07 27 19 – Sheet Membrane Air and Vapour Barrier
 - .6 Section 07 62 00 – Sheet Metal Flashing and Trim
 - .7 Section 07 92 00 – Sealants
 - .8 Division 22 – Plumbing: Coordination of pipes and pipe fittings and other materials penetrating roof membranes.
 - .9 Division 23 – Heating, Ventilation and Air Conditioning: Coordination of ductwork and other materials penetrating roof membranes.
 - .10 Division 26 – Electrical: Coordination conduit, wiring, communications cabling, cable trays and other materials penetrating roof membranes.

1.2 REFERENCES

- .1 Reference Standards:
 - .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C518-21, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - .2 ASTM C578-23, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - ~~.3 ASTM C726-17, Standard Specification for Mineral Wool Roof Insulation Board.~~
 - .4 ASTM C728-17a(2022), Standard Specification for Perlite Thermal Insulation Board.
 - .5 ASTM C1002-22, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

- .6 ASTM C1177/C1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .7 ASTM C1289-23a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .8 ASTM D41/D41M-11(2023), Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
- .9 ASTM D312/D312M-16a(2023), Standard Specification for Asphalt Used in Roofing.
- .10 ASTM D448-12(2022) Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
- .11 ASTM D2178/D2178M-15a(2021), Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- .12 ASTM D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- .13 ASTM D3273-21, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- .14 ASTM D6162/D6162M-21, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.
- .15 ASTM D6163/D6163M-21, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.
- .16 ASTM D6164/D6164M-21, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- .17 ASTM D6222/D622M-16(2023), Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcement.
- .18 ASTM D6223/D6223M-21, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcement.
- .19 ASTM D6509/D6509M-16(2023), Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcement.
- .20 ASTM E84-23d, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .21 ASTM E96/E96M-23, Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- .2 Canada Green Building Council (CaGBC):
 - .1 LEED Canada V4 – Building Design and Construction (BD+C).
- .3 Canadian General Standards Board (CGSB):
 - .1 CGSB 37-GP-9Ma, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing. (Withdrawn)

- .2 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction. (Withdrawn)
- .4 Canadian Roofing Contractors Association (CRCA):
 - .1 CRCA Roofing Specifications Manual.
- .5 Canadian Standards Association (CSA Group):
 - .1 CSA-A123.3-05 (R2015), Asphalt Saturated Organic Roofing Felt (Reaffirmed 2010).
 - .2 CAN/CSA-A123.4-04 (R2023), Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems, Includes Update No. 1 (2006).
 - .3 CSA A123.21:20, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems.
 - .4 CSA-A123.23-15 (2020), Product Specification for polymer-modified bitumen sheet, prefabricated and reinforced.
 - .5 CSA A231.1:19/A231.2:19, Precast Concrete Paving Slabs/Precast Concrete Pavers, Includes Update No. 1 (2020).
 - .6 CSA O121-17 (R2022), Douglas Fir Plywood.
 - .7 CSA O151-17 (R2022), Canadian Softwood Plywood.
- .6 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .7 Ontario Industrial Roofing Contractors' Association (OIRCA):
 - .1 OIRCA Guide Specification.
- .8 Underwriters Laboratories' of Canada (ULC):
 - .1 ULC 102.2, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies (ULC S102.2). 2018
 - .2 ULC 107, Methods of Fire Tests of Roof Coverings (CAN/ULC S107.10).
 - .3 ULC-701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering (CAN/ULC-S701-11). (Withdrawn).
 - .4 ULC-704.1, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced. 2017
 - .5 ULC-706, Standard for Wood Fibre Insulating Boards for Buildings (CAN/ULC S706-09).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Consultant, OIRCA representative, installer, manufacturer's representative in accordance with Section 01 31 19 – Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

- .5 Notify the Consultant prior to bid closing if anything in the specification or the drawings does not meet OIRCA or manufacturer's warranty requirements.
- .6 Review OIRCA warranty certificate requirements.

1.4 ACTION SUBMITTALS / INFORMATION SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:
 - .1 Provide copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide copies of Workplace Hazardous Materials Information System WHMIS SDS and indicate VOC content for:
 - .1 Primers.
 - .2 Vapour retarder membrane.
 - .3 Sealers.
 - .4 Insulation.
 - .5 Base and cap sheet.
- .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:
 - .1 Indicate flashing, control joints, tapered insulation details, slope, minimum and maximum thicknesses, board size, layout, and numbering and elevation datums at low and high points.
 - .2 Provide installation details for parapets, curbs, and roof penetrations.
 - .3 Provide layout for tapered insulation.
- .3 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .4 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumens, roofing felts, and membrane with specification requirements.
- .5 Manufacturer's field report: in accordance with Section 01 45 00 – Quality Control.
- .6 Reports: indicate procedures followed, ambient temperatures and wind velocity during application.
- .7 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .8 Declaration of Materials Compatibility: submit written declaration stating that materials are compatible with the membrane and substrates and adjacent air/vapour barrier membrane, and are acceptable to the membrane manufacturer. Include a list of materials, suppliers, and manufacturers.
- .9 LEED Submittals: provide LEED submittals in accordance with Section 01 61 01 – LEED Product Requirements.

1.5 QUALITY ASSURANCE

- .1 Single-Source Responsibility: obtain roofing membrane materials from a single manufacturer regularly engaged in the manufacturing and supply of the specified products and meeting or exceeding the material properties and performance characteristics of the materials and manufacturers named in this Section and to meet the warranty requirements.
- .2 Installer Qualifications: company or person specializing in application of modified bituminous roofing systems with five years documented experience approved by manufacturer.
- .3 Roofing and sheet metal work shall be performed in conformance with roofing manufacturer's written recommendations using materials in accordance with CAN/ULC S107.
- .4 Perform Work to OIRCA practice Manual and manufacturers written instructions.
- .5 Work shall be executed by an applicator approved by the OIRCA as a member in good standing at time of application.
- .6 Inspection: Roofing system to be inspected throughout the installation by an OIRCA accepted independent Inspector.
- .7 Provide only materials listed by OIRCA.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 01 – LEED Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
 - .2 Provide and maintain dry, off-ground weatherproof storage.
 - .3 Store rolls of felt and membrane in upright position. Store membrane rolls with selvage edge up.
 - .4 Remove only in quantities required for same day use.
 - .5 Place plywood runways over completed Work to enable movement of material and other traffic.
 - .6 Store sealants at +5 degrees C minimum.
 - .7 Store insulation protected from weather, daylight and deleterious materials.
 - .8 Do not store materials on roof in concentrations that exceed design live load.
- .3 Packaging Waste Management
 - .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management.

1.7 SITE CONDITIONS

- .1 Ambient Conditions:

- .1 Do not perform roofing work when air temperature, including wind chill, falls below the membrane manufacturer's recommended limit.
- .2 Do not apply roofing materials to a damp, frozen or unsuitable surface.
- .3 Do not expose roofing materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.
- .4 Ensure wood has a moisture content less than 19% prior to encapsulating with impermeable membrane.
- .2 Fire Protection:
 - .1 Comply with safety measures described in manufacturer's written installation requirements, requirements of insurance companies and other requirements of the Authorities Having Jurisdiction.
 - .2 Fire Extinguishers, located within six meters of each roofing torch, ULC labelled for ABC protection.
 - .3 At the end of each workday, use a heat detector gun to spot any smouldering or concealed hot spots. Job planning must be organized to ensure workers are still on location at least one hour after torch application.
 - .4 Do not apply torch directly to dry or unprotected wood surfaces.

1.8 WARRANTY

- .1 The Contractor shall provide a Roofing Warranty certificate with a five year Roofing Warranty Period, signed by both the Contractor and the Warrantor stating:
 - .1 The Roofing System has been constructed in accordance with the Contract Documents;
 - .2 The Roofing Warranty Period;
 - .3 Moisture leaks to be corrected within a time-frame determined by the Owner.
 - .4 The Owner as the warrantee, and stating that roofing work will remain in place and be free of any defects in materials and workmanship for the stated Roofing Warranty Period; and either:
 - .1 If a five (5) year Roofing Warranty Period is required: Warrantor shall, at no additional expense to the Owner, repair any roofing failures (of the Roofing System including: moisture penetration, installation errors, manufacturers defects) which includes the replacement of all affected components of the Roofing System, occurring between the date of Substantial Performance of the Work and the end of the Roofing Warranty Period.
- .2 Roofing Membrane Manufacturer: Provide manufacturer's warranty stating that they will repair or replace defective roofing (including labour) and base flashing materials that do not remain watertight, that splits, tears, or separates at the seams or from the substrate within the specified warranty period and as follows:
 - .1 Warranty Period: 10 years Warranty, starting from Substantial Performance for the Project.

- .2 Name of Warrantee: Warrantor shall issue a written and signed warranty identifying the owner's name as the warrantee, and stating that executed work will remain in place and be free of any defects in materials and workmanship for the stated warranty period.

1.9 THIRD PARTY ROOFING INSPECTION

- .1 The Contractor will engage third party roofing inspection. The Inspector will provide numerous inspections and reports to the Owner during the progress of the roofing work, in accordance with the OIRCA Roofing Applications Standards, to help ensure the roofing work is provided as set out in this Contract. Upon notice from the Owner, the Contractor shall expediently perform all steps and make changes as identified by the roofing inspector, at no cost to the Owner. The involvement of the roofing inspector does not relieve the Contractor of the responsibility to supervise, inspect and provide the roofing work as set out in this Contract.
- .2 The Construction schedule shall include roofing inspections. The Owner will provide the number of roofing inspections and the frequency. The Owner, Consultant, roofing inspector(s), and Roofing System manufacturer, at reasonable times, shall have proper and safe access to the Work, including parts of the Work in preparation at locations other than the Place of the Work, for the purposes of observation, inspection and testing.
- .3 Provide copies of the manufacturer's site reports to the Owner, Consultant, and roofing inspector, prior to Substantial Performance of the Work.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis-of-Design: Materials and colours listed below form the Basis-of-Design materials for this project.
- .2 Acceptable Membrane Manufacturers: Subject to compliance with requirements specified in this section and as established by the Basis-of-Design materials, manufacturers offering similar products that may be incorporated into the Work include the following:
 - .1 Henry Company.
 - .2 IKO Industries Ltd.
 - .3 Siplast.
 - .4 Soprema.
- .3 Use only materials from one manufacturer.

2.2 PERFORMANCE / DESIGN CRITERIA

- .1 Provide system with products to achieve ten year manufacturers warranty certificate as indicated above.
- .2 Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

- .3 Roofing System: to CSA A123.21 for wind uplift resistance.
 - .1 Net factored wind uplift pressure 0.53kPa to 2.15kPa. Wind uplift diagram as indicated on Structural Drawings.
 - .2 Coordinate with roof system manufacturer; confirm results with Consultant prior to commencing Work.

2.3 DECK COVERING

- .1 Glass Mat Faced Roof Boards: to ASTM C1177 for manufacturing and ASTM D3273 for mould resistance, standard, mould resistant, thickness as indicated.
 - .1 Surface Burning Characteristics: In accordance with CAN/ULC S102.
 - .1 Flame Spread: 0.
 - .2 Smoke Developed: 0.
 - .2 Long Edges: Square.
 - .3 Location: Where indicated on Drawings.
 - .4 Acceptable Materials:
 - .1 GlasRoc Sheathing, CertainTeed.
 - .2 Securock Gypsum Fiber Roof Board, CGC.
 - .3 DensDeck, Georgia Pacific.
 - .4 Dexcell Glass Mat Roof Board, National Gypsum.
- .2 Sheathing board attachment to steel deck: Corrosion-resistant, self-tapping screws and plates, capable of meeting Performance Criteria specified.
 - .1 Minimum Fastener Properties:
 - .2 Nominal 8 mm diameter fastener with oversized head.
 - .3 Buttress Threads: 12 threads per inch.
 - .4 Pull-out value in 22 gauge Grade E steel deck: 4.2 kN.
 - .5 Typical Static Back-Out: 5.1 N-m.
 - .6 Length to be sufficient to penetrate steel deck by minimum recommended length.

2.4 ROUGH CARPENTRY

- .1 Blocking, nailers, and other carpentry: as indicated in Section 06 10 00 - Rough Carpentry.
- .2 Do not use pressure treated materials where membrane materials are to be adhered directly to wood Products.

2.5 PRIMER

- .1 Primer comprised of elastomeric bitumen, volatile solvents and adhesive enhancing additives as recommended by membrane roofing manufacturer to suit substrate and installation conditions.
 - .1 Acceptable Materials:
 - .1 Blueskin Adhesive – Henry Company.
 - .2 IKO SAM Adhesive.

- .3 TA-325, Siplast.
- .4 Elastocol Stick, Soprema.

2.6 AIR AND VAPOUR RETARDER

- .1 Premanufactured Self Adhesive Air/Vapour Barrier: Self-adhesive air/vapour barrier membrane composed of SBS modified bitumen with thermoplastic polymers and high density polyethylene film and as follows:
 - .1 Thickness: Minimum 0.8 mm.
 - .2 Cold Bending: -35°C.
 - .3 Static Puncture: 400 N.
 - .4 Membrane Breaking Strength (MPa): MD=75, XD=98.
 - .5 Water Vapour Permeance: 0.92 ng/Pa•s•m² to ASTM E96.
 - .6 Acceptable Materials:
 - .1 Vapor Bloc SA – Henry Company.
 - .2 MVP, IKO.
 - .3 Sopravap'R, Soprema.
 - .4 V-Force Vapor Barrier for Siplast System, Elevate (Formerly Firestone).
- .2 Vapour retarder continuity strip: SBS membrane with reinforcement, and elastomeric bitumen. Sanded upper surface; underside self-adhesive, compatible with wall and roof air/vapour retarder membranes as recommended by accepted membrane manufacturers below.
 - .1 Acceptable Materials:
 - .1 ModifiedPlus G100 Tack Sheet, Henry Company.
 - .2 Armourbond Flash Sand, IKO.
 - .3 Paradiene 20 SA, Siplast.
 - .4 Sopraflash Stick Duo, Soprema.

2.7 INSULATION

- .1 Primary Insulation: Closed-cell polyisocyanurate foam core laminated to heavy non-asphaltic glass fibre reinforced facers; 25 mm thickness of largest panels practical, having square edges, minimum LTTR RSI 0.92/25 mm; conforming to ASTM C1289 Type II, Class 1, Grade 3, ULC 704.1, Type III, Class 3, (20 psi) to a tolerance not exceeding 3 mm from nominal size in any dimension, and as follows:
 - .1 Third-party test reports from an accredited laboratory must be provided to verify the declared performance in cold temperatures.
 - .2 Acceptable Materials:
 - .1 Secureshield GC, Carlisle.
 - .2 ACFoam III, Atlas Roofing Corporation.
 - .3 H-Shield GC, Hunter.
 - .4 Therm III, IKO.
 - .5 E'NRGY 3, Johns Manville.

Contract Number: RFTC-1868-24-TR88179

- .6 Paratherm, Siplast.
- .7 Sopra-ISO Plus, Soprema.
- ~~.2 Insulation Mineral Wool Roof Insulation: mineral wool fiber insulation made from ballast rock and slag and with rigid impregnated with a bitumen upper layer and as follows:~~
 - ~~.1 Acceptable Materials:~~
 - ~~.1 Toprock® DD, Rockwool Inc.~~
 - ~~.2 Soprarock DD Plus, Soprema.~~
- ~~.3 Tapered Insulation: Closed-cell polyisocyanurate foam core laminated to organic/inorganic fiber-reinforced facer(s)~~
 - ~~.1 Compressive Strength: Minimum 20 psi (ASTM C1289, Type II, Class 1)~~
 - ~~.2 Thermal Resistance (R-value): Approximately R-5.6 per inch (LTTR method, ASTM C1289); Varies based on slope and thickness; submit layout for review~~
 - ~~.3 Maximum Board Size: 4 ft x 8 ft~~
 - ~~.4 Taper Slope: As indicated on drawings~~
 - ~~.5 Acceptable Materials:~~
 - ~~.1 Sopra Iso Tapered, Soprema~~
 - ~~.2 H Shield Tapered, Hunter Panels~~
 - ~~.3 Tapered ENRGY 3, Johns Manville~~
- ~~Sloped Insulation: Extruded Polystyrene (XPS) Board Insulation: ASTM C578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.~~
 - ~~.1 Rigid closed cell extruded polystyrene foam insulation.~~
 - ~~.2 Comply with ASTM C 578-95, Type IV, density 1.6 lb/cu. ft. min. compressive resistance 210 kPa to ASTM D1621~~
 - ~~.3 Thermal resistance: RSI values of 0.88. at 40 °F and 75 °F respectively to ASTM C518.~~
 - ~~.4 Water absorption: 0.7 to ASTM D2842)~~
 - ~~.5 Surface Burning Characteristics ASTM C 578~~
 - ~~.1 Flame spread 0.~~
 - ~~.2 Smoke Developed 155.~~
 - ~~.6 Basis of Design Materials:~~
 - ~~.1 Sopra XPS 30, Soprema~~

2.8

MEMBRANE

- .1 Composite Cover Board and Base Sheet: Asphaltic-support board and factory applied base sheet:
 - .1 Description: SBS modified base sheet membrane and polyester reinforcement, factory applied to a semi-rigid asphaltic board. The top surface is covered with sand. The membrane side lap is 60% self-adhesive and 40% covered with a poly film that is heat sealed.
 - .1 Board size: 910 mm x 2440 mm x thickness as indicated on Drawings (minimum 5 mm).
 - .2 In conformance with: CGSB 37.56-M

- | | | | |
|----|--------------------------------|--------------|------|
| .3 | Properties: | MD | XD |
| .1 | Strain Energy (kN/m) | 9 | 7 |
| .2 | Breaking Strength (N/50 mm) | 17 | 12.5 |
| .3 | Ultimate Elongation (%) | 60 | 65 |
| .4 | Tear Resistance (N) | 60 | |
| .5 | Static Puncture Resistance (N) | 400 | |
| .6 | Dimensional Stability (%) | -0.4 | 0.3 |
| .7 | Plastic Flow (°C) | ≥ 115 | |
| .8 | Cold Bending (at -30°C) | No Cracking | |
| .9 | Lap Joint Strength (kN/m) | Pass > 4kN/m | |
- .2 Acceptable Materials:
- .1 Protectoboard Base 180, IKO.
 - .2 Protectoboard with Paratech 180 TG, Siplast
 - .3 2-1 Soprasmart Board, Soprema.
- .2 Roof Cap Sheet: Roof waterproofing system comprised of reinforced, elastomeric bitumen cap sheet applied using manufacturer's recommended cold adhesive; base sheet having two surfaces sanded; cap sheet having bottom surface sanded and top surface is protected by coloured granules, and as follows:
- .1 Prefabricated membrane to CSA A123.23.
 - .2 Reinforcement: Composite polyester and glass grid.
 - .3 Elastomeric Bitumen: Mix of bitumen and SBS polymer.
 - .4 Protection: Coloured granules – white.
 - .5 Acceptable Materials:
 - .1 MP-HD-Cap, IKO.
 - .2 Parafor 30, Siplast
 - .3 ColPly Traffic Cap 460, Soprema.
- .3 Membrane base sheet flashing (stripping):
- .1 Primer: Manufacturer's recommended elastomeric bitumen or synthetic rubber blend, volatile solvents, adhesive enhancing additives and resins used to prime substrate to enhance the adhesion of self-adhesive membranes suitable for application temperatures.
 - .2 Roofing membrane with non-woven polyester reinforcement and glass grid and elastomeric bitumen. Top face covered with thermofusible plastic film, underside self-adhesive and protected by silicone release paper in accordance with CSA A123.23 type two, class C, grade one.
 - .3 Components:
 - .1 Reinforcement: Non-woven polyester and glass grid.
 - .2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.
 - .3 Mark top face with lines to ensure proper roll alignment.
 - .4 Characteristics:
 - .1 Cold bending at minimum -25°C: No cracking.
 - .2 Reinforcing weight: minimum 160 g/m².

- .3 Membrane Thickness: minimum 2.5 mm.
- .5 Acceptable Materials:
 - .1 G100 Tack Sheet, Henry.
 - .2 Armourbond Flash, IKO.
 - .3 Sopralply Flam Stick, Soprema,

2.9 ADHESIVE

- .1 Insulation Adhesive: Manufacturers standard adhesives specifically formulated for installation of plastic insulation to roofing materials:
 - .1 Acceptable Materials:
 - .1 Insta-Foam Products Inc. Insta-Stik, Dow.
 - .2 880-333 – Henry Company.
 - .3 IKO Millennium.
 - .4 Parafast Insulation Adhesive by Siplast.
 - .5 Duotack Adhesive, Soprema.
- .2 Roofing Base Sheet Adhesive: manufacturers standard OIRCA approved products.
- .3 Sheathing Board Adhesive: Manufacturers standard adhesives specifically formulated for installation of sheathing to metal deck.
 - .1 Basis-of-Design Materials:
 - .1 830-05, Henry Company.
 - .2 IKO Millennium.
 - .3 Parafast Insulation Adhesive, Siplast.
 - .4 Duotack Adhesive, Soprema.

2.10 ACCESSORIES

- .1 Fasteners:
 - .1 Fasteners to Steel Decking: Cadmium-plated flat-headed, self-tapping screws, No. 14, of Type A or AB, in conformance with CSA B35.3.
- .2 Perimeter Fire Seal: SBS modified bitumen, minimum 60 gm/m² glass fleece reinforced, self adhering membrane having sanded top face, cut into strips minimum 150 mm wide x nominal 1.5 mm thick.
 - .1 Acceptable Materials:
 - .1 Modiflex Tapes, IKO.
 - .2 Sopraguard Tape, Soprema.
- .3 Walkways:
 - .1 Consisting of one additional ply of cap sheet membrane. Grey colour to be different from field membrane as selected by Consultant.
- .4 Flashing and sheet metal in accordance with section 07 62 00 – Sheet Metal Flashing and Trim.

- .5 Waterproofing Mastic: solvent-based mastic containing SBS modified bitumen, fibres and mineral fillers, used to seal around penetrations and extrusions.
 - .1 Compatibility: With air/vapour barrier membrane, substrate and insulation.
 - .2 Specific gravity at 20°C: 1.0 kg/l to 1.12 kg/l.
 - .3 Application Temperature: -10°C to +35°C.
 - .4 Solids by Weight: 70% to 83 %.
 - .5 Acceptable Materials:
 - .1 AquaBarrier Mastic, IKO
 - .2 Sopramastic, Soprema.
- .6 Expansion Joint Waterproofing Membrane: EPDM-based synthetic rubber flexible membrane as recommended by waterproofing system materials manufacturer.
 - .1 Acceptable Materials:
 - .1 Soprajoint Plus, Soprema.
 - .2 Situra Redline
 - .3 Or as recommended by membrane manufacturer.
- .7 Low Rise Foam Adhesive:
 - .1 Acceptable Materials:
 - .1 Millennium, IKO
 - .2 Duotack, Soprema.
- .8 Torches: Use only torches designed for torching roofing material and acceptable to manufacturer.
- .9 Waterproofing liquid flashing: two component PMMA liquid membrane with fleece fabric.
 - .1 Acceptable Materials:
 - .1 Pumadeq 31MV, Henry Company.
 - .2 Metateck, IKO
 - .3 Parapro Field/ Parapro Flashing, Siplast.
 - .4 RS 230 Field, Soprema Alsan with Alsan RS 230 Flash, Soprema.

2.11 PIPE SUPPORTS

- .1 Roof drain pans, vent stack covers and other roof penetration flashings: pre-manufactured, stainless steel construction, purpose-made to suit application and location, designed to tie-in to SBS modified membrane roofing systems.
 - .1 Basis-of-Design Materials:
 - .1 Materials as required (coordinate with electrical and mechanical Drawings), Thaler Metal Industries Ltd., include submittal of manufacturer's 20-year Warranty.

- .2 Premanufactured Pipe Supports: fabricated from 100% recycled content, with 2.7 mm thickness galvanized steel frame, 150 mm wide x 100 mm tall x length to suit installation; including fasteners, bridge components, and angled supports as required for a complete installation and having the following accessories:
 - .1 Pipe and Conduit Support: Galvanized pipe clamp sized to suit gas pipe in accordance with manufacturers instruction's.
 - .2 Multi-Pipe and Conduit Support: Galvanized pipe support system size and number to suit pipes being supported in accordance with manufacturer's instructions.
 - .3 Extendable Height Support: Galvanized steel pipe extensions to suit installation in accordance with manufacturer's instructions.
 - .4 Provide loose piece of cap sheet membrane under each support.
 - .5 Acceptable Materials:
 - .1 C-Port, Clearline Technologies.
 - .2 Dura-Blok, Eaton
 - .3 Quick Block Sleeper, Pipe-Ease Inc.

Part 3 Execution

3.1 EXAMINATION

- .1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual and OIRCA Roofing Practices Manual.
- .2 Verification of Conditions:
 - .1 Inspect with Consultant deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed. The start of roofing work will mean roofing conditions are acceptable for work completion.
- .3 Evaluation and Assessment:
 - .1 Prior to beginning of work ensure:
 - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
 - .2 Curbs have been built.
 - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
 - .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

3.2 PREPARATION

- .1 The interface of the walls and roof assemblies to be fitted with durable rigid material sheet metal and plywood providing connection point for continuity of air barrier.

- .2 Assembly, component and material connections to be made in consideration of appropriate design loads.
- .3 Cover walls, walks, sloped roofs and adjacent work where materials hoisted or used. Roofing Contractor shall assume full responsibility for damage.
- .4 Use warning signs and barriers. Maintain in good order until completion of Work.
- .5 Clean off drips and smears of bituminous material immediately.
- .6 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .7 Repair or replace defaced or disfigured finishes caused by work of this section.
- .8 Fire Protection: Provide fire protection during installation.
 - .1 Comply with safety measures described in manufacturer's written installation requirements, requirements of insurance companies and other requirements of the Authorities Having Jurisdiction.
 - .2 Fire Extinguishers, located within six meters of each roofing torch, ULC labelled for ABC protection.
 - .3 At the end of each workday, use a heat detector gun to spot any smouldering or concealed hot spots. Job planning must be organized to ensure workers are still on location at least one hour after torch application.
 - .4 Do not apply torch directly to dry or unprotected wood surfaces.

3.3 SHEATHING

- .1 Mechanically fasten sheathing where indicated on Drawings with manufacturer's written instructions.
- .2 Place with long axis of each sheet transverse to trusses, with end joints staggered and fully supported.

3.4 PRIMING DECK

- .1 Do priming in accordance with manufacturers written recommendations.
- .2 Apply deck primer to deck substrate at the rate recommended by manufacturer.
- .3 Surfaces to be primed must be free of rust, dust or any residue that may hinder adherence.
- .4 Cover primed surfaces with roofing membrane within time limits recommended by roofing membrane system manufacturer.

3.5 AIR AND VAPOUR RETARDER INSTALLATION

- .1 Install self adhering air/vapour barrier membrane by unrolling air/vapour barrier membrane onto substrate aligned with substrate materials starting at bottom of slope without removing silicone release sheet, and as follows:
 - .1 Peel back one end of silicone release sheet and adhere membrane to substrate; peel remaining release sheet at a 45° angle to avoid wrinkles in membrane.

- .2 Cut roll and start again where membrane is not properly aligned to deck; re-align membrane and overlap end of misaligned piece by 150 mm.
- .3 Overlap adjacent membranes by 75 mm; overlap end laps by 150 mm; stagger end laps by 300 mm; place thin sheet of metal under end lap of membrane to provide structural support to lapped membranes.
- .2 Overlap roof air/vapour barrier to wall air/vapour barrier using compatible continuity strip to provide continuity of building envelope.

3.6 GENERAL MEMBRANE INSTALLATION

- .1 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.
- .2 Clean off drips and smears of bituminous material immediately.
- .3 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .4 Do not install roofing materials during rain or snowfall.
- .5 Provide fire protection during installation.
- .6 Metal connectors and decking shall be treated with rust proofing or galvanization.

3.7 INSULATION APPLICATION

- .1 Insulation: fully adhered, adhesive application:
 - .1 Adhere insulation to vapour barrier using manufacturer's recommended adhesive applied at a rate recommended by the manufacturer
 - .2 Place boards in parallel rows with ends staggered and minimum two layers with staggered joints, and in firm contact with one another.
 - .3 Cut end pieces to suit.
 - .4 Apply adhesive in continuous ribbons at 300 mm on centre.
- .2 Tapered insulation application:
 - .1 Adhere insulation using manufacturer's recommended adhesive applied at rate recommended by manufacturer; adhere insulation at locations where roof deck will be visible in final installation.
 - .2 Install tapered insulation in accordance with shop drawings. Stagger joints between layers 150 mm minimum.
- .3 Overlay Board: adhesive application (roof slopes more than 6% slope):
 - .1 Adhere overlay board to insulation with adhesive at the rate recommended by manufacturers written instruction.
 - .2 Place boards with long joints continuous, and short joints staggered. Ensure boards are evenly and tightly butted together, with joints offset from primary insulation joints.
 - .3 Cut ends to suit and apply adhesive in continuous ribbons at 300 mm on centre.
 - .4 Apply only as many boards as can be covered with roofing membrane the same day.

3.8 (EXPOSED) CONVENTIONAL MEMBRANE ROOFING (CMR) APPLICATION

- .1 Base sheet application - adhered:
 - .1 Install membrane base sheet in full bed of adhesive applied at rate recommended by roofing membrane manufacturer using a notched 5 mm neoprene squeegee starting at drain and perpendicular to slope.
 - .2 Apply base sheet in parallel strips, lapping side joints 100 mm and end joints 150 mm; stagger end joints a minimum of 300 mm.
 - .3 Roll surface installed membrane using a 30 kg steel roller to smooth membrane and to provide continuous and uniform adhesion to insulation.
 - .4 Seal lap joints of base sheet at end each workday; perform work without interruption to avoid tears and formation of fish mouths, air pockets or wrinkles.
 - .5 Cut off corners at end laps being covered by next roll.
 - .6 Terminate base sheet at top of cant or at perimeter.
- .2 Perimeter Fire Seal Application
 - .1 Apply perimeter fire seal to roof perimeter and curb substrates prior to applying base sheet materials. Apply fire seal to vertical joints in parapet or curb sheathing, and at vertical corners.
 - .2 Extend fire seal minimum 50 mm up parapet faces and extend fire seal minimum 75 mm onto adjacent substrates. Ensure air bubbles and fish mouths are removed.
 - .3 Install perimeter fire seal to act as temporary moisture seal until installation of flashing materials.
- .3 Reinforced gusset installation:
 - .1 Install gussets at every angle, and on inside and outside corners.
 - .2 Install self adhesive gussets before installing self adhesive base sheet flashing membranes.
- .4 Base sheet flashing installation:
 - .1 Apply base sheet flashing when primer coat is dry and in accordance with manufacturer's written instructions.
 - .2 Position pre-cut membrane pieces; peel back 100 mm to 150 mm of silicone release paper to hold the membrane in place at the top of the parapet, then gradually peel back remaining silicone release paper, pressing down on the membrane with aluminium applicator to provide good adhesion and to provide smooth transition between up-stand and field surface; smooth entire membrane surface with a roller for full adhesion.
 - .3 Cut off corners at end laps being covered by next roll.
 - .4 Install a reinforcing gusset in all inside and outside corners.
 - .5 Seal overlaps at the end of each workday.
- .5 Cap sheet application – adhered:
 - .1 Install cap sheet in a full bed of adhesive applied at a rate recommended by membrane manufacturer using notched 5 mm neoprene squeegee

- starting at drains and perpendicular to the slope; use brush grade or trowel grade adhesive as required for different membrane installation requirements as recommended by manufacturer's written installation requirements.
- .2 Lap side joints 100 mm and end joints 150 mm; stagger end joints and joints between membranes plies a minimum of 300 mm; stagger base and cap sheet membranes by 300mm.
- .3 Brush surface to provide complete and uniform adhesion immediately after placement of membrane into adhesive.
- .4 Cut off corners at end laps being covered by next roll.
- .5 Provide a smooth application, free of wrinkles, fish mouths, air pockets or tears.
- .6 Terminate cap sheet at top of cant or at perimeter.
- .6 Cap Sheet Flashings Application:
 - .1 Install cap sheet flashing in 1 m widths. Overlap side by 100 mm. Stagger base and cap sheet overlaps by minimum 100 mm. Make overlaps 150 mm wide.
 - .2 Draw parallel chalk line 150 mm from parapet or upstand bases. Sink surface granules into bed of hot bitumen with torch from chalk line to parapet or upstand.
 - .3 Adhere cap sheet to base sheet membrane starting from bottom and working to top using trowel grade adhesive applied with 5 mm notched steel trowel at a rate recommended by membrane manufacturer; use roller to apply even pressure over entire surface to provide uniform adhesion across entire surface.
- .7 Roof penetrations:
 - .1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

3.9 WALKWAYS

- .1 Install walkway membrane in accordance with the manufacturer's printed installation instructions to provide walkway access from roof access points to rooftop units and other mechanical elements requiring maintenance service.

3.10 DRAINS

- .1 Ensure all leaders are properly secured before proceeding with work.
- .2 Install drains and seals in accordance with the manufacturer's printed instructions.
- .3 Make openings water and vapour tight at membrane.
- .4 Install strainer and drain cover as per details.

3.11 ELECTRICAL CONDUIT FLASHING

- .1 At all electric conduit locations, install conduit flashing per manufacturer's approved details.
- .2 Flash-in base with roof membrane per manufacturer's approved detail.
- .3 Coordinate with electrical sub-contractor for disconnection and reconnection of wiring within a two hour limited timeframe.

3.12 GAS LINES AND CONDUIT

- .1 Install preformed plastic gas line supports.
- .2 Install supports at 2440 mm o.c. maximum, and at all directional changes in accordance with reviewed shop drawings. In addition if the gas lines are 19 mm or less the maximum space for supports are 1220 mm.
- .3 Install support at maximum of 305 mm from all connections in the gas lines.
- .4 Where preformed plastic supports are not suitable install specified precast concrete pavers, complete with pedestals on top of membrane.
- .5 On top of concrete pavers re-install existing wood blocking. Replace damaged missing with specified wood blocking to required height.
- .6 Secure gas line and conduit with clamping ring.
- .7 Ensure that piping is not damaged during roofing work and cleanup. Make good any damages caused.

3.13 FIELD QUALITY CONTROL

- .1 Inspection and testing of roofing application to be carried out by OIRCA accepted testing laboratory designated by Owner in cooperation with Consultant.
- .2 Inspection fees to be paid by Owner, in accordance with Section 01 45 00 – Quality Control.
- .3 Flood Testing:
 - .1 Do not conceal waterproofing until inspection and testing are completed to satisfaction of Consultant.
 - .2 Temporarily plug drains and dam horizontal surface areas to be tested and flood with water to minimum depth of 80 mm.
 - .3 Maintain flooded depth for 24 hours.
 - .4 If leaks occur repair and retest.
 - .5 Remove water at end of test.
- .4 Manufacturers' Field Services:
 - .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
 - .2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for

inspection of product installation in accordance with manufacturer's instructions.

- .3 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .4 Obtain reports within three days of review and submit.

3.14 CLEANING

- .1 Clean off drips and smears of bituminous material immediately.
- .2 Remove bituminous markings from finished surfaces.
- .3 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.

3.15 PROTECTION

- .1 Protect roof from traffic and damage. Comply with precautions deemed necessary by Consultant.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Tempered safety glass.
 - .2 Laminated safety glass.
 - .3 Spandrel glass.
 - .4 Fire rated glass.
 - .5 Low emissivity (low e) glass.
 - .6 Sealed insulating glass.
 - .7 Accessories.: Sealant, setting blocks, spacer shims, Glazing tape, glazing compound for fire rated glazing materials, glazing splines, glazing clips, Screws, bolts, fasteners, Lock-strip gaskets and accessories:
- .2 Related Requirements:
 - .1 Section 07 92 00 – Sealants
 - .2 Section 08 11 13 – Steel Doors and Frames
 - .3 Section 08 11 16 – Aluminum Doors and Frames
 - .4 Section 08 44 13 – Glazed Aluminum Curtain Walls
 - .5 Section 08 50 13 – Aluminum Windows
 - .6 Section 08 87 53 – Glazing Film

1.2 REFERENCES

- .1 Reference Standards:
 - .1 American National Standards Institute (ANSI):
 - .1 ANSI Z97.1-2015 (R2020), Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
 - .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C542-05 (2017), Specification for Lock-Strip Gaskets.
 - .2 ASTM C1172-19, Standard Specification for Laminated Architectural Flat Glass.
 - .3 ASTM D790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .4 ASTM D2240-15(2021), Standard Test Method for Rubber Property - Durometer Hardness.
 - .5 ASTM E84-23d, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .6 ASTM E330/E330M-14(2021), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .7 ASTM F1233-08(2019), Standard Test Method for Security Glazing Materials and Systems.
 - .3 Canada Green Building Council (CaGBC):

- .1 LEED Canada V4 – Building Design and Construction (BD+C).
- .4 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1-2017, Safety Glazing.
 - .2 CAN/CGSB-12.2-M91(R2017), Flat, Clear Sheet Glass.
 - .3 CAN/CGSB-12.3-M91(R2017), Flat, Clear Float Glass.
 - .4 CAN/CGSB-12.4-M91(R2017), Heat Absorbing Glass.
 - .5 CAN/CGSB-12.8-2017, Insulating Glass Units.
 - .6 CAN/CGSB-12.9-M91, Spandrel Glass. (Withdrawn)
 - .7 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting. (Withdrawn)
 - .8 CAN/CGSB 12.20-M89, Structural Design of Glass for Buildings. (Withdrawn)
- .5 Canadian Standards Association (CSA Group):
 - .1 CSA A440.2:22/A440.3:22, Fenestration energy performance/User guide to CSA A440.2-19, Fenestration energy performance.
 - .2 CSA Certification Program for Windows, Doors, and Skylights.
- .6 Fenestration and Glazing Industry Alliance (FGIA):
- .7 Glazing Association of North America (GANA):
 - .1 GANA Glazing Manual – IYOG Edition 2022.
- .8 Insulating Glass Manufacturers Alliance (IGMA).
- .9 National Fire Protection Association (NFPA):
 - .1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2022 Edition.
 - .2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2022 Edition.
 - .3 NFPA (Fire) 257, Fire Test for Window and Glass Block Assemblies, 2022 Edition.
- .10 Underwriters Laboratories ECOLOGO Certification Program (UL):
 - .1 UL 2761, Sealants and Caulking Compounds (formerly CCD-045) 2011.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meetings: one week prior to beginning work of this Section.
 - .1 Verify project requirements.
 - .2 Review installation conditions.
 - .3 Co-ordinate with other building subtrades.
 - .4 Review manufacturer's instructions and warranty requirements.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.

- .2 Submit product data that provides performance data of IGU assemblies, including CoG U-value, SHGC, STC etc.
- .3 Submit electronic copy of WHMIS SDS - Safety Data Sheets. Indicate VOC's:
 - .1 For glazing sealant materials during application and curing.
- .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Delegated Design: Submit shop drawings, signed and sealed by the delegated design engineer, detailing fabrication and assembly of glazed aluminum curtain wall systems clearly indicating all construction details including; but not limited to, the following:
 - .1 Fully dimensioned layouts for positioning of secondary support members and anchorage of tie-back devices to structures;
 - .2 Large scale details of members and materials, of brackets and anchorage devices and of connection and jointing details;
 - .3 Include thermal values and weathertightness rating data.
 - .4 Fully dimensioned layouts for positioning of brackets and anchorage devices to structures;
 - .5 Dimensions, gauges, thicknesses;
 - .6 Type, size and spacing of fastening devices;
 - .7 Glazing details;
 - .8 Air/vapour barrier details, acoustic control details, aluminum alloy and temper designations, metal finishing specifications and other pertinent data and information;
 - .9 Internal drainage;
 - .10 Show details of perimeter and interface connecting work of this section with work of adjacent sections.
- .3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit 300 mm x 300 mm size of each glazing type. Consultant reserves the right to change type and colour of glass after review of submitted samples.
- .4 Certificates: Submit proof of FGIA (formerly IGMAC) certification for insulating glass units, including component codes.
- .5 Manufacturer's Instructions: Submit manufacturer's installation instructions.
- .6 LEED Submittals: provide LEED submittals in accordance with Section 01 61 01 - LEED Product Requirements.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

- .1 Manufacturer's technical recommendations:

- .1 Perform glazing work in accordance with written recommendations from the glass manufacturer or glass fabricator.
- .2 Certify glass compatibility with glazing materials (i.e. insulating glass sealants, structural sealants and silicones, gaskets, setting blocks, etc.).
- .3 Designs to be analyzed for thermal stress and wind/snow loads.
- .4 Provide shop inspection for glass.
- .2 Window fabricator qualifications: shall be a member in good standing of the Ontario Glass And Metal Association (OGMA) and adhere to the rules and regulations for workmanship, training and personnel as set forth by the association.
- .3 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Provide testing and analysis of glass under provisions of Section 01 45 00 - Quality Control.
 - .2 Provide shop inspection and testing for glass.
- .4 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Glass panels in doors, lites and windows shall have a permanent label located in the lower right-hand side of the glass unit in accordance with CAN/CGSB-12.1
- .6 Glazing for Fire-Rated Door and Window Assemblies: Glass tested per NFPA (Fire) 252 and NFPA (Fire) 257, as applicable, for assemblies complying with NFPA 80 and listed and labelled per requirements of authorities having jurisdiction.
- .7 Tempered glass shall be heat soaked in accordance with EN 14179-1 and EN 14179-2 for the following applications: railings, balustrades, exposed overhead locations, exterior exposures one or more storeys above pedestrian areas, heavy tempered glass, fabricated glass with cut outs, notches, holes or countersinks. Provide manufacturer's factory label on each unit confirming tempered glass has been heat soaked.

1.7 SITE CONDITIONS

- .1 Install glazing when ambient temperature is 4 degrees C minimum. Maintain ventilated environment for 24 hours after application.
- .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00 - Common Product Requirements.
- .2 Coordinate Work of this Section with Work of other Sections so as not to delay construction schedule.
- .3 Deliver, store and handle all components to prevent damage.
- .4 Provide secure, temporary, dry enclosed structure for storage of glass units.
- .5 All individual cases of glass to be secured, blocked and braced to prevent falls.

- .6 Replace any broken, scratched, or damaged materials at Contractor's expense.
- .7 Protect all exposed surfaces from stain, discolouration, corrosion, and other abuse.
- .8 Packaging Waste Management
 - .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management.

1.9 WARRANTY

- .1 Provide manufacturers guarantee for the following types of glass listed, against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of Work.
 - .1 Sealed Glass Units: Replace units that exhibit failure of hermetic seal under normal use evidenced by the obstruction of vision by dust, moisture, or film on interior surface of glass: Ten Years.
 - .2 Coated- Glass: Replace units that display peeling, cracking, and other deterioration in metallic coating under normal use: Ten Years.
 - .3 Laminated Glass: Replace units that display edge separation, delamination, and blemishes exceeding those allowed by ASTM C1172: 5 Years.
 - .4 Provide warranty for glazing to include in maintenance manuals as specified in Section 01 78 00 – Closeout Submittals.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design products are named in this Section; additional manufacturers offering similar setting systems may be incorporated into the work provided they meet the performance requirements established by the named products.
- .2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - .1 Vision Glass:
 - .1 AGC Flat Glass North America (formerly AFG or AFGD).
 - .2 AHC Glass (formerly Visteon).
 - .3 Cardinal Glass Industries Inc.
 - .4 Guardian Glass.
 - .5 Hartung Glass Industries
 - .6 Pilkington Glass of Canada.
 - .7 Prelco Inc.
 - .8 Vitro Architectural Glass (formerly PPG Industries).
 - .9 Schott Glass AG.

2.2 PERFORMANCE / DESIGN CRITERIA

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:

- .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330/E330M and in accordance with CAN/CGSB-12.20.
- .3 Limit center-of-glass deflection to the smallest of:
 - .1 Displacement associated with the structural capacity of the glazing unit.
 - .2 $L/100$, where L is the shortest side dimension of the unit measured in inches.
 - .3 Or 19 mm.

2.3 MATERIALS

- .1 Tempered Safety Glass: to CAN/CGSB-12.1, transparent, 6 mm minimum thickness.
 - .1 Type: 2-tempered.
 - .2 Class: B-float.
 - .3 Category: II – 540 J impact resistance.
- .2 Laminated Safety Glass: to CAN/CGSB-12.1, transparent, thickness as directed.
 - .1 Type: 1-laminated, tempered.
 - .2 Class: B-float.
 - .3 Category: II – 540 J impact resistance.
 - .4 Laminating Film:
 - .1 Material: Polyvinyl Butyral (PVB)
 - .2 Minimum film thickness: 1.14 mm
 - .3 Colour: Clear as indicated on Drawings.
- .3 Spandrel glass: to CAN/CGSB-12.9, minimum 6 mm thick.
 - .1 Type: 1-Tempered
 - .2 Class: A-Float
 - .3 Style: 3-Organic – applied silicone elastomeric coated.
 - .4 Form: I-Insulating glass unit
 - .5 Colour: as indicated on Drawings.
 - .6 Acceptable Materials:
 - .1 Opaci-Coat 300, ICD.
 - .2 Span-Kote.
- .4 Fire Rated Glass: Comprised of multiple layers of tempered glass ceramic, laminated with transparent intumescent materials, providing distortion free viewing through pane and as follows:
 - .1 Thickness: As required by manufacturer to meet structural requirements for performance range specified.
 - .2 Impact Safety Rating: Category I, 665 J/m in accordance with ANSI Z97.1.
 - .3 Temperature Rise Rating: Not required.

- .4 Fire Rating: As indicated in door and frame schedule.
- .5 Labelled: Permanent logo listing name of product, manufacturer, testing laboratory, fire rating period and safety requirements.
- .6 Acceptable Manufacturers:
 - .1 InterEdge Technologies.
 - .2 SAFTI Fire and Safety Rated Glass.
 - .3 Saint-Gobain Glass Solutions.
 - .4 Technical Glass Products.
- .5 Frit Glass Coating: In accordance with CAN/CGSB-12.13 and as follows:
 - .1 Tempered glass unit with Duranar DTG 2-coat system, on second surface, pattern and colour as indicated on Drawings with high opacity white frit factory applied oven baked Fluoropolymer finish as supplied by PPG Canada Inc.
 - .2 Acceptable Applicators:
 - .1 Durapaints Inc.
 - .2 Goldray Corporation.
 - .3 Garibaldi Glass Industries Inc.
- .6 Low Emissivity (Low E) Glass: to CAN/CGSB-12.10, thickness as indicated and as follows:
 - .1 Metallic coating: soft, sputtered.
 - .2 Basis-of-Design Materials:
 - .1 Planitherm XN II, Saint-Gobain Glass.

2.4 MATERIALS: SEALED INSULATING GLASS

- .1 Drawings and Specifications for insulated glass units are intended to show design concept, configuration, components and arrangement; they are not intended to identify nor solve completely the problems from thermal stress. Insulating glass units shall withstand thermal stresses created by shadowing of exterior components or assembly and elevated interstitial space temperatures. Glass thermal stress analysis shall be provided by Contractor.
- .2 Triple Pane Insulating Glass Units: meet or exceed requirements of CAN/CGSB-12.8. Units shall be certified by the Fenestration and Glazing Industry Alliance (FGIA), (formerly Insulated Glass Manufacturers Alliance (IGMA)). Overall unit thickness shall be minimum 44 mm using 6 mm glass thickness for individual panes. Use two stage seal method of manufacture, as follows:
 - .1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator, super spacer bar or TDSE Intercept.
 - .2 Secondary Seal: silicone base sealant, completely filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.
- .3 Spacer/separator to provide continuous vapour barrier between interior of sealed unit and secondary seal.
- .4 Clear Float Glass: to CAN/CGSB-12.3, glazing quality, for inner lite and exterior lite above 2133 mm a.f.f. and as indicated on Drawings.

- .5 Clear Safety Glass: to CAN/CGSB-12.1 for outer lite below 2133 mm above floor finish, as indicated on Drawings and as follows:
 - .1 Type: Two-tempered.
 - .2 Class: B-float.
- .6 Provide low-E coating on No.2 and No.5 surfaces of triple glazed insulating glass units.
- .7 Gas: 95% Argon filled.
- .8 Other Glazing Accessories: setting blocks to CAN/CSA-A440.

2.5 ACCESSORIES

- .1 Sealant: in accordance with Section 07 92 00 – Sealants.
- .2 Setting blocks: Neoprene, EPDM, or Silicone, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .3 Spacer shims: Neoprene or Silicone, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .4 Glazing tape:
 - .1 Preformed butyl compound with integral resilient tube spacing device, ten-fifteen Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.
 - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal.
- .5 Glazing compound for fire rated glazing materials:
 - .1 Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2%, designed for compression of 25% to effect an air and vapour seal.
 - .2 Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50% in both extension and compression (total 100%); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.
 - .1 Acceptable materials:
 - .1 Dow Corning 795, Dow Corning Corp.
 - .2 Silglaze-II 2800, General Electric Co.
 - .3 Spectrum 2, Tremco Inc.
 - .3 Setting Blocks: Hardwood, glass width by 100 mm x 5 mm thick.
 - .4 Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
 - .5 Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.
- .6 Glazing splines: resilient polyvinyl chloride or silicone, extruded shape to suit glazing channel retaining slot, black colour.

- .7 Glazing clips: manufacturer's standard type.
- .8 Screws, bolts and fasteners: Type 304 stainless steel.
- .9 Glass presence markers: easily removable, non-residue depositing.
- .10 Lock-strip gaskets: to ASTM C542.

2.6 FABRICATION

- .1 Verify glazing dimensions on Site.
- .2 Clearly label each glass light with maker's name, weight, quality, type and certification number. Do not remove labels until after work has been reviewed by Engineer.
- .3 Accurately size glass to fit openings allowing the clearances shown on the following tables:

.1 Minimum glass clearances:

	Thickness	Edge Clearance	Face Clearance
(1)	2 mm	3 mm (a)	1.5 mm
(2)	3 mm	3 mm (a)	3 mm
(3)	4 mm	3 mm (a)	3 mm
(4)	5 mm	3 mm (a)	3 mm
(5)	6 mm	5 mm	3 mm
(6)	6 mm	6 mm	3 mm
(7)	over 6 mm	6 mm or 3/4 times the glass thickness, whichever is greater	

(a) where any dimension of glass exceeds 760 mm increase minimum edge clearance by 1.5 mm.

- .4 Bite of glass edge on stop:
 - .1 Up to 1270 mm united size: 6 mm minimum.
 - .2 1270 mm to 2540 mm united size: 10 mm minimum.
 - .3 Over 2540 mm united size: 13 mm minimum.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

- .1 Ensure all wood backing rebates and stops properly primed and finished, coordinate with Section 06 40 00 – Architectural Woodwork.
- .2 Ensure all glazing rebates smooth and true, free of projections nails, screws, fastenings properly set to prevent contact with glass.

- .3 Ensure all stops, splines, glazing accessories provided are accurately cut to length and proper size and type for specific glazing.
- .4 Clean contact surfaces with solvent and wipe dry.
- .5 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .6 Prime surfaces scheduled to receive sealant.

3.3 GENERAL INSTALLATION

- .1 Install work in accordance with the Quality Management provisions specified in this section and manufacturer's written instructions.
- .2 Size glass to Code requirements and verify glass for openings are correctly sized and are within allowable tolerances. Install glass with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.
- .3 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .4 Remove and replace glazing stops in original locations, using original fasteners, securely set and undamaged.
- .5 Use setting blocks, spacers and, for wet glazing, shims, as required to properly support the glass, centred in place in the glazing space independent of the glazing materials and to uniformly distribute its load.
- .6 Use a minimum of two setting blocks, located at the quarter points. Locate spacers at jamb edges of glass, uniformly spaced at 600 mm o.c. maximum, and 300 mm maximum from top to bottom.
- .7 Handle and install heat absorbing glass in accordance with manufacturer's directions.
- .8 Prevent nicks, abrasion and other damage likely to develop stress on edges.
- .9 Set glass properly centred with uniform bite and face and edge clearance, free from twist, warp or other distortion likely to develop stress.
- .10 Trim tape protruding more than 2 mm above stop.
- .11 Leave labels on glass until it has been set and inspected and accepted. Leave glass whole and without cracks, scratches or other defects and with settings in perfect condition at completion. Remove rejected, broken or damaged glass due to defective materials or improper setting and replace with acceptable materials. Units producing distorted vision shall be rejected and replaced at no cost to the Owner.
- .12 Remove, dispose of, and replace broken, cut and abraded glass.
- .13 Install glass presence markers in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

3.4 EXTERIOR

- .1 Arrange for installed glass to have labels facing the interior. Ensure that sufficient space is left within the glazing space to allow thermal movement of glass without imposing stress on the glass.

- .2 Install curtain wall glazing to Section 08 44 13 - Glazed Aluminum Curtain Walls, and as follows:
 - .1 Perform work in accordance with GANA Glazing Manual.
 - .2 Cut glazing spline to length; install on glazing light. Seal corners by butting spline and sealing junctions with sealant.
 - .3 Place setting blocks at one third points, with edge block maximum 150 mm from corners.
 - .4 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
 - .5 Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
 - .6 Trim protruding tape edge.
- .3 Install pressed steel frame and hollow steel door glazing as follows:
 - .1 Perform work in accordance GANA Glazing Manual.
 - .2 Cut glazing tape to length and set against permanent stops, 6 mm below sight line. Seal corners by butting tape and dabbing with sealant.
 - .3 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.
 - .4 Place setting blocks at one third points, with edge block maximum 150 mm from corners.
 - .5 Rest glazing on setting blocks and push against tape and heel head of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.
 - .6 Install removable stops with spacer strips inserted between glazing and applied stops, 6 mm below sight line.
 - .7 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, maximum 9 mm below sight line.
 - .8 Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 INTERIOR

- .1 Glazing materials and installation to meet Ontario Building Code requirements for fire rated separations where required; refer to drawings for locations of fire-rated separations.
- .2 Arrange for installed glass to have labels facing the interior. Ensure that sufficient space is left within the glazing space to allow thermal movement of glass without imposing stress on the glass.
- .3 Provide insulating glass units in sound attenuated partitions.
- .4 Unless otherwise specified or indicated, interior glazing shall be dry glazing.
- .5 Install extruded resilient channel gasket around entire perimeter of glass. Make tight butt joint at corners of lights. Place setting blocks at sill and spacers at both jambs as required to centre the unit in the frame. Place the unit into the frames and apply the stops against the gaskets. Tighten the screws or clips to obtain positive uniform pressure avoiding excessive pressure.

- .6 Ensure rattle free cushioning.
- .7 Install spacer shims at 600 mm o.c. to centre balustrade glazing in rebate space. Install shims 6 mm below sight line. Apply cap bead of glazing sealant to uniform line, flush with rebate sightline and tool to smooth appearance, both sides.
- .8 Install two-sided frameless structural butt joint glass assemblies where indicated using tempered safety glass with slightly wet grinded kerf and polished butt-joint edges for aesthetics. Ensure precise levelling of sill member achieved and provision made at head to accommodate deflection of structure. For glazing at head and sill use wet, dry, or wet/dry glazing systems. Position glazing so vertical edges spaced slightly apart and seal with clear, colourless, or coloured silicone sealant. At framing or rebate locations, provide silicone sealant in clear, colourless, or colour selected by Consultant. Ensure sealant flush with and does not protrude above glazing stop or rebate.
- .9 Install wet glazing materials to obtain complete contact and adhesion over the full bite area of the unit and to be free from gaps, air bubbles and embedded foreign matter. Use primers where recommended by the glazing material manufacturer. Use sufficient bedding compound so that when glass is pressed into place, excess compound is forced well out around entire margin. Use shims to ensure maintenance of uniform face clearance. Where required on both sides of a unit, make shims coincident.
- .10 Install glazing tape to ensure complete contact and adhesion over the full bite area of the unit. Make joints only at corners of the unit. Use preshimmed glazing tape at glass installed with pressure plates. Fit tape accurately with tight joints, free from tension, gaps and cracks. After installation of the glass, the glazing tape shall not extend more than 3 mm above the line of the fixed stop. Remove and reglaze units where the glazing tape exceeds this tolerance.
- .11 Gun in a heel bead of glazing compound ensuring a continuous seal between glazed element and frame.
- .12 Finish gunned bead surfaces uniformly smooth and straight, to slope away from glass.

3.6 INSTALLATION - FIRE RATED GLASS

- .1 Comply with GANA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- .2 Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- .3 Place hardwood setting blocks located at quarter points of glass with edge block no more than 150 mm from corners.
- .4 Glaze vertically into labelled fire rated steel frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described above.
- .6 Do not remove protective edge tape.
- .7 Install removable stop and secure without displacement of tape.

- .8 Do not pressure glaze.
- .9 Knife trim protruding tape.
- .10 Provide minimum 5 mm edge clearance.
- .11 Install vision panels in fire rated doors to requirements of NFPA (Fire) 80.
- .12 Install so that appropriate fire rating labels and markings remain permanently visible.

3.7 CLEANING

- .1 At completion of Work, remove and dispose of all protections, clean down all exposed aluminum surfaces, replace all damaged members, including members with damaged finishes.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Remove traces of primer, caulking.
- .4 Remove glazing materials from finish surfaces.
- .5 Remove labels after work is complete.
- .6 Clean glass using approved non-abrasive cleaner in accordance with manufacture's instructions.
- .7 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.8 PROTECTION OF FINISHED WORK

- .1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

3.9 SCHEDULE

.1 Aluminum Windows:

.1 GL-2 (44 mm):

- .1 Exterior Lite: 6 mm Planiclear Tempered: Planitherm XN II (#2)
- .2 Airspace: 13 mm Black Swisspacer Ultimate, with 90% Argon gas
- .3 Middle Lite: 6 mm Parsol Grey Tempered
- .4 Airspace: 13 mm Black Swisspacer Ultimate, with 90% Argon gas
- .5 Interior Lite: 6 mm Planiclear Tempered: Planitherm XN II (#5).

- .2 Spandrel: triple glazed same as above, grey back painted #5 glass, with mineral fibre in aluminum backpan.

.2 Aluminum Doors:

.1 GL-1 (51 mm):

- .1 Exterior Lite: 6 mm Planiclear Laminated Tempered: 4Bird Etch (4BE01) PVB/ Planiclear Tempered: Planitherm XN II (#4).
- .2 Airspace: 13 mm Black Swisspacer Ultimate, with 90% Argon gas
- .3 Middle Lite: 6 mm Parsol Grey Tempered
- .4 Airspace: 13 mm Black Swisspacer Ultimate, with 90% Argon gas

.5 Interior Lite: 6 mm Planiclear Tempered

- .3 Hollow Steel Doors and Borrowed Lights:
 - .1 Interior Doors:
 - .1 Single pane 6 mm tempered safety glazing.
 - .2 Single 6 mm clear fire rated glazed light, as indicated.
 - .4 Borrowed Light in Pressed Steel Frames:
 - .1 Single 6 mm clear tempered safety glazed units.
 - .2 Single 6 mm clear fire rated glazed light, as indicated.
- .5 Other glass types as indicated on Drawings.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Intent:
 - .1 Provide sign and base in strict accordance with York Region Facilities Signage Guidelines and details on Drawings.
- .2 This Section includes:
 - .1 Exterior Panel signs.
 - .2 **Dimensional characters (letters and numbers) and logos.**
 - .3 Signage accessories.
- .3 Related Sections:
 - .1 See Division 26 Sections for electrical service and connections for illuminated characters and for access to remote transformers.

1.2 REFERENCES

- .1 Reference Standards:
 - .1 Aluminum Association (AA):
 - .1 AA DAF-45-2003 (R2009), Designation System for Aluminum Finishes
 - .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM B209/B209M-21a, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM B221-21, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .3 International Code Council (ICC):
 - .1 ICC A117.1-2017, Accessible and Usable Buildings and Facilities.
 - .4 National Association of Architectural Metal Manufacturers (NAAMM):
 - .1 NAAMM AMP 500-06, Metal Finishes Manual

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
 - .2 Coordinate location of remote transformers with building construction. Ensure that transformers are accessible after completion of Work.

1.4 INFORMATIONAL SUBMITTALS / ACTION SUBMITTALS

- .1 Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- .2 Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

- .1 Provide large-scale details of wording, lettering, and artwork.
- .2 Wiring Diagrams: For signs with illuminated characters.
- .3 Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: An employer of workers trained and approved by signage manufacturer.
- .2 Source Limitations: Obtain each sign type through one source from a single manufacturer.
- .3 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 SITE CONDITIONS

- .1 Existing Conditions / Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Provide sign and base in strict accordance with York Region Facilities Signage Guidelines and details on Drawings.

2.2 PANEL SIGNS

- .1 General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colours, designs, shapes, sizes, and details of construction.
 - .1 Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1.5 mm measured diagonally.
- .2 Aluminum Sheet and Plate: ASTM B209/B209M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 5005-H15.
- .3 PVC: Extruded, high-impact PVC plastic in white colour indicated.
- .4 Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory-paint brackets in colour matching Consultant's sample as indicated on Drawings.

2.3 DIMENSIONAL CHARACTERS

- .1 Aluminum Castings: Provide aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- .2 Cutout Characters: Cut characters from solid plate of thickness and metal indicated. Produce precisely cut characters with square cut, smooth, eased edges. Comply with requirements indicated for finish, style, and size.
 - .1 Metal: Clear anodized finish aluminum

2.4 ACCESSORIES

- .1 Mounting Methods: Weld and use concealed fasteners fabricated from materials that are not corrosive to sign material and mounting surface.
- .2 Concrete Base: as indicated on Drawings and in accordance with Structural specifications.
- .3 Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FABRICATION

- .1 General: Provide manufacturer's standard double-post, single-panel-type post and panel signs. The completed sign assembly shall consist of a message panel supported between 2 posts. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - .1 Allow for thermal movement resulting from a maximum ambient temperature change (range) of 100 deg F (38 deg C). Design, fabricate, and install post and panel sign assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners.
 - .1 Base design on actual surface temperatures of metals due to both solar heat gain and nighttime-sky heat loss.
 - .2 Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress on exposed and contact surfaces.
 - .3 Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.
 - .4 Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.
 - .5 Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
- .2 Posts: Fabricate posts to lengths required for mounting method indicated.

- .1 Direct Burial: For permanent sign installation, provide posts 36 inches (900 mm) longer than height of sign to permit direct embedment in concrete foundations.
- .3 Panels: Form panels to required size and shape. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.
 - .1 Increase metal thickness or reinforce with concealed stiffeners or backing materials as required to produce surfaces without distortion, buckles, warp, or other surface deformations.
 - .2 Continuously weld joints and seams, unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

2.6 FINISHES, GENERAL

- .1 Comply with NAAMM AMP 500 Metal Finishes Manual, for recommendations for applying and designating finishes.
- .2 Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- .3 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- .1 Clear Anodic Finish: Manufacturer's standard clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish.
- .2 Baked-Enamel Finish: Manufacturer's standard baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - .1 Colour: as indicated on Drawings.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- .2 Verify that items, including anchor inserts, and electrical power provided under other sections of Work are sized and located to accommodate signs.
- .3 Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- .4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 - .1 Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
 - .2 Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
- .2 Excavation: In firm, undisturbed or compacted soil, drill or (using a post-hole digger) hand-excavate holes for each post to the minimum diameter recommended by sign manufacturer, but at least 4 times the largest post cross-section.
- .3 Excavate hole depths approximately 75 mm lower than required post bottom, with bottom of posts set at least 900 mm below finished grade.
- .4 Cast-Metal Plaques: Mount plaques using standard fastening methods recommended in writing by manufacturer for type of wall surface indicated.
 - .1 Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.
- .5 Illuminated Characters:
 - .1 Run wires into wall construction through conduit.
 - .2 Exposed-to-view wiring or conduit on wall face is not permitted.
 - .3 Engage a licensed electrician to connect wiring to power source.
- .6 Dimensional Characters: Mount characters using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
 - .1 Projected Mounting: Mount characters at projection distance from wall surface indicated.

3.3 CLEANING AND PROTECTION

- .1 After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION

Washroom	Material	Manufacturer & Product	Colour	Remarks
Vanity				
MR-01	Fixed Position Tilt Mirror	Manufacturer: Bobrick Product: B-293 2448; 6mm glass mirror secured to concealed wall hanger with theft-resistant mounting Size: 18" W x 36" H (46 x 91cm) Mounting height: Refer to drawings	S.S.	York Region Design Standard
MR-02	Fixed Position Mirror	Manufacturer: Bobrick Product: B-290 1830; 6mm glass mirror secured to concealed wall hanger with theft-resistant mounting Size: 18" W x 30" H (46 x 76cm) Mounting height: Refer to drawings	S.S.	York Region Design Standard
PD-01	Paper Towel Dispenser	Manufacturer: Swish Product: Frost Universal Hand Towel Dispenser 5050 Size: 10.6"W x 9.7"H x 6.9"D Mounting height: Refer to drawings	White	York Region Design Standard
SP-01	Soap Dispenser	Manufacturer: Swish Product: Proline Soap Dispenser #WHB1LDS Size: 4-3/5"W x 4-9/10"D x 10"H Finish: White Mounting height: Refer to drawings	White	York Region Design Standard
SP-02	Soap Dispenser	Manufacturer: Swish Product: ClearVu Encore Soap Dispenser - White 30 oz; #9330 Mounting height: Refer to drawings	White	York Region Design Standard
WB-01	Waste Bin	Manufacturer: Frost Product: Frost 304-NLS Size: 98.0cm H x 55.1cm W x 20.3cm D (38.6" H x 21.7" W x 8" D) Mounting height: Refer to drawings	S.S.	York Region Design Standard
WB-02	Paper Towel Dispenser and Waste Bin	Manufacturer: Frost Product: Recessed - Frost 427-60A Size: 4' - 8.17" x 17.25" x 12.5" (142 x 44 x 61 cm) Mounting height: Refer to drawings	S.S.	York Region Design Standard
Water Closet				
BR-01	Backrest	Manufacturer: Frost Model: Toilet backrest, 1028 Finish: Stainless steel Size: 38.3cm L x 20.3cm D x 10.2cm H (15.1"L x 8"D x 4"H)	S.S.	
CH-01	Coat Hook	Manufacturer: Bobrick Product: Stainless steel clothes hook, B-233	S.S.	
GB-01	Grab Bar	Manufacturer: Frost Product: 1-1/4" diameter 90-degree grab bar, 1003-SP30"x30" Size: 30"L x 30"D x 3.25"H (76.2cm L x 76.2cm D x 8.3cm H) Finish: brushed stainless steel w/ peened grip Mounting height: Refer to drawings	S.S.	York Region Design Standard
GB-02	Grab Bar	Manufacturer: Frost Product: 1-1/4" diameter straight grab bar, 1001-SP24" Size: 24"L x 3"D x 3.25"H (61.0cm L x 7.6cm D x 8.3cm H) Finish: brushed stainless steel w/ peened grip Mounting height: Refer to drawings	S.S.	York Region Design Standard
SD-01	Sanitary Napkin Disposal	Manufacturer: N/A (Provided by York Region Facilities Operations and Maintenance Team) Product: N/A (Provided by York Region Facilities Operations and Maintenance Team) Size: Approximately 19" W x 6" H x 21" D Finish: stainless steel Mounting height: Refer to drawings	S.S.	Owner to supply, contractor to install
SH-01	Coat Hook	Manufacturer: Frost Product: Flip up shelf 955	S.S.	

Washroom	Material	Manufacturer & Product	Colour	Remarks
TD-01	Toilet Tissue Dispenser	Manufacturer: Swish Product: Tork 56TR #889 DISP T/T JUMBO SIDE/SIDE T22 Size: 19" x 12" x 5.5" (49 x 30 x 14 cm) Finish: Smoke (transparent dark grey)	Smoke (Transparent Dark Grey)	York Region Design Standard
TP-01	Toilet Partition	Manufacturer: Hadrian Product: Headrail braced Standard Series Colour: 609 Colonial Blue	Blue	
UD-01	Urinal Divider	Product: Screen Colour: 609 Colonial Blue Size: 1219mm tall wall mounted Mounting height: Refer to drawings	Blue	
Shower				
SGB-01	Grab Bar (L-Shaped)	Manufacturer: Frost Product: 30"x40" L-Shaped Grab Bar 1 -1/4" Diameter, 1003-SP Size: 40"L x 30"H (102cm L x 76cm H) Finish: brushed stainless steel w/ peened grip Mounting height: Refer to drawings	S.S.	York Region Design Standard
SGB-02	Grab Bar (Vertical)	Manufacturer: Frost Product: 1-1/4" diameter straight grab bar, 1001-SP36" Size: 36"L x 3"D x 3.25"H (91.4cm L x 7.6cm D x 8.3cm H) Finish: brushed stainless steel w/ peened grip Mounting height: Refer to drawings	S.S.	York Region Design Standard
SGB-03	Grab Bar	Manufacturer: Frost Product: 1-1/4" diameter straight grab bar, 1001-SP24" Size: 24"L x 3"D x 3.25"H (61.0cm L x 7.6cm D x 8.3cm H) Finish: brushed stainless steel w/ peened grip Mounting height: Refer to drawings	S.S.	York Region Design Standard
SBE-01	Folding Bench	Manufacturer: Bobrick Product: B-518 folding shower seat with padded cushion, left-hand seat Size: 21-1/4" W x 32-7/8" L (54 x 83.5cm) Mounting height: Refer to drawings	S.S. with white padding	
Locker				
LO-01	Locker	Manufacturer: Hadrian Product: Emperor Corridor Locker Size: 15" x 18" x 60" Colours: 609 Colonial Blue Mounting: Locker pedestal	Blue	
LO-02	Locker	Manufacturer: Hadrian Product: Emperor Corridor Locker Size: 15" x 18" x 60" Colours: 510 Black Mounting: Locker pedestal	Black	
LO-03	Locker	Manufacturer: Hadrian Product: Emperor Corridor Locker Size: 15" x 18" x 60" Colours: 541 Extra White Mounting: Locker pedestal	White	
BN-01	Bench	Manufacturer: Robinson Steel Company Product: Hardwood Locker Room Bench Top Size: 20" deep x 1.25" thick; length as required per drawings Mounting: Locker pedestal	Mixed Hardwoods	
BN-02	Bench	Manufacturer: Global Industria Product: ADA Locker Room Bench Top, Hardwood Size: 142"W x 20"D x 1-1/4"Thick Mounting: Wall Mount Brackets For 20" Deep ADA Locker Bench Top, Black, Pair Mounting height: Refer to drawings	Hardwood	

BUILDING CODE ANALYSIS

INTRODUCTION:

YORK REGION NORTH ROADS OPERATIONS CENTRE IS LOCATED:

LEGAL DESCRIPTION: PART OF LOT 23 CONCESSION CONCESSION 5, PART 1 ON PLAN 65R-20334; SUTTON WEST

MUNICIPAL ADDRESS: 3525 BASELINE RD. SUTTON WEST, ON L0E 1R0

THE PROJECT IS AN ADDITION AND INTERIOR ALTERATION TO AN EXISTING BUILDING. THE SCOPE OF WORK INCLUDES DEMOLITION, BUILDING ENVELOPE RECLADDING, EXPANDING THE EXISTING GARAGE, ADDITION OF ADMINISTRATIVE SPACES, AND INTERIOR ALTERATION OF THE EXISTING GARAGE AND WASH BAY.

APPENDIX A:

TECHNICAL BUILDING CODE ANALYSIS

1.0 PROJECT DESCRIPTION

YORK REGION NORTH ROADS MAINTENANCE FACILITY CONSISTS OF ONE BUILDING ONE STOREY IN HEIGHT:

TOTAL GROSS FLOOR AREA: 1,676SM
BUILDING AREA: 1,778SM
BUILDING HEIGHT: 7.3M

2.0 APPLICABLE BUILDING CODE AND STANDARDS

THE APPLICABLE BUILDING CODE FOR THE PROJECT IS THE ONTARIO BUILDING CODE 2012, INCLUDING REGULATIONS UPDATES UP TO AND INCLUDING 76220.

COMPLIANCE
THE FOLLOWING CODE ANALYSIS FOR THE PROJECT HAS BEEN REVIEWED UNDER THE CURRENT CODE. IT IS ASSUMED THAT THE BASE BUILDING WAS BUILT IN COMPLIANCE WITH THE APPLICABLE EDITION OF THE ONTARIO BUILDING CODE AT THE TIME OF CONSTRUCTION.

APPLICATION OF THIS CODE
THIS CODE APPLIES TO:
ALTERATION OF ANY BUILDING (1.1.1.1(1))

3.0 MAJOR USE AND OCCUPANCY

MAJOR OCCUPANCIES FOR THE PROJECT: GROUP F2, D

BUILDING HEIGHT AND AREA OF ENTIRE BUILDING SHOULD BE USED (3.2.5.5)

MAJOR OCCUPANCIES SHALL BE SEPARATED FROM ADJOINING MAJOR OCCUPANCIES BY FIRE SEPARATIONS HAVING A FIRE-RESISTANCE RATING CONFORMING TO TABLE 3.1.3.1:
- BETWEEN GROUP D AND GROUP F2: NOT REQUIRED

4.0 BUILDING CLASSIFICATION AND CONSTRUCTION REQUIREMENTS

GROUP F2: 3.2.2.70. (UP TO 4 STOREYS, NOT SPRINKLERED)

BUILDING AREA: 1,500SM IF 1 STOREY IN HEIGHT FACING 1 STREET

CONSTRUCTION: PERMITTED TO BE OF COMBUSTIBLE OR NONCOMBUSTIBLE FLOORS: FIRE SEPARATIONS WITH A FIRE-RESISTANCE RATING OF 45 MIN SUPPORTING STRUCTURE: LOADBEARING WALLS & COLUMNS HAVE A FIRE-RESISTANCE RATING OF NOT LESS THAN 45 MIN, OR BE OF NONCOMBUSTIBLE CONSTRUCTION.

5.0 COMPONENT FIRE SEPARATIONS:

THE EXISTING WALL BETWEEN THE PROPOSED OFFICE (GROUP D) AND PROPOSED REPAIR GARAGE EXPANSION (GROUP F2) EAST OF GRIDLINE 7 IS TO HAVE A 2H FIRE RESISTANCE RATING PER 3.3.5.5.(1)
- PER 3.3.5.5.(1), A REPAIR GARAGE AND ANY ANCILLARY SPACES SERVING IT SHALL BE SEPARATED FROM OTHER OCCUPANCIES BY A FIRE RESISTANCE RATING OF NOT LESS THAN 2 HOURS.

THE EXISTING WALL BETWEEN THE PROPOSED OFFICE (GROUP D) AND PROPOSED REPAIR GARAGE EXPANSION (GROUP F2) NORTH OF GRIDLINE E IS TO HAVE A 2H FIRE RESISTANCE RATING PER 3.3.5.5.(1)
- PER 3.3.5.5.(1), A REPAIR GARAGE AND ANY ANCILLARY SPACES SERVING IT SHALL BE SEPARATED FROM OTHER OCCUPANCIES BY A FIRE RESISTANCE RATING OF NOT LESS THAN 2 HOURS.

EXITS: 45 MIN FIRE SEPARATION (3.4.4.1 AND SUBSECTION 3.2.2)
CLOSURES: TO FOLLOW TABLE 3.1.8.4
FUEL-FIRED EQUIPMENT SERVICE ROOM:
- FUEL-FIRED APPLIANCES SHALL BE INSTALLED IN SERVICE ROOMS SEPARATED FROM THE REMAINDER OF THE BUILDING BY FIRE SEPARATIONS HAVING A FIRE-RESISTANCE RATING NOT LESS THAN 1 HR (3.6.2.1.(1)).
ELECTRICAL ROOMS:
- 1 HR (3.6.2.1.(6)) UNLESS OTHERWISE REQUIRED BY THE ELECTRICAL CODE.
OTHER SERVICE ROOMS: 1 HR (3.6.2.1.(7))
JANITOR ROOMS: 45 MIN FIRE SEPARATION (3.3.1.20.2)
PUBLIC CORRIDORS: NO FIRE SEPARATION REQUIRED (3.3.1.4.(3))

FIRE BLOCKS:
- FIRE BLOCKS BETWEEN CONCEALED VERTICAL AND HORIZONTAL SPACES. (3.1.11.4)
- MAXIMUM DISTANCE BETWEEN EXITS SHALL BE 1/2 THE DIAGONAL DIMENSION OF A FLOOR AREA, BUT NEED NOT BE MORE THAN 9m FOR A FLOOR AREA HAVING A PUBLIC CORRIDOR OR ONE HALF THE MAXIMUM DIAGONAL DIMENSION OF THE FLOOR AREA, BUT NOT LESS THAN 9m FOR ALL OTHER FLOOR AREAS (3.4.2.3)
- PER 3.3.1.3.(8), EACH SUITE IN A FLOOR AREA MUST HAVE AN EXTERIOR EXIT DOORWAY.
- MAXIMUM TRAVEL DISTANCE TO AN EXIT: 30M PER 3.4.2.5.(1)(f)
- MINIMUM NUMBER OF EXITS REQUIRED: REQUIRED NOT LESS THAN 2 EXITS PER FLOOR AREA (3.4.2.1)
- MINIMUM WIDTH OF CORRIDORS: 1100mm (3.4.3.2.(7)(a))
- MINIMUM WIDTH OF DOORWAYS: 700mm (3.4.3.2.(7)(g))
- MINIMUM WIDTH OF BARRIER FREE DOORWAYS: CLEAR WIDTH 860mm (3.5.3.3.(1))

HEADROOM CLEARANCE (3.4.3.5):
- EXITS: 2100mm
- DOORWAYS: 2030mm
- DOORWAYS WITH CLOSERS OR OTHER DEVICES: 1980mm
7.0 OCCUPANT LOADS
GROUP F2 (GARAGE): 1,081SM/ 46 = 24 PEOPLE
GROUP D (OFFICE): 597SM/ 9.3 = 65 PEOPLE
TOTAL: 89 PEOPLE FOR ENTIRE FACILITY
8.0 WASHROOM FIXTURE REQUIREMENTS
GROUP F2 (GARAGE): 24 PEOPLE/ 2 = 12 PEOPLE = 2/SEX (3.7.4.9)
GROUP D (OFFICE): 597SM/ 14 = 43 PEOPLE/ 2 = 22 PEOPLE = 2/SEX (3.7.4.7)
9.0 FIRE ALARM AND DETECTION SYSTEMS
- FIRE ALARM AND DETECTION SYSTEM NOT REQUIRED PER 3.2.4.1.

10.0 PROVISIONS FOR FIRE FIGHTING

BUILDING ACCESS:

- DIRECT ACCESS FOR FIREFIGHTING SHALL BE PROVIDED FROM THE OUTDOORS TO EVERY STOREY THAT IS NOT SPRINKLERED AND WHOSE FLOOR LEVEL IS LESS THAN 25m ABOVE GRADE, BY AT LEAST ONE UNOBSTRUCTED WINDOW OR ACCESS PANEL FOR EACH 15M OF WALL IN EACH WALL REQUIRED TO FACE A STREET BY SUBSECTION 3.2.2.

ACCESS ROUTES:

- ACCESS ROUTES FOR FIRE DEPARTMENT VEHICLES SHALL BE PROVIDED TO THE BUILDING FACE HAVING A PRINCIPAL ENTRANCE AND TO EACH BUILDING FACE HAVING ACCESS OPENINGS FOR FIREFIGHTING AS REQUIRED BY ARTICLES 3.2.5.1 AND 3.2.5.2 (3.2.5.4)
- THE PRINCIPAL ENTRANCE SHALL BE LOCATED NOT LESS THAN 3m AND NOT MORE THAN 15m FROM THE CLOSEST PORTION OF THE ACCESS ROUTE REQUIRED FOR FIRE DEPARTMENT USE (3.2.5.5.1)
- THE ACCESS ROUTE SHALL ALLOW A FIRE DEPARTMENT PUMPER VEHICLE TO BE LOCATED ADJACENT TO THE HYDRANTS PER 3.2.5.5.2(A), AND PROVIDE AN UNOBSTRUCTED PATH OF TRAVEL OF NOT MORE THAN 45m FOR THE FIREFIGHTER FROM THE VEHICLE TO THE BUILDING (3.2.5.5.2(C))
- PER ARTICLE 3.2.5.6, THE PORTION OF THE ROADWAY PROVIDED AS A REQUIRED ACCESS ROUTE INCLUDES THE FOLLOWING:
- A CLEAR WIDTH NOT LESS THAN 6m (3.2.5.6.1(A))
- A CENTRELINE RADIUS NOT LESS THAN 12m (3.2.5.6.1(B))
- AN OVERHEAD CLEARANCE NOT LESS THAN 5m (3.2.5.6.1(C))
- A CHANGE OF GRADIENT NOT MORE THAN 1:12.5 OVER 15m MIN (3.2.5.6.1(D))
- DESIGNED TO SUPPORT THE EXPECTED LOADS IMPOSED BY FIREFIGHTING EQUIPMENT AND IS SURFACED WITH ASPHALT AND DESIGNED TO PERMIT ACCESSIBILITY UNDER ALL CLIMATIC CONDITIONS (3.2.5.6.1(E))
- HAVE A TURNAROUND FACILITIES FOR ANY DEAD-END PORTION OF THE ACCESS ROUTE MORE THAN 90m LONG (3.2.5.6.1(F))
- CONNECTED TO PUBLIC THOROUGHFARE (3.2.5.6.1(G))

STANDPIPE SYSTEM:

- STANDPIPE SYSTEM NOT REQUIRED AS THE BUILDING AREA IS NOT LARGER THAN 2,000m² (3.2.9.1.)

SPRINKLER SYSTEM:

- SPRINKLER SYSTEM IS NOT REQUIRED (3.2.2.70.)

FIRE DEPARTMENT CONNECTION:

- THE FIRE DEPARTMENT CONNECTION FOR A STANDPIPE SYSTEM SHALL BE LOCATED SO THAT THE DISTANCE FROM THE FIRE DEPARTMENT CONNECTION TO A HYDRANT IS NOT MORE THAN 45m AND IS UNOBSTRUCTED (3.2.5.16.1)

PORTABLE FIRE EXTINGUISHERS:

- PORTABLE FIRE EXTINGUISHERS SHALL BE PROVIDED AND INSTALLED IN CONFORMANCE WITH THE NATIONAL FIRE CODE 2020 (3.2.5.17)

PROTECTION FROM FREEZING:

- EQUIPMENT FORMING PART OF A FIRE PROTECTION SYSTEM SHALL BE PROTECTED FROM FREEZING (3.2.5.18)

11.0 FLAME SPREAD RATINGS

- EXITS: MAX. 25 (TABLE 3.1.13.2)
- INTERIOR WALLS & CEILING FINISHES: MAX. 150 (3.1.13.2)
- CORRIDORS: MAX. 25 (3.1.13.6.(5))

12.0 FIRE-STOPPING AND PENETRATIONS THROUGH FIRE SEPARATIONS

- AS PER 3.1.9.1.7 - PIPING, TUBING, DUCTS, CHIMNEYS, OPTICAL FIBRE CABLES, ELECTRICAL WIRES AND CABLES, TOTALLY ENCLOSED NONCOMBUSTIBLE RACEWAYS, ELECTRICAL OUTLET BOXES, AND OTHER BUILDING SERVICES THAT PENETRATE FIRE SEPARATIONS SHALL BE SEALED BY A FIRE STOP SYSTEM THAT HAS A F RATING

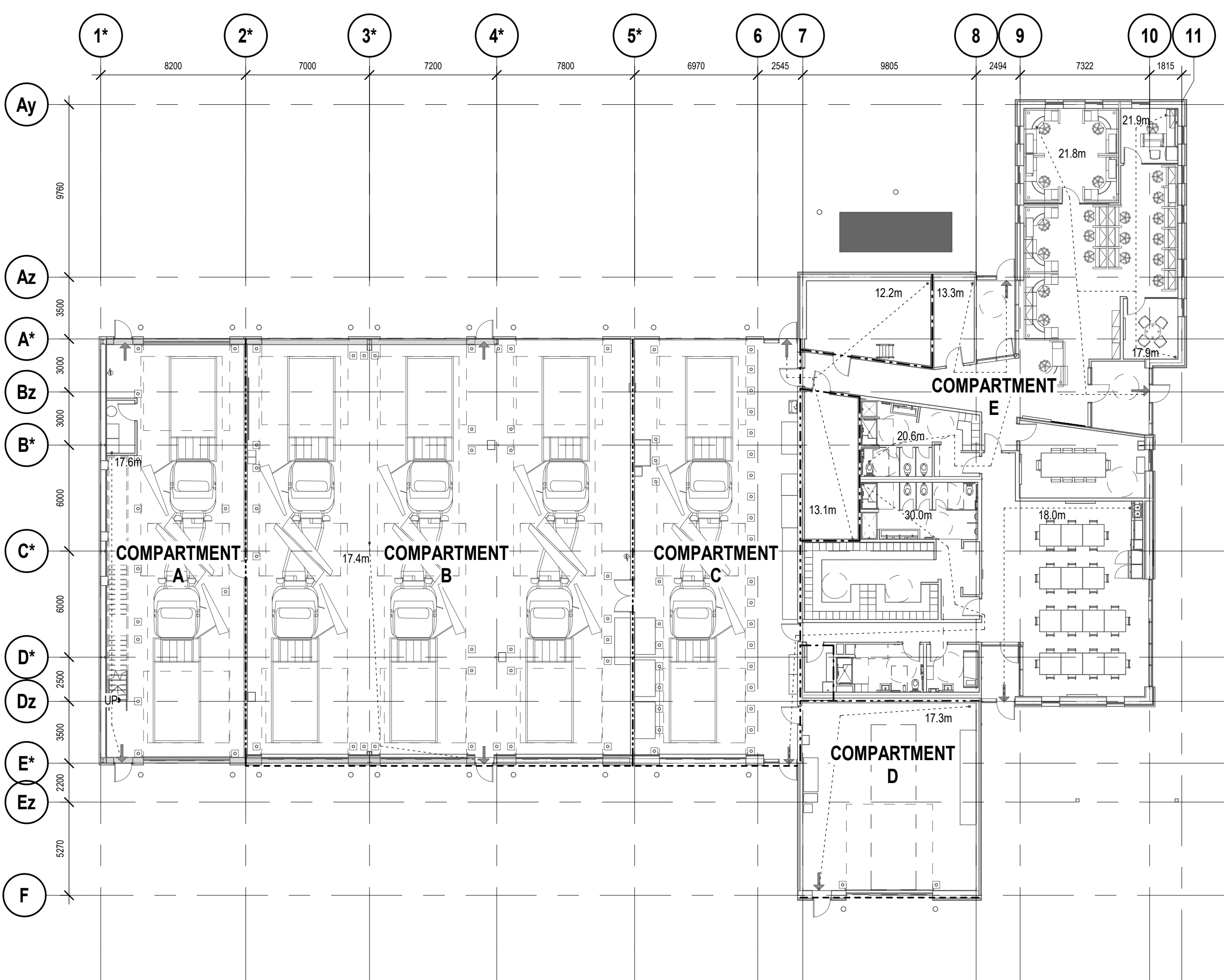
13.0 ADDITIONAL REQUIREMENTS

FLOW CONTROL, DRAINAGE FOR ROOF TO BE AS PER NATIONAL PLUMBING CODE 2015

LIMITING DISTANCE CALCULATIONS (3.2.3.1.C.)

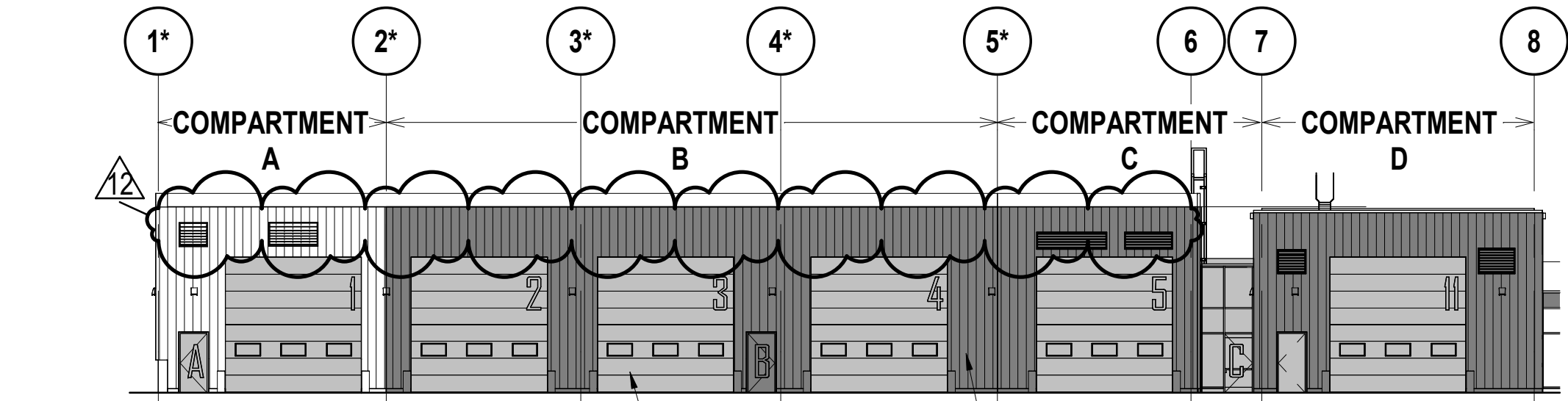
NOTE: THE REPAIR GARAGE HAS BEEN SPLIT INTO THREE COMPARTMENTS (COMPARTMENTS A, B, AND C) BASED ON LIMITING DISTANCE, AREA OF EXPOSED BUILDING FACE, AND % OF OPENINGS PERMITTED. % OF OPENINGS PROVIDED WOULD EXCEED % OF OPENINGS PERMITTED WITHOUT SPLITTING THE REPAIR GARAGE INTO COMPARTMENTS A, B, AND C BASED ON LIMITING DISTANCE AND AREA OF EXPOSED BUILDING FACE.

COMPARTMENT A	NORTH ELEVATION	SOUTH ELEVATION	EAST ELEVATION	WEST ELEVATION
LIMITING DISTANCE:	26.3M	12.8M	-	248.8M
AREA:	55.6SM	55.6SM	-	168.4SM
AREA OF OPENINGS:	29.2SM	29.2SM	-	0SM
% OF OPENINGS PERMITTED:	100%	100%	-	100%
% OF OPENINGS PROVIDED:	60.1%	60.1%	-	0%
FIRE-RESISTANCE RATING REQUIRED:	-	-	-	-
NON-COMBUSTIBLE CONSTRUCTION REQUIRED:	NO	NO	NO	NO
NON-COMBUSTIBLE CLADDING REQUIRED:	NO	NO	NO	NO
COMPARTMENT B	NORTH ELEVATION	SOUTH ELEVATION	EAST ELEVATION	WEST ELEVATION
LIMITING DISTANCE:	26.3M	12.8M	-	-
AREA:	147.4SM	147.4SM	-	-
AREA OF OPENINGS:	60.6SM	71.6SM	-	-
% OF OPENINGS PERMITTED:	100%	48.7%	-	-
% OF OPENINGS PROVIDED:	61.5%	48.7%	-	-
FIRE-RESISTANCE RATING REQUIRED:	-	1HR	-	-
NON-COMBUSTIBLE CONSTRUCTION REQUIRED:	NO	NO	NO	NO
NON-COMBUSTIBLE CLADDING REQUIRED:	NO	YES	NO	NO
COMPARTMENT C	NORTH ELEVATION	SOUTH ELEVATION	EAST ELEVATION	WEST ELEVATION
LIMITING DISTANCE:	26.3M	12.8M	103.5M	-
AREA:	57.5SM	57.5SM	46.4SM	-
AREA OF OPENINGS:	35.2SM	35.2SM	0SM	-
% OF OPENINGS PERMITTED:	100%	96%	100%	-
% OF OPENINGS PROVIDED:	61.5%	61.5%	0%	-
FIRE-RESISTANCE RATING REQUIRED:	-	1HR	-	-
NON-COMBUSTIBLE CONSTRUCTION REQUIRED:	NO	NO	NO	NO
NON-COMBUSTIBLE CLADDING REQUIRED:	NO	NO	NO	NO
COMPARTMENT D	NORTH ELEVATION	SOUTH ELEVATION	EAST ELEVATION	WEST ELEVATION
LIMITING DISTANCE:	35.8M	9.0M	53.2M	288.3M
AREA:	38.3SM	67.6SM	76.4SM	49.3SM
AREA OF OPENINGS:	0SM	29.5SM	0SM	0SM
% OF OPENINGS PERMITTED:	100%	48%	100%	100%
% OF OPENINGS PROVIDED:	0%	41.5%	0%	0%
FIRE-RESISTANCE RATING REQUIRED:	-	1HR	-	-
NON-COMBUSTIBLE CONSTRUCTION REQUIRED:	NO	NO	NO	NO
NON-COMBUSTIBLE CLADDING REQUIRED:	NO	NO	NO	NO
COMPARTMENT E	NORTH ELEVATION	SOUTH ELEVATION	EAST ELEVATION	WEST ELEVATION
LIMITING DISTANCE:	18.9M	11.8M	51.3M	288.3M
AREA:	46.6SM	42.6SM	127.6SM	51.0SM
AREA OF OPENINGS:	16.3SM	11.2SM	49.3SM	6.2SM
% OF OPENINGS PERMITTED:	100%	100%	100%	100%
% OF OPENINGS PROVIDED:	34.8%	26.3%	38.6%	12.2%
FIRE-RESISTANCE RATING REQUIRED:	-	-	-	-
NON-COMBUSTIBLE CONSTRUCTION REQUIRED:	NO	NO	NO	NO
NON-COMBUSTIBLE CLADDING REQUIRED:	NO	NO	NO	NO



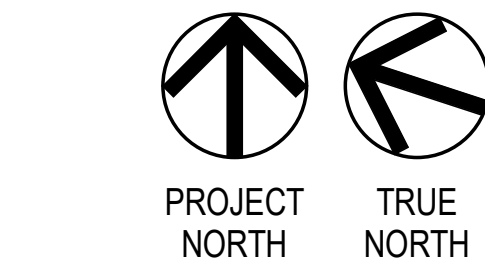
1 A001 LEVEL 01 BUILDING CODE FLOOR PLAN

Scale: 1 : 200



2 A001 BUILDING CODE SOUTH ELEVATION

Scale: 1 : 200



Project Team:
 Prime Consultant
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Client
YORK REGION

Seal & Permit

12	ISSUED FOR ADDENDUM 5	2025-07-31
11	ISSUED FOR ADDENDUM 4	2025-07-18
10	REISSUED FOR TENDER	2025-05-23
9	ISSUED FOR TENDER	2025-04-25
8	RE-ISSUED FOR BUILDING PERMIT RESUBMISSION	2025-03-13
7	ISSUED FOR BUILDING PERMIT	2024-11-27
6	ISSUED FOR SPA 2ND RESUBMISSION	2024-11-22
5	ISSUED FOR PRE-TENDER REVIEW	2024-10-31
4	ISSUED FOR SPA 1ST RESUBMISSION	2024-10-07
3	ISSUED FOR 60% CD	2024-05-02
2	100% DD	2024-02-29
1	60% DD	2024-01-25

NO. ISSUED FOR DATE

Drawing History
 Scale
 As indicated
 Region of York Project Number
22046
 Project
YORK REGION NORTH ROADS OPERATIONS CENTRE
 3525 BASELINE RD. SUTTON WEST, ON L0E 1R0
 Drawing Title

BUILDING CODE ANALYSIS

Project Number
6016
 Drawing Number
A001
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ABBREVIATIONS

A.D.	AREA DRAIN
A.F.F.	ABOVE FINISHED FLOOR
ALUM. OR AL.	ALUMINUM
ANCD.	ANGLED
ARCH.	ARCHITECTURAL
B.F.W.A.	BARRIER FREE WAVE ACTUATOR
C.B.	CATCH BASIN
C.G.	CORNER GUARD
C.J.	CONTROL JOINT
C.O.	CONCRETE OPENING
COL.	COLUMN
CONC.	CONCRETE
CONT.	CONTINUOUS
CONST.	CONSTRUCTION
C.P.T.	CARPET
NT.S.	NOT TO SCALE
D.F.	DRINKING FOUNTAIN
DM.	DIMENSION
DTL	DETAIL
DWG.	DRAWING
E.B.	EMERGENCY BUTTON
ELECT.	ELECTRICAL
EL. OR ELEV.	ELEVATION
ELVR.	ELEVATOR
EQ.	EQUAL
EQUIP.	EQUIPMENT
F.O.	FACE OF
F.O.C.	FACE OF CURB
FD	FLOOR DRAIN
HDR.	HARDWARE
H.W.C.	FIRE HOSE CABINET
F.E.C.	FIRE EXTINGUISHER CABINET
FIN. FLR.	FINISH FLOOR
F.R.R.	FIRE RESISTANCE RATING
H.	HEIGHT
H.B.	HOSE BIBB
HORIZ.	HORIZONTAL
H.M.	HOLLOW METAL
H.M.I.	HOLLOW METAL INSULATED
HP.	HIGH POINT
H.S.S.	HOLLOW STEEL SECTION
INSUL.	INSULATION
LP.	LOW POINT
MAX.	MAXIMUM
MATL.	MATERIAL
MECH.	MECHANICAL
MIN.	MINIMUM
MIRR.	MIRROR
M.A.S.	MASONRY OPENING
NA.	NOT APPLICABLE
N.I.C.	NOT IN CONTRACT
NO.	NUMBER
NT.S.	NOT TO SCALE
O.B.C.	ONTARIO BUILDING CODE
ON CENTRE	ON CENTRE
O.H.	OVERHEAD
O.W.S.J.	OPEN WEB STEEL JOIST
P.B.	PUSH BUTTON
P.LAM.	PLASTIC LAMINATE
P.S.	PRESSED STEEL
RD.	ROOF DRAIN
R.O.	ROUGH OPENING
REQD.	REQUIRED
REINF.	REINFORCED
RM.	ROOM
R.W.L.	RAIN WATER LEADER
S.B.S.	STYRENE BUTADIENE STYRENE
SIM.	SIMILAR
SPEC.	SPECIFICATION
SO.	SQUARE
S.S.	STAINLESS STEEL
STRUCT.	STRUCTURAL
T.G.	TEMPERED GLASS
T.O.F.	TOP OF
TYP.	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
US.	UNDERSIDE
V.C.T.	VINYL COMPOSITION TILE
VERT.	VERTICAL
W.	WIDTH
W.A.	WAVE ACTUATOR TO OPEN
W.A.L.	WAVE ACTUATOR TO LOCK

CONSTRUCTION NOTES

- DRAWINGS ARE NOT TO BE SCALED
- ALL DIMENSIONS ARE TO BE VERIFIED ON SITE.
- BRING ALL OMISSIONS AND DISCREPANCIES, INCLUDING DIMENSIONS, TO THE ATTENTION OF THE CONSULTANT PRIOR TO COMMENCEMENT OF ANY WORK.
- PROVIDE 19.1mm FIRE RATED PLYWOOD BACKING FOR TELEPHONES AND SURFACE MOUNTED ELECTRICAL PANELS UNLESS OTHERWISE NOTED.
- FULLY COORDINATE ALL ADDITIONAL SUPPORT REQUIRED FOR ANCHORAGE OF MECHANICAL EQUIPMENT OR DUCTS AND ELECTRICAL FIXTURES.
- ENSURE THAT WHEREVER A FIRE SEPARATION IS INDICATED ON THE DRAWINGS PER DIRECTION OF THE CONSTRUCTION NOTES, ALL COMPONENTS OF THE ASSEMBLY SHALL BE OF APPROVED MATERIALS, AND INSTALLATION/FABRICATION PROCEDURES ARE PER DIRECTION OF THE INDICATED UNDERWRITERS LABORATORIES OF CANADA LTD.' LATEST EDITION MANUAL AND OTHERWISE MEETING THE REQUIREMENTS OF THE ONTARIO BUILDING CODES. ALL FIRE SEPARATIONS MUST BE CONTINUOUS WITHIN THEIR EXTENT, AND ALL JOINTS TO BE SMOKE TIGHT.
- DIMENSIONS INDICATED ARE FROM EXTERIOR FACE OF SHEATHING, CONCRETE OR CONCRETE BLOCK AT EXTERIOR WALLS AND FACE OF STEEL STUDS, CONCRETE AND CONCRETE BLOCK AT INTERIOR PARTITIONS.
- OUTSIDE EDGE OF DOOR AND GLAZING FRAMES TO BE LOCATED 150mm AWAY FROM ADJACENT WALLS UNLESS OTHERWISE NOTED.
- MAINTAIN CONTINUITY OF ALL FIRE SEPARATIONS AND PENETRATIONS WITH APPROVED U.L.C. LISTED FIRE STOPPING SYSTEMS AND FIRE SEALANTS BOTH SIDES OF PARTITIONS.
- MAINTAIN CONTINUITY OF ALL PENETRATIONS WITH STRIPPING MEMBRANES SINGLE LAPPED TO EXTERIOR AND APPROVED SEALANTS COMPATIBLE WITH MEMBRANE PRODUCTS USED.
- ISOLATE ALL MECHANICAL, PIPES DUCTS AND EQUIPMENT FROM INTERIOR PARTITIONS TO AVOID ACOUSTIC NOISE TRANSFER.
- PROVIDE SOLID BLOCKING IN GYPSUM BOARD PARTITIONS FOR ATTACHMENT OF EQUIPMENT, FIXTURES, HANDRAILS, LADDERS etc.

SYMBOL LEGEND

⊕	CENTERLINE MARK
⊕	PARTITION ASSEMBLY TYPE
⊕	EXTERIOR ASSEMBLY TYPE
⊕	ROOF ASSEMBLY TYPE
⊕	INTERIOR GLAZING TYPE
⊕	EXTERIOR GLAZING TYPE
⊕	CEILING REFERENCE
⊕	2440 - CEILING HEIGHT A.F.F. U.N.O.
⊕	ROOM NAME
⊕	ROOM NAME & NUMBER
⊕	ARCHITECTURAL DATUM
⊕	ELEVATION ON BUILDING
⊕	ELEVATIONS AND SECTIONS
⊕	BUILDING SECTION
⊕	1 - SECTION NUMBER
⊕	A101 - REFERENCE SHEET NUMBER
⊕	WALL SECTION OR SECTION DETAIL
⊕	1 - SECTION NUMBER
⊕	A101 - REFERENCE SHEET NUMBER
⊕	PLAN DETAIL
⊕	1 - DETAIL NUMBER
⊕	A101 - REFERENCE SHEET NUMBER
⊕	DETAIL REFERENCE
⊕	1 - DETAIL NUMBER
⊕	A101 - REFERENCE SHEET NUMBER
⊕	TITLE - DETAIL TITLE
⊕	ELEVATION SYMBOL
⊕	1 - DETAIL NUMBER
⊕	A101 - REFERENCE SHEET NUMBER
⊕	DOOR SYMBOL BY ROOM NUMBER
⊕	REFER TO DOOR SCHEDULE
⊕	EXISTING CONSTRUCTION
⊕	CONCRETE (SMALL SCALE)
⊕	CONCRETE (LARGE SCALE)
⊕	CONCRETE BLOCK
⊕	FIBREBOARD
⊕	GYPSUM BOARD/SHEATHING
⊕	PLYWOOD
⊕	RIGID OR SEMI RIGID INSULATION
⊕	BATT INSULATION
⊕	BACKFILL
⊕	GRAVEL

ROOM FINISH SCHEDULE GENERAL NOTES

WHERE MULTIPLE FINISHES ARE INDICATED FOR A SURFACE:

- REFER TO REFLECTED CEILING PLAN FOR CEILING TYPE EXTENTS
- REFER TO INTERIOR ELEVATIONS AND DETAILS DRAWINGS FOR MATERIAL LOCATIONS
- REFER TO FLOOR FINISH PLANS FOR FLOOR TYPE EXTENTS
- REFER TO DOOR SCHEDULE FOR TYPE EXTENTS AND MATERIAL LOCATIONS

- ALL VERTICAL TILE GROUT LINES TO ALIGN FROM FLOOR TO CEILING
- ALL HORIZONTAL TILE GROUT LINES TO ALIGN ACROSS FULL EXTENT OF ROOM
- ALL WALL TILE GROUT LINES TO ALIGN WITH FLOOR TILE GROUT LINES UNLESS NOTED OTHERWISE
- FLOOR FINISH TRANSITIONS TO BE ON CENTER OF DOOR THRESHOLDS
- FLOOR FINISH TO EXTEND UNDER ALL VANITIES, PLUMBING FIXTURES, AND ACCESSORIES
- REFER TO SPECIFICATION SECTION (B 99-59) MATERIALS LIST FOR FINISH CODES

PAINT GLOSS LEVELS

- GLOSS LEVEL 1 MATTE FINISH (FLAT) - CEILINGS
- GLOSS LEVEL 3 EGGSHELL FINISH - WALLS
- GLOSS LEVEL 4 SATIN FINISH - EXTERIOR WALLS
- GLOSS LEVEL 5 TRADITIONAL SEMI-GLOSS FINISH - DOOR FRAMES AND DOORS, METAL FIXTURES

EXTERIOR WALL ASSEMBLY NOTES:

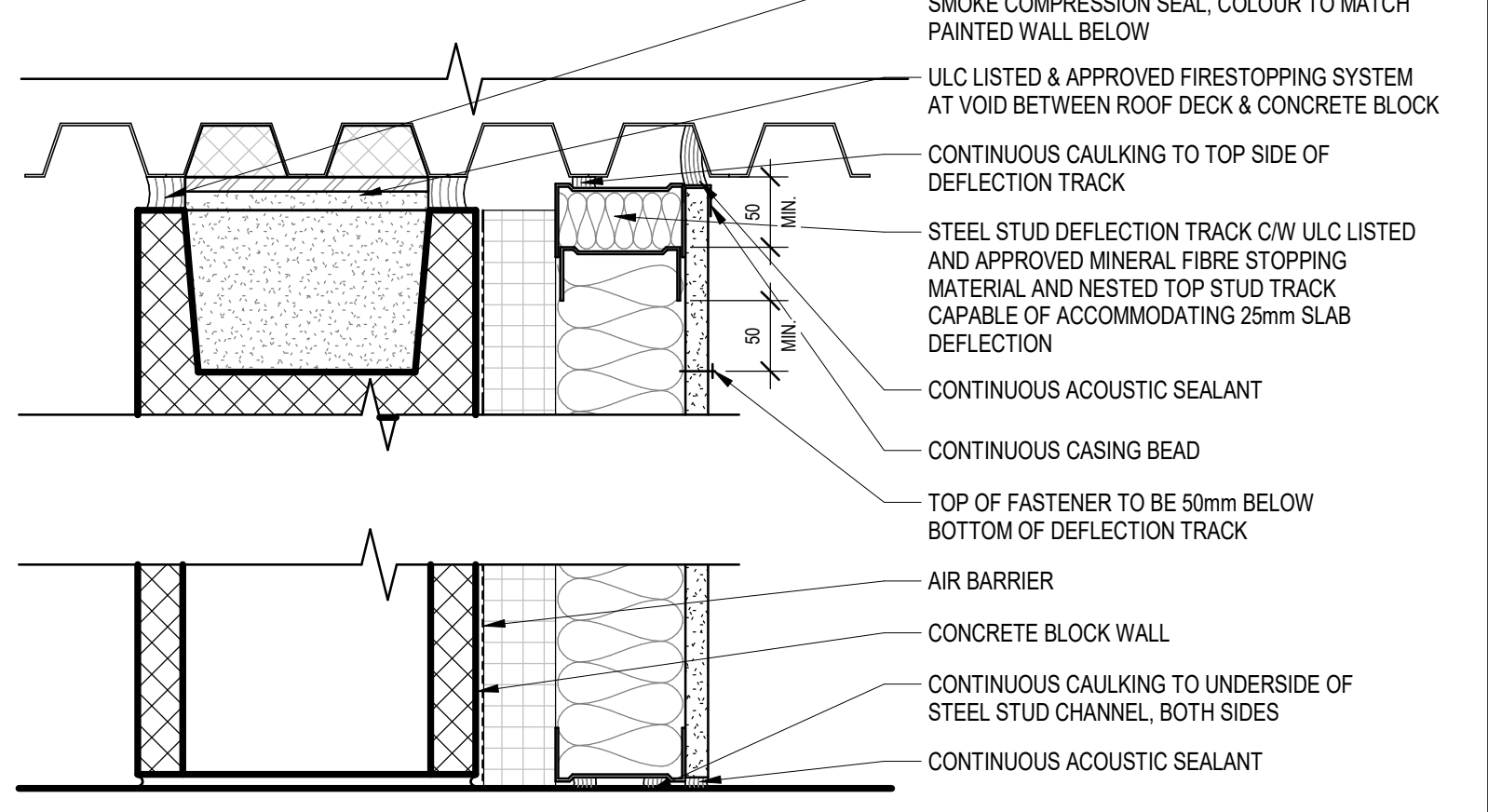
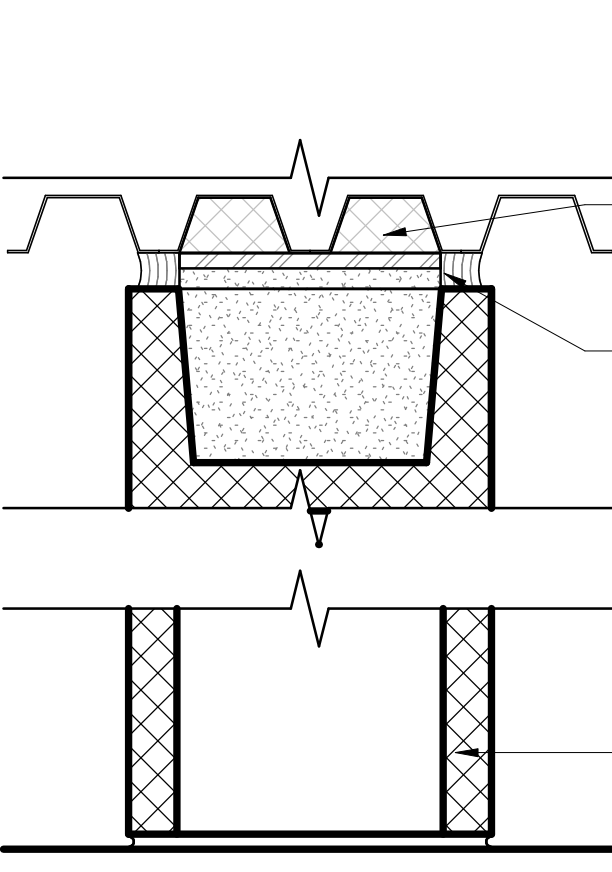
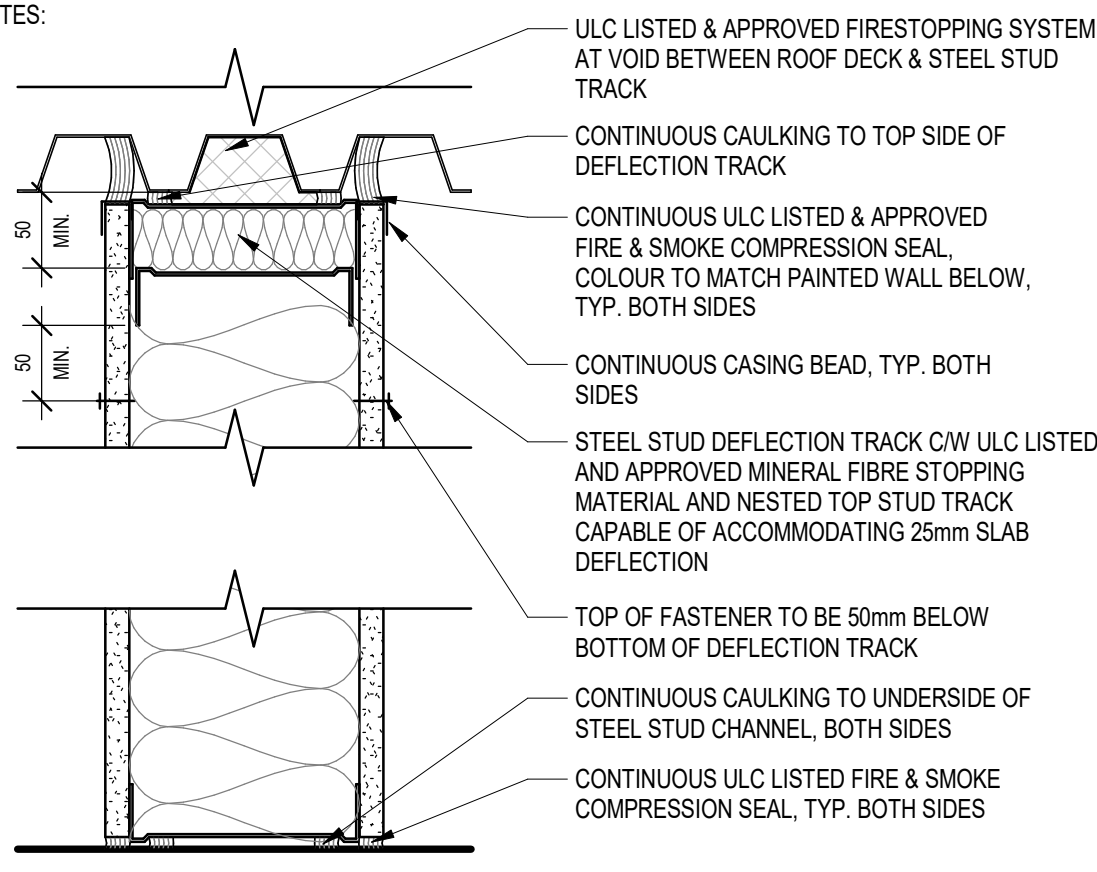
- THE FOLLOWING EXTERIOR WALL CONSTRUCTION TYPES INDICATE THE GENERAL ASSEMBLY CONSTRUCTION MATERIALS, REFER TO ADDITIONAL NOTES LISTED BELOW AND LARGE-SCALE DETAILS THAT INDICATE ADDITIONAL COMPONENT MATERIALS, ASSEMBLIES AND MEMBRANE VAPOUR BARRIER TRANSITIONS AND TIE-INS TO ADJACENT WALL, FLOOR AND ROOF ASSEMBLIES, INCLUDING TIE-INS IN CONNECTIONS AT WINDOW, DOOR, LOUVER AND SIMILAR OPENINGS.
- ALL STEEL STUDS TO BE ENGINEERED FOR LATERAL WIND LOADS BY STEEL STUD SUPPLIER.
- REFER TO BUILDING ENVELOPE DETAILS FOR ALUMINUM AND GLASS SPANDREL PANELS.
- EXTERIOR SHEATHING SHALL BE GLASS MAT FACED GYPSUM SHEATHING.
- PROVIDE DEFLECTION TRACK AT TOP OF ALL STEEL STUD FRAMED WALLS SUFFICIENT TO ACCOMMODATE MINIMUM 20mm VERTICAL DEFLECTION.
- PROVIDE 20mm OR 50mm DEFLECTION GAP AT TOP OF ALL CONCRETE BLOCK WALLS. REFER TO LARGE SCALE DETAILS

ASSEMBLY - EXTERIOR WALL

TYPE	DESCRIPTION	FIRE RATING	COMMENTS
W1	INSULATED METAL PANEL (GARAGE) -102mm INSULATED METAL PANEL SYSTEM -HORIZONTAL STRUCTURAL SUB-GIRTS (EXISTING TO REMAIN, AS WELL AS ADDITIONAL LOCATIONS BETWEEN STRUCTURAL FRAMING) -STEEL STRUCTURE	-	MINIMUM EFFECTIVE USI = 0.133W/m2K (R-42.6)
W1A	INSULATED METAL PANEL (GARAGE) -102mm INSULATED METAL PANEL SYSTEM -HORIZONTAL STRUCTURAL SUB-GIRTS BETWEEN STRUCTURAL FRAMING -254mm STEEL STUDS @610mm O.C. -152mm STEEL STUDS @610mm O.C. -2 LAYERS 12.7mm TYPE-X GYPSUM BOARD (IMPACT RESISTANT) -102mm HORIZONTAL FURRING CHANNELS -31mm METAL LINER PANEL	1HR. REFER TO OBC 2012, SB-2, TABLE 2.3.4.A.	MINIMUM EFFECTIVE USI = 0.133W/m2K (R-42.6); SEE CODE PLAN FOR RATINGS; FIRE RATING ACHIEVED BY COLD-FORMED METAL STUDS AND GYPSUM BOARD
W1B	INSULATED METAL PANEL (WASH BAY) -102mm INSULATED METAL PANEL SYSTEM -HORIZONTAL STRUCTURAL SUB-GIRTS (EXISTING TO REMAIN, AS WELL AS ADDITIONAL LOCATIONS BETWEEN STRUCTURAL FRAMING) -STEEL STRUCTURE -FIBREGLASS REINFORCED PLASTIC PANEL	-	MINIMUM EFFECTIVE USI = 0.133W/m2K (R-42.6)
W2	CORRUGATED METAL PANEL (DARK GREY) -40mm PRE-FINISHED VERTICAL CORRUGATED METAL PANEL -63.5mm HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -25mm SUPPORT GIRTS -152mm INSULATED METAL PANEL SYSTEM -HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -254mm STEEL STUDS @610mm O.C. -2 LAYERS 12.7mm TYPE-X GYPSUM BOARD (IMPACT RESISTANT)	-	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0)
W2A	CORRUGATED METAL PANEL (DARK GREY) -40mm PRE-FINISHED VERTICAL CORRUGATED METAL PANEL -63.5mm HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -25mm CLADDING SUPPORT RAIL SYSTEM SET IN INSULATED METAL PANEL JOINT -152mm INSULATED METAL PANEL SYSTEM -HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -254mm STEEL STUDS @610mm O.C. -2 LAYERS 12.7mm TYPE-X GYPSUM BOARD (IMPACT RESISTANT)	1HR. REFER TO OBC 2012, SB-2, TABLE 2.3.4.A.	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0); SEE CODE PLAN FOR RATINGS; FIRE RATING ACHIEVED BY COLD-FORMED METAL STUDS AND GYPSUM BOARD
W2B	CORRUGATED METAL PANEL (DARK GREY) -40mm PRE-FINISHED VERTICAL CORRUGATED METAL PANEL -63.5mm HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -25mm SUPPORT GIRTS -152mm INSULATED METAL PANEL SYSTEM -25mm HORIZONTAL HAT BARS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -240mm CONCRETE BLOCK	-	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0)
W2C	CORRUGATED METAL PANEL (DARK GREY) -40mm PRE-FINISHED VERTICAL CORRUGATED METAL PANEL -63.5mm HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -25mm CLADDING SUPPORT RAIL SYSTEM SET IN INSULATED METAL PANEL JOINT -152mm INSULATED METAL PANEL SYSTEM -HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS	-	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0)
W3	FAUX EXTERIOR WOOD SLAT WALL -25mm FAUX EXTERIOR WOOD SLAT C/W HIDDEN SIDING CLIPS -22mm HORIZONTAL METAL FURRING CHANNELS, SPACING AND GAUGE TO SUIT SPANS AND WIND LOADS -25mm CLADDING SUPPORT RAIL SYSTEM SET IN INSULATED METAL PANEL JOINT -152mm INSULATED METAL PANEL SYSTEM -HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS	-	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0)
W4	COMPOSITE METAL PANEL WALL (BLACK) -51mm ALUMINUM COMPOSITE METAL PANEL C/W CLIP SYSTEM -63.5mm HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -25mm CLADDING SUPPORT RAIL SYSTEM SET IN INSULATED METAL PANEL JOINT -152mm INSULATED METAL PANEL SYSTEM -HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -203mm STEEL STUDS @400mm O.C. -64mm STEEL STUDS @400mm O.C. -15.9mm GYPSUM BOARD	-	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0)
W4A	COMPOSITE METAL PANEL WALL (DARK GREY) - EYEBROW -51mm ALUMINUM COMPOSITE METAL PANEL C/W CLIP SYSTEM -63.5mm HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -25mm CLADDING SUPPORT RAIL SYSTEM SET IN INSULATED METAL PANEL JOINT -152mm INSULATED METAL PANEL SYSTEM	-	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0)
W4C	COMPOSITE METAL PANEL WALL (BLACK) -51mm ALUMINUM COMPOSITE METAL PANEL C/W CLIP SYSTEM -63.5mm HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -25mm CLADDING SUPPORT RAIL SYSTEM SET IN INSULATED METAL PANEL JOINT -152mm INSULATED METAL PANEL SYSTEM -HORIZONTAL GIRTS, SPACING & GAUGE TO SUIT SPANS & WIND LOADS -203mm STEEL STUDS @400mm O.C. -64mm STEEL STUDS @400mm O.C. -15.9mm GYPSUM BOARD	-	MINIMUM EFFECTIVE USI = 0.132W/m2K (R-43.0)
W5	ALUMINUM CURTAIN WALL SYSTEM -TRIPLE GLAZED SEALED UNITS -CLEAR ANODIZED ALUMINUM FRAME -19mm SNAP CAP -133mm BACK BODY	-	MINIMUM EFFECTIVE USI = 0.246W/m2K (R-23.1)

PARTITION HEAD & BASE DETAILS:

NOTES:



PARTITION ASSEMBLY NOTES:

- REFER TO PARTITION CONSTRUCTION TYPES, THE SEQUENTIAL ORDER OF MATERIAL COMPONENTS LISTED FOR EACH PARTITION TYPE CORRESPONDS DIRECTLY TO THE SIDE THAT EACH PARTITION IS REFERENCED FROM ON FLOOR PLANS WITH A PARTITION TYPE
- ALL PARTITIONS INDICATED TO BE CONSTRUCTED WITH A "FIRE SEPARATION" SHALL EXTEND FULL HEIGHT TO THE UNDERSIDE OF FLOOR OR ROOF DECK AND BE FIRE STOPPED WITH A U.L.C. APPROVED FIRE-STOPPING SYSTEM COMPLETE WITH FIRE SEALANT BOTH SIDES
- ALL PENETRATIONS THROUGH PARTITIONS REQUIRED TO BE CONSTRUCTED AS A FIRE SEPARATION SHALL BE FIRE STOPPED WITH A U.L.C. LISTED FIRE-STOPPING MATERIAL C/W FIRE SEALANT BOTH SIDES
- ALL INTERIOR STEEL STUD PARTITIONS THAT EXTEND FULL HEIGHT TO ROOF DECK ABOVE, SHALL BE CONSTRUCTED WITH A 50mm DEEP TOP DEFLECTION TRACK, STOP VERTICAL STUDS SHORT BY ± 15mm WHICH WILL ALLOW FOR 15mm VERTICAL DEFLECTION. AT PARTITIONS WITH A FIRE RESISTANCE RATING, A SECOND STUD TRACK IS TO BE SET INTO THE 50mm TOP TRACK WHICH WILL ALLOW FOR 15mm DEFLECTION. U.L.C. LISTED FIRE STOPPING MATERIAL SHALL BE PLACED BETWEEN THE DOUBLE TOP TRACKS, AND FIRE SEALANT APPLIED AT BOTH SIDES OF PARTITION TOP, BOTTOM AND TO DIFFERENT DEFLECTION TRACK MAY BE USED IN LIEU OF A DOUBLE TOP TRACKS, AND FIRE SEALANT APPLIED AT BOTH SIDES OF PARTITION TOP, BOTTOM AND TO DIFFERENT ADJACENT CONSTRUCTIONS. A SINGLE 50mm DEEP SLOTTED DEFLECTION TRACK MAY BE USED IN LIEU OF A DOUBLE TOP TRACK, STOP VERTICAL STUDS ±15mm BELOW THE UNDERSIDE OF SLAB, AND SPACE IS FILLED WITH FIRE RATED ACOUSTIC SEALANT MAINTAINING FIRE RATING (ON BOTH SIDES) AS REQUIRED BY ASSOCIATED PARTITION TYPES WHILE MAINTAINING THE INTEGRITY OF THE U.L.C. DESIGN.
- ALL PARTITIONS ARE TO BE FRAMED AROUND MECHANICAL AND ELECTRICAL SERVICES AS REQUIRED. STUD FRAMING OR FURRING CHANNELS SHALL NOT BE ATTACHED TO MECHANICAL DUCTWORK, TO AVOID ACOUSTIC VIBRATION NOISE TRANSFER
- ALL FIRE RATED PARTITIONS DENOTED AS A U.L.C. DESIGN SHALL BE CONSTRUCTED IN STRICT ACCORDANCE WITH THE STANDARD OF CONSTRUCTION AND ACCEPTABLE MANUFACTURERS OF PARTICULAR MATERIALS INCLUDING FIRE RATED MATERIAL DESIGNATIONS UNDER MATERIAL "GUIDE NUMBERS" IN THE LATEST EDITION OF THE UNDERWRITERS LABORATORIES OF CANADA MANUAL. PARTITION CONSTRUCTION TYPES LISTED IN SB-3 OF THE OBC ARE NOT PERMITTED FOR FIRE RESISTANCE RATINGS, BUT ARE ACCEPTABLE FOR ACOUSTIC STC RATINGS LISTED.
- PROVIDE 25mm DEFLECTION JOINT AT TOP OF CONCRETE BLOCK WALLS. AT CONCRETE BLOCK WALLS WITH A FIRE RESISTANCE RATING, FILL DEFLECTION GAP WITH U.L.C. APPROVED FIRE STOPPING MATERIAL COMPLETE WITH FIRE SEALANT BOTH SIDES.
- REFER TO STRUCTURAL DOCUMENTS FOR CONCRETE BLOCK PARTITION REINFORCING, CORE FILLS, LINTELS AND BOND BEAMS.
- WHERE GYPSUM BOARD MEETS ADJACENT MATERIALS, PROVIDE CONTINUOUS SEALED JOINT PERIMETER
- ALL PENETRATIONS THROUGH PARTITIONS REQUIRED TO BE CONSTRUCTED AS AN ACOUSTIC SEPARATION SHALL BE SEALED WITH ACOUSTIC SEALANT BOTH SIDES.
- AT FIRE SEPARATIONS WITHOUT FIRE RESISTANCE RATINGS (SMOKE SEPARATIONS) PROVIDE CONTINUOUS SMOKE SEALANT AT FLOORS AND ROOF STRUCTURES TO DISMISSED ADJACENT TO DISMISSED CONSTRUCTION ASSEMBLIES.
- IN ACCORDANCE WITH THE OBC 2012, SB-2, AT CAST IN PLACE CONCRETE WALLS MAINTAIN APPLICABLE CONCRETE COVER OVER REINFORCING STEEL FOR FIRE SEPARATIONS WITH FIRE RESISTANCE RATING INDICATED ON FLOOR PLANS.
- IN ACCORDANCE WITH THE OBC 2012, SB-2, AT CONCRETE BLOCK WALLS, MASONRY UNITS SHALL BE SELECTED OF CONCRETE TYPE AND EQUIVALENT THICKNESS TO SUIT FIRE RESISTANCE RATING.

ASSEMBLY - PARTITION

TYPE	DESCRIPTION	FIRE RATING	COMMENTS
E.P2	EXISTING GARAGE MASONRY WALL - 190mm CONCRETE BLOCK	45MIN. REFER TO OBC 2012, SB-2, TABLE 2.1.1.	EXISTING CONCRETE BLOCK WALL TO REMAIN. PROVIDE FIRE STOPPING AND FIRE SEALING AT ALL WALL, FLOOR, AND CEILING INTERFACES AND ALL PENETRATIONS TO MEET A 45-MINUTE FIRE RESISTANCE RATING. EXISTING THICKNESS AND CONSTRUCTION OF WALL TO BE VERIFIED AND CONFIRMED THROUGH ENGINEERING JUDGEMENT TO MEET A 45-MINUTE FIRE RESISTANCE RATING (BY INDEPENDENT GENERAL CONTRACTOR)
P1	1HR FIRE RATED ACOUSTIC PARTITION TO U/S STRUCTURAL DECK - 15.9mm TYPE 'X' GYPSUM BOARD - 152mm STEEL STUDS AT 610mm O.C. - C/W 152mm ACOUSTIC INSULATION - 15.9mm FIRE-RATED GYPSUM BOARD	1HR. REFER TO ULC DESIGN NO. U425	SEE CODE PLAN FOR RATINGS
P2	MASONRY WALL -240mm CONCRETE BLOCK	45MIN. REFER TO OBC 2012, SB-2, TABLE 2.1.1.	SEE CODE PLAN FOR RATINGS; FIRE RATING ACHIEVED BY TYPE AND SIZE OF CONCRETE BLOCK
P3	MASONRY WALL -240mm CONCRETE BLOCK	2HR. REFER TO OBC 2012, SB-2, TABLE 2.1.1.	SEE CODE PLAN FOR RATINGS; FIRE RATING ACHIEVED BY TYPE AND SIZE OF CONCRETE BLOCK
P4	MASONRY WALL -240mm CONCRETE BLOCK -AIR BARRIER -51mm CONTINUOUS SEMI-RIGID MINERAL WOOL INSULATION -62mm STEEL STUDS AT 400mm O.C. FILLED WITH BATT INSULATION -15.9mm FIRE-RATED GYPSUM BOARD	2HR. REFER TO OBC 2012, SB-2, TABLE 2.1.1.	MINIMUM EFFECTIVE USI = 0.281 W/m2K (R-20.2); SEE CODE PLAN FOR RATINGS; FIRE RATING ACHIEVED BY TYPE AND SIZE OF CONCRETE BLOCK
P5	PARTITION TO U/S STRUCTURAL DECK -15.9mm GYPSUM WALL BOARD -62mm STEEL STUDS AT 400mm O.C. -15.9mm GYPSUM WALL BOARD	-	WHERE TILE IS INDICATED ON THE DRAWINGS, REPLACE 15.9mm GYPSUM BOARD WITH 15.9mm TILE BACKER BOARD; PLYWOOD BACKING TO BE INCLUDED WHERE REQUIRED TO SUPPORT EQUIPMENT AND WHERE INDICATED ON FURNITURE AND EQUIPMENT PLAN
P7	CEDAR PANEL ACOUSTIC PARTITION TO U/S STRUCTURAL DECK -38mm CEDAR SLATS @ 73.5mm O.C. C/W HIDDEN FASTENERS - 15.9mm GYPSUM BOARD - 62mm STEEL STUDS AT 400mm O.C. - C/W 92mm ACOUSTIC INSULATION - 15.9mm GYPSUM BOARD	-	PLYWOOD BACKING TO BE INCLUDED WHERE REQUIRED TO SUPPORT EQUIPMENT AND WHERE INDICATED ON FURNITURE AND EQUIPMENT PLAN
P8	PARTITION TO U/S STRUCTURAL DECK - 15.9mm GYPSUM BOARD - 152mm STEEL STUDS AT 400mm O.C. - 15.9mm GYPSUM BOARD	-	WHERE TILE IS INDICATED ON THE DRAWINGS, REPLACE 15.9mm GYPSUM BOARD WITH 15.9mm TILE BACKER BOARD; PLYWOOD BACKING TO BE INCLUDED WHERE REQUIRED TO SUPPORT EQUIPMENT AND WHERE INDICATED ON FURNITURE AND EQUIPMENT PLAN
P9	PARTITION TO U/S STRUCTURAL DECK - 15.9mm GYPSUM WALL BOARD -62mm STEEL STUDS AT 400mm O.C.	-	WHERE TILE IS INDICATED ON THE DRAWINGS, REPLACE 15.9mm GYPSUM BOARD WITH 15.9mm TILE BACKER BOARD
P10	PARTITION TO U/S STRUCTURAL DECK - 15.9mm GYPSUM BOARD - 203mm STEEL STUDS AT 400mm O.C. - 15.9mm GYPSUM BOARD	-	WHERE TILE IS INDICATED ON THE DRAWINGS, REPLACE 15.9mm GYPSUM BOARD WITH 15.9mm TILE BACKER BOARD; PLYWOOD BACKING TO BE INCLUDED WHERE REQUIRED TO SUPPORT EQUIPMENT AND WHERE INDICATED ON FURNITURE AND EQUIPMENT PLAN
P11	PARTITION -15.9mm GYPSUM WALL BOARD -62mm STEEL STUDS AT 400mm O.C. -15.9mm GYPSUM WALL BOARD	-	WHERE TILE IS INDICATED ON THE DRAWINGS, REPLACE 15.9mm GYPSUM BOARD WITH 15.9mm TILE BACKER BOARD; PLYWOOD BACKING TO BE INCLUDED WHERE REQUIRED TO SUPPORT EQUIPMENT AND WHERE INDICATED ON FURNITURE AND EQUIPMENT PLAN
P12	MASONRY WALL -240mm CONCRETE BLOCK -AIR BARRIER -51mm CONTINUOUS SEMI-RIGID MINERAL WOOL INSULATION -152mm STEEL STUDS AT 400mm O.C. FILLED WITH BATT INSULATION -152mm STEEL STUDS AT 400mm O.C. FILLED WITH BATT INSULATION -15.9mm FIRE-RATED GYPSUM BOARD	2HR. REFER TO OBC 2012, SB-2, TABLE 2.1.1.	MINIMUM EFFECTIVE USI = 0.281 W/m2K (R-20.2); SEE CODE PLAN FOR RATINGS; FIRE RATING ACHIEVED BY TYPE AND SIZE OF CONCRETE BLOCK
P13	PARTITION TO U/S STRUCTURAL DECK - 15.9mm GYPSUM BOARD - 152mm STEEL STUDS AT 400mm O.C. - 152mm STEEL STUDS AT 400mm O.C. - 15.9mm GYPSUM BOARD	-	WHERE TILE IS INDICATED ON THE DRAWINGS, REPLACE 15.9mm GYPSUM BOARD WITH 15.9mm TILE BACKER BOARD; PLYWOOD BACKING TO BE INCLUDED WHERE REQUIRED TO SUPPORT EQUIPMENT AND WHERE INDICATED ON FURNITURE AND EQUIPMENT PLAN
P14	PARTITION TO U/S STRUCTURAL DECK - 15.9mm TYPE 'X' GYPSUM BOARD - 203mm STEEL STUDS AT 610mm O.C. - 15.9mm FIRE-RATED GYPSUM BOARD	45MIN. REFER TO ULC DESIGN NO. U425	SEE CODE PLAN FOR RATINGS

ASSEMBLY - CEILING			
TYPE	DESCRIPTION	FIRE RATING	COMMENTS
C1	ACOUSTIC CEILING PANEL -25mm FELT ACOUSTIC CEILING PANEL	-	
C2	PAINTED EXPOSED STRUCTURE	-	PAINT ALL EXPOSED STRUCTURAL, MECHANICAL AND ELECTRICAL SYSTEMS, PT2
C3	ACOUSTIC CEILING BLADES -25mm PREFABRICATED FELT ACOUSTIC CEILING BLADES	-	
C4	ACOUSTIC CEILING TILE -15.9mm ACOUSTIC CEILING TILE -22mm FURRING CHANNELS	-	
C6	GYPSUM CEILING -15.9mm GYPSUM BOARD -STUD FRAMING AS REQUIRED	-	

ASSEMBLY - SOFFIT

TYPE	DESCRIPTION	FIRE RATING	COMMENTS
S1	FAUX EXTERIOR WOOD SLAT SOFFIT -25mm FAUX EXTERIOR WOOD SLATS C/W HIDDEN SIDING CLIPS -22mm METAL FURRING CHANNELS, SPACING AND GAUGE TO SUIT SPANS AND WIND LOADS -25mm SUPPORT GIRTS	-	REFER TO 31A603 FOR VARIATION IN SUPPORT GIRT DEPTHS

ASSEMBLY - FLOOR

TYPE	DESCRIPTION	FIRE RATING	COMMENTS
F1	TYPICAL SLAB ON GRADE -CONCRETE SLAB ON GRADE (REFER TO STRUCTURAL FOR THICKNESS) -AIR/VAPOUR BARRIER -254mm RIGID INSULATION -200mm GRANULAR A FILL, NATIVE SOILS	-	MINIMUM EFFECTIVE USI = 0.111 W/m2K (R-51.2)

ROOF ASSEMBLY NOTES:

- ROOF CONSTRUCTION TYPES INDICATE THE GENERAL ASSEMBLY OF CONSTRUCTION MATERIALS, REFER TO SPECIFICATIONS AND ADDITIONAL LARGE-SCALE DETAILS THAT INDICATE ADDITIONAL COMPONENT MATERIALS, ASSEMBLIES AND MEMBRANE VAPOUR BARRIER TRANSITIONS AND TIE-INS TO ADJACENT EXTERIOR WALL VAPOUR BARRIERS.

ASSEMBLY - ROOF

TYPE	DESCRIPTION	FIRE RATING	COMMENTS
EX	EXISTING ROOF -EXISTING STANDING SEAM ROOFING -STEEL STRUCTURE -EXISTING BAGGED INSULATION BETWEEN STRUCTURAL MEMBERS	-	
R1	STANDING SEAM ROOM (NEW GARAGE EXPANSION) -38mm STANDING SEAM MECHANICAL LOCK PANELS W/ GALVANIZED COATING -10mm DRAINAGE/VENTILATION MAT -VAPOUR/PERMEABLE UNDERLAYMENT MEMBRANE -12.7mm INSULATION COVER BOARD -2 LAYERS 50mm RIGID POLYISO INSULATION -SELF-ADHESIVE AIR/VAPOUR BARRIER MEMBRANE -12.7mm GYPSUM ROOF DECK SHEATHING BOARD -38mm METAL DECK -NEW STEEL STRUCTURE, SLOPED TO MATCH EXISTING GARAGE ROOF	-	MINIMUM EFFECTIVE USI = 0.229W/m2K (R-24.8)
R2	TYPICAL ROOF -2 LAYERS 7.5mm RIGID POLYISOCYANURATE INSULATION -TAPERED RIGID POLYISOCYANURATE INSULATION LOCATION AND THICKNESSES AS REQUIRED TO DRAIN -SELF-ADHESIVE AIR/VAPOUR BARRIER MEMBRANE -12.7mm GYPSUM ROOF DECK SHEATHING BOARD -38mm METAL DECK -STEEL STRUCTURE SLOPED FOR DRAINAGE	-	MINIMUM EFFECTIVE USI = 0.147W/m2K (R-38.7)
R3	CANOPY ROOF -2 LAYERS 7.5mm RIGID POLYISOCYANURATE INSULATION -TAPERED RIGID POLYISOCYANURATE INSULATION LOCATION AND THICKNESSES AS REQUIRED TO DRAIN -SELF-ADHESIVE AIR/VAPOUR BARRIER MEMBRANE -12.7mm GYPSUM ROOF DECK SHEATHING BOARD -38mm METAL DECK -STEEL STRUCTURE	-	

Project Team:

Prime Consultant
GEC ARCHITECTURE

Structural and Building Envelope Consultant
ENTUITIVE

Mechanical and Electrical Consultant
MCW CONSULTANTS LTD.

Civil Consultant
PLANMAC ENGINEERING

Passive House Consultant
PEEL PASSIVE HOUSE

LEED Consultant
MCW CONSULTANTS LTD.

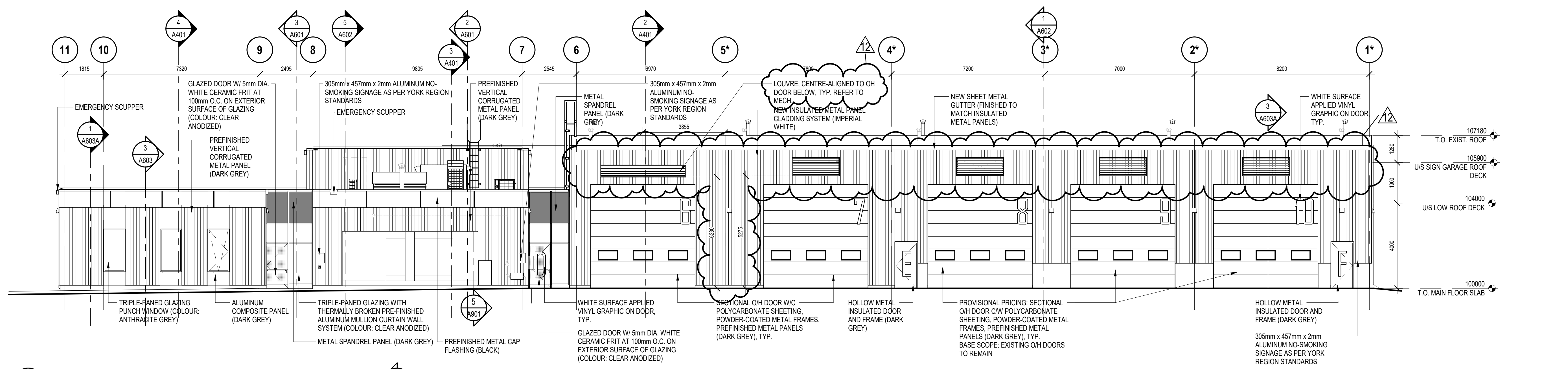
Landscape Consultant
MHBC

Client

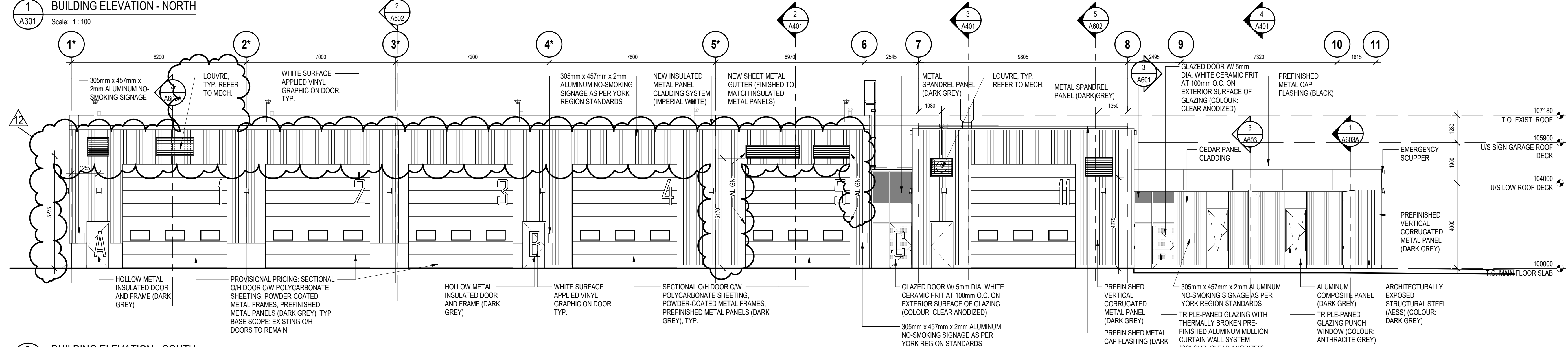
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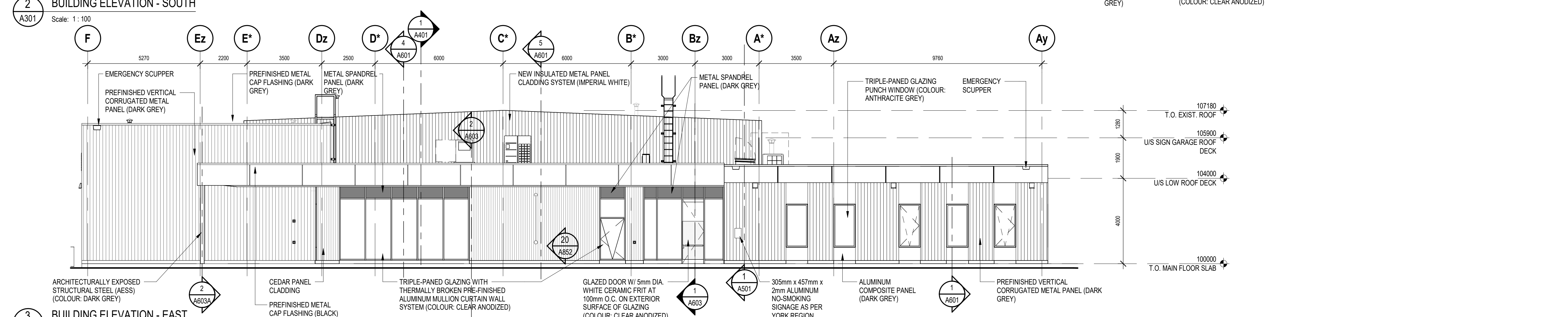
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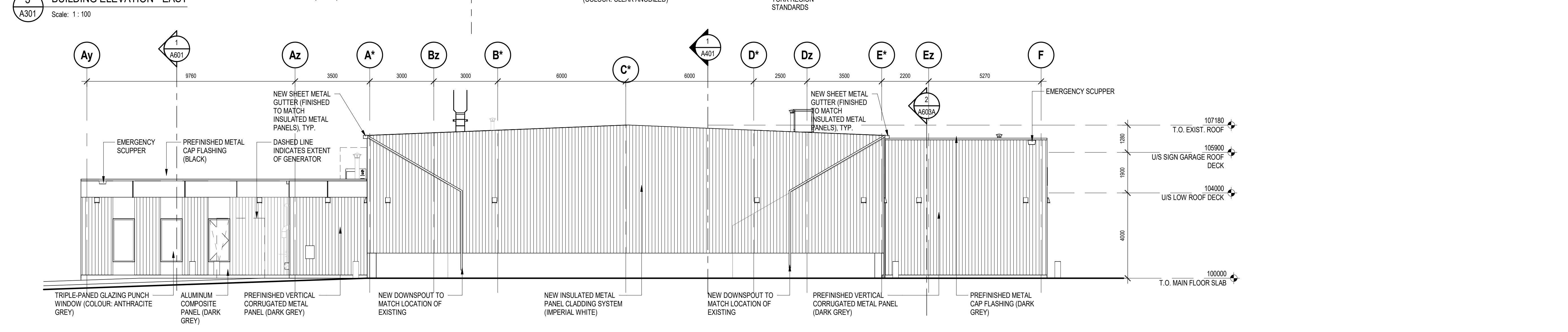
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2 BUILDING ELEVATION - SOUTH
Scale: 1 : 100



3 BUILDING ELEVATION - EAST
Scale: 1 : 100



4 BUILDING ELEVATION - WEST
Scale: 1 : 100

12	ISSUED FOR ADDENDUM 5	2025-07-31
11	ISSUED FOR ADDENDUM 4	2025-07-18
10	REISSUED FOR TENDER	2025-05-23
9	ISSUED FOR TENDER	2025-04-25
8	ISSUED FOR BUILDING PERMIT	2024-11-27
7	ISSUED FOR SPA 2ND RESUBMISSION	2024-11-22
6	ISSUED FOR PRE-TENDER REVIEW	2024-10-31
5	ISSUED FOR SPA 1ST RESUBMISSION	2024-10-07
4	ISSUED FOR 60% CD	2024-05-02
3	ISSUED FOR SPA	2024-04-12
2	100% DD	2024-02-29
1	60% DD	2024-01-25

Drawing History

Scale	1 : 100	Checked By	TB
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Region of York Project Number
22046

Region of York Building Code
G013-B

Project

YORK REGION NORTH ROADS
OPERATIONS CENTRE

3525 BASELINE RD, SUTTON WEST, ON L0E 1R0

Drawing Title

ELEVATIONS

Project Number	6016	Drawing Number	A301
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Civil Consultant
PLANMAC ENGINEERING

Passive House Consultant
PEEL PASSIVE HOUSE

LEED Consultant
MCW CONSULTANTS LTD.

Landscape Consultant
MHBC

Client

YORK REGION



Seal & Permit

6	ISSUED FOR ADDENDUM 5	2025-07-31
5	ISSUED FOR ADDENDUM 4	2025-07-18
4	REISSUED FOR TENDER	2025-05-23
3	ISSUED FOR TENDER	2025-04-25
2	ISSUED FOR BUILDING PERMIT	2024-11-27
1	ISSUED FOR PRE-TENDER REVIEW	2024-10-31

Drawing History

Scale	1 : 20	Checked By	TB
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Region of York Project Number	22046	Region of York Building Code	G013-B
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Project

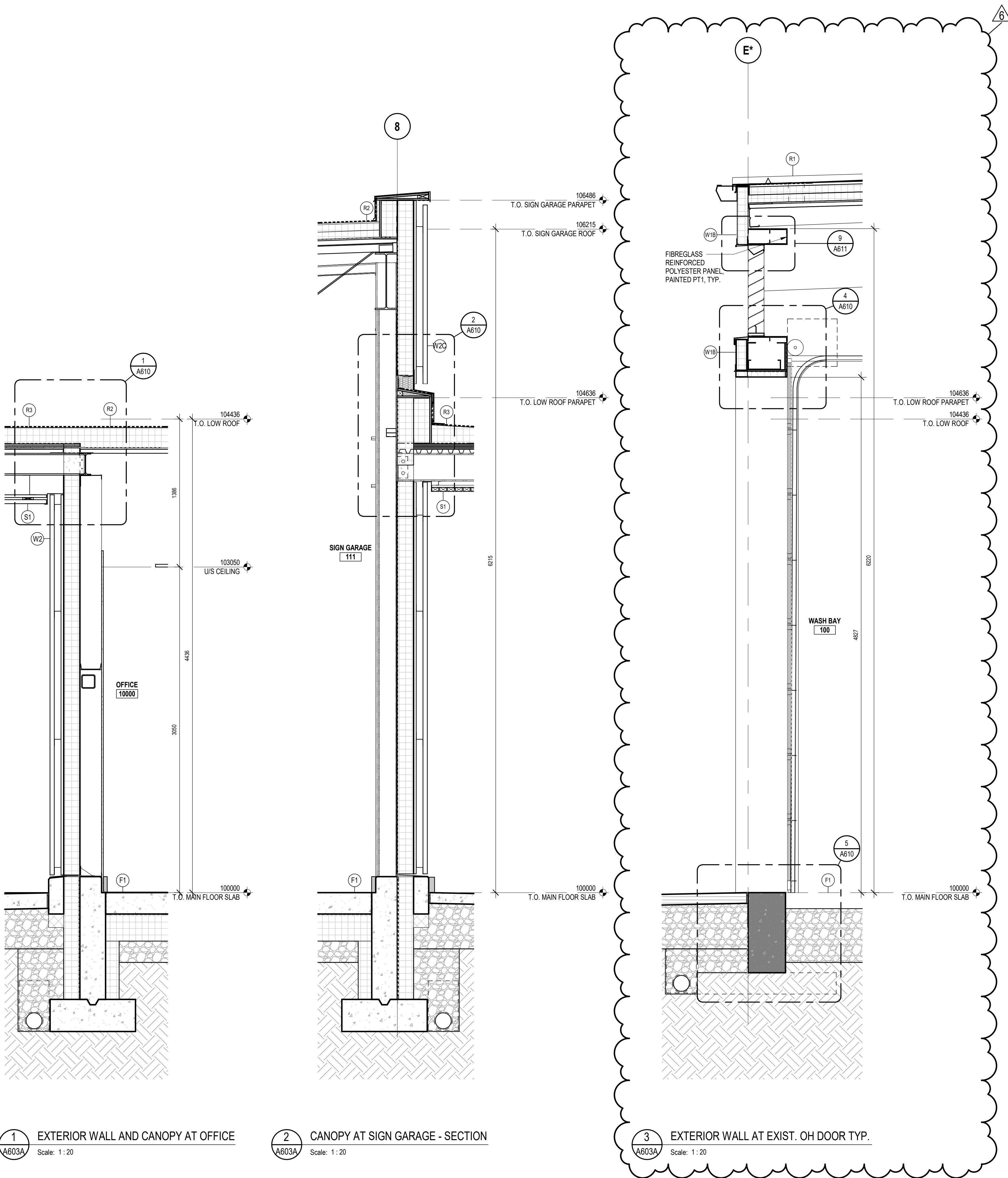
YORK REGION NORTH ROADS
OPERATIONS CENTRE

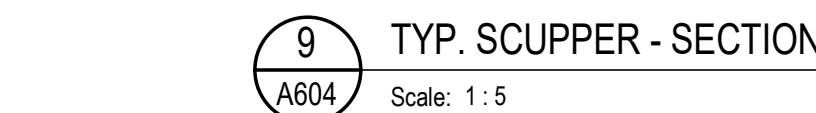
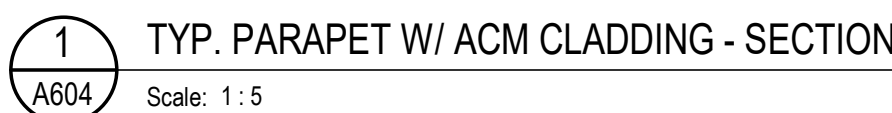
3525 BASELINE RD. SUTTON WEST, ON L0E 1R0

Drawing Title

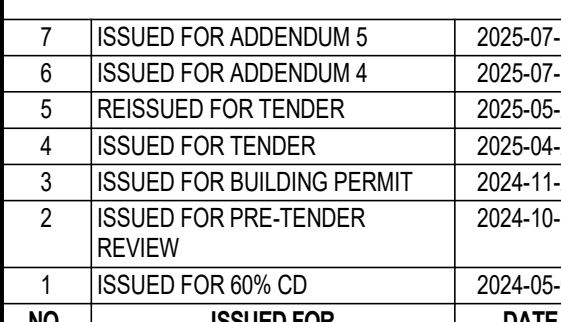
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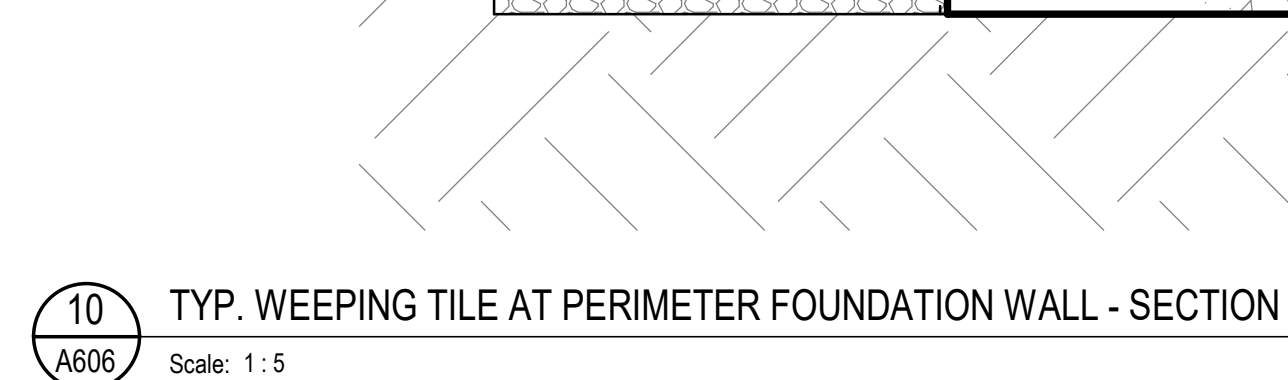
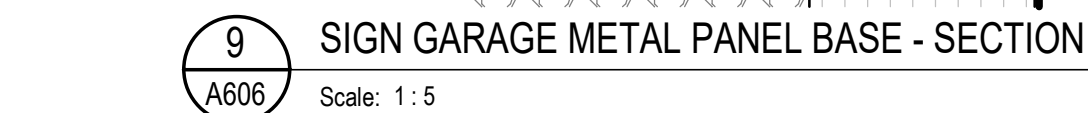
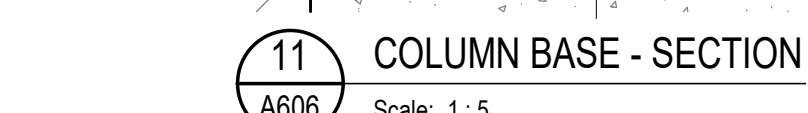
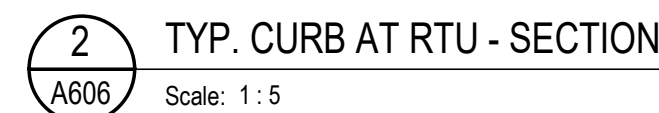
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NO.	ISSUED FOR	DATE
Drawing History		
Scale		Checked By
1 : 5		TB
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22046	G013-B	
Project		
YORK REGION NORTH ROADS OPERATIONS CENTRE		
3525 BASELINE RD. SUTTON WEST, ON L0E 1R0		
Drawing Title		
DETAILS		
Project Number	Drawing Number	
6016	A604	





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NO.	ISSUED FOR	DATE

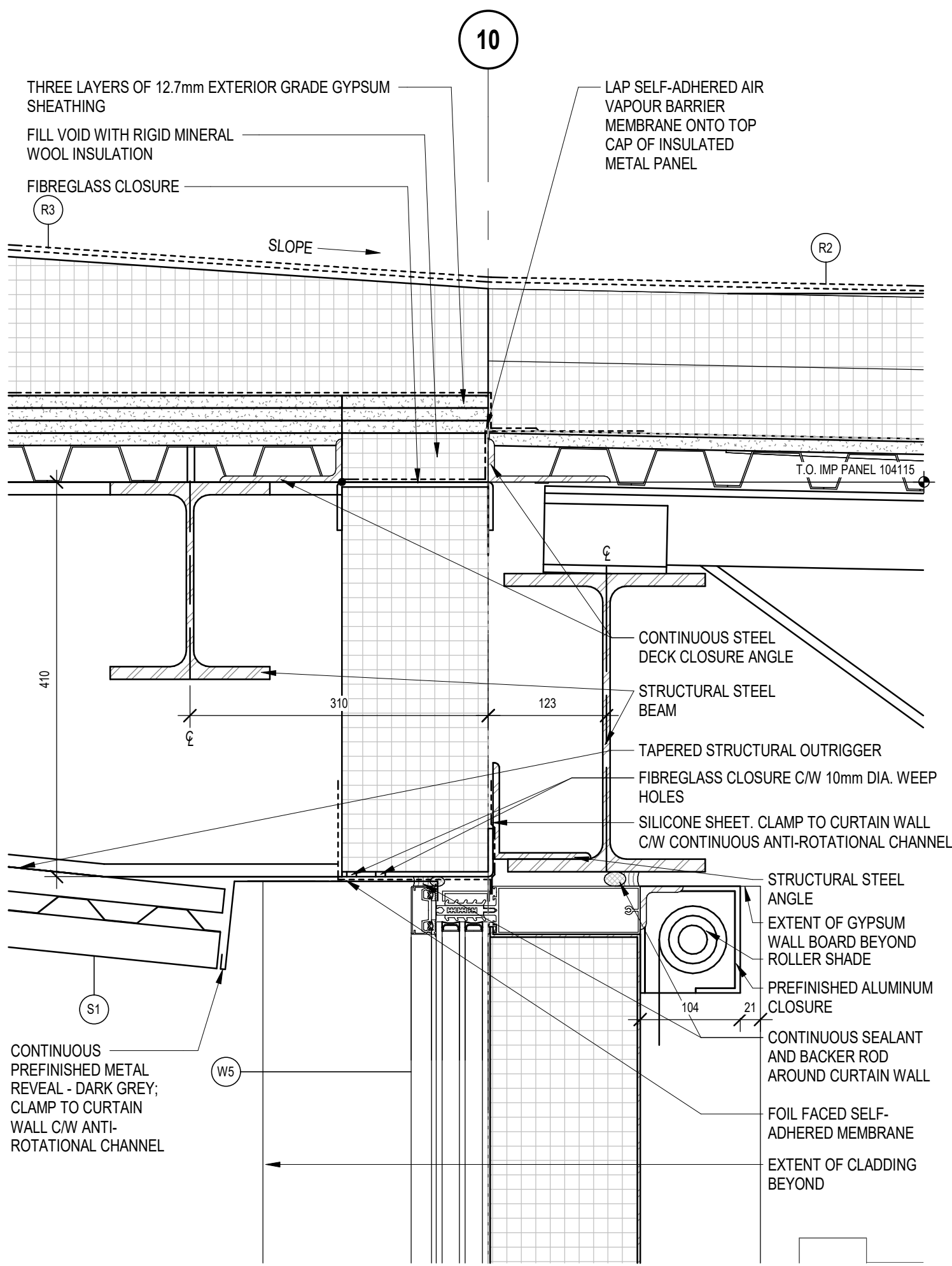
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Region of York Project Number	Region of York Building Code
22046	G013-B

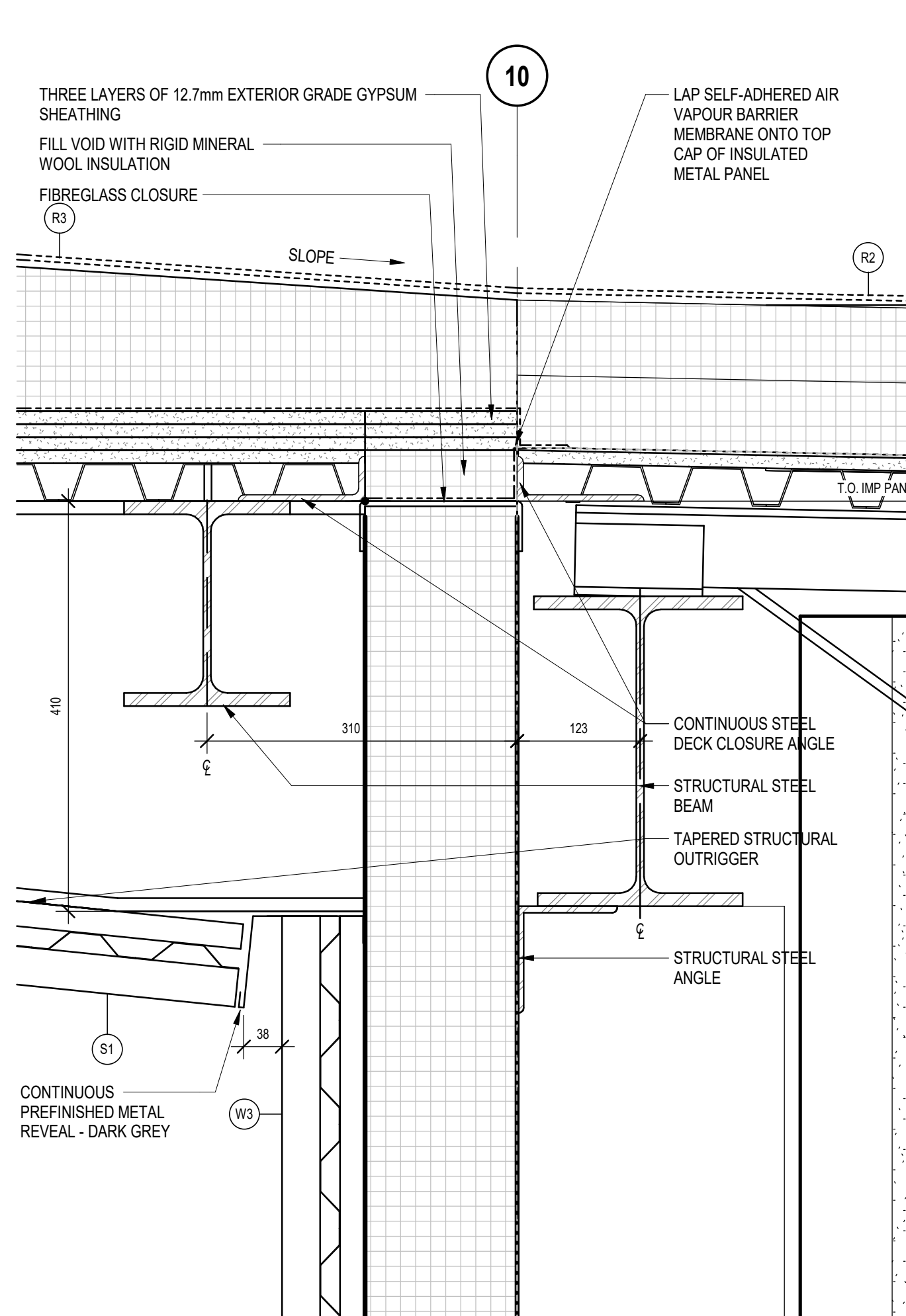
3525 BASELINE RD. SUTTON WEST, ON L0E 1R0

	DETAILS
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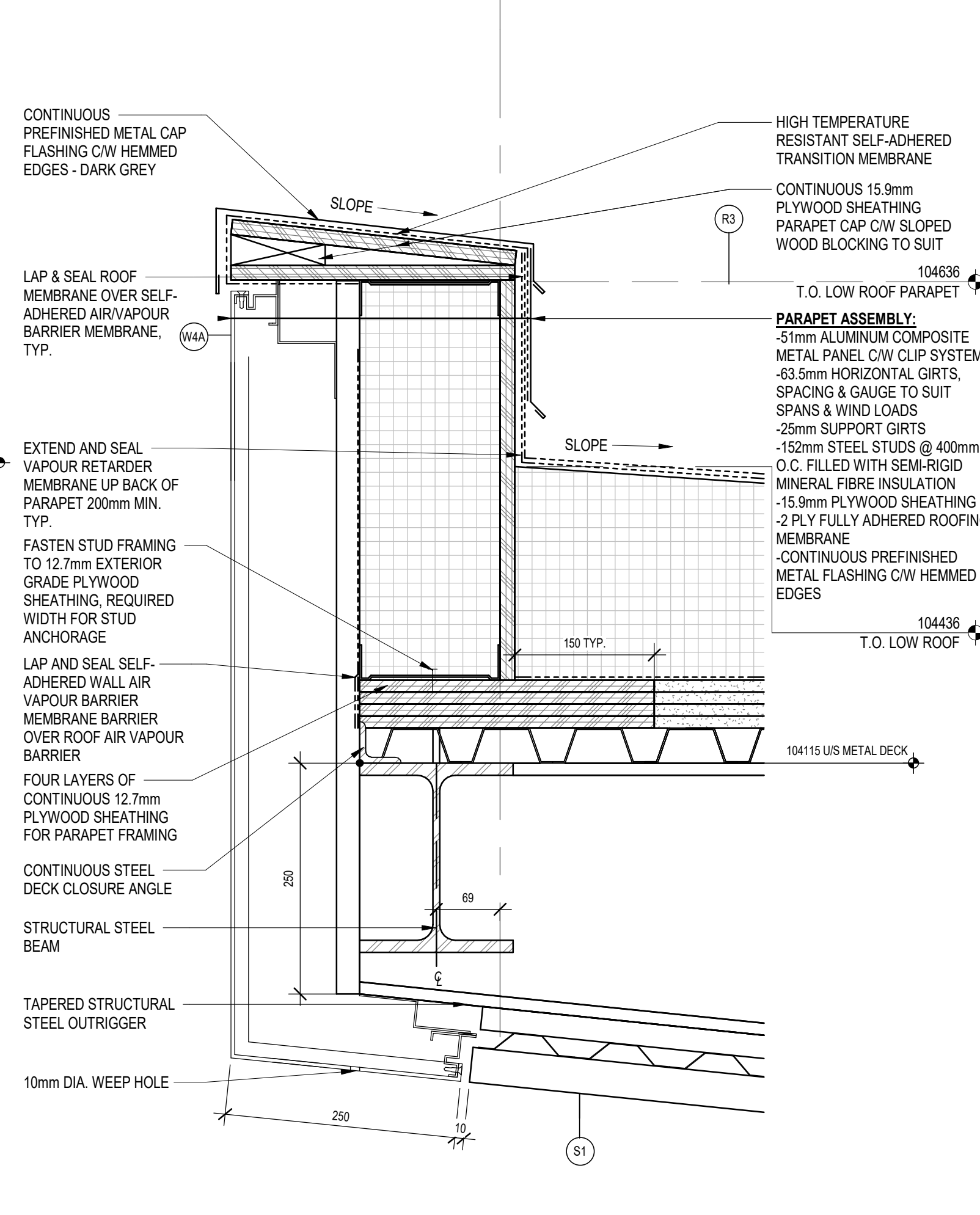
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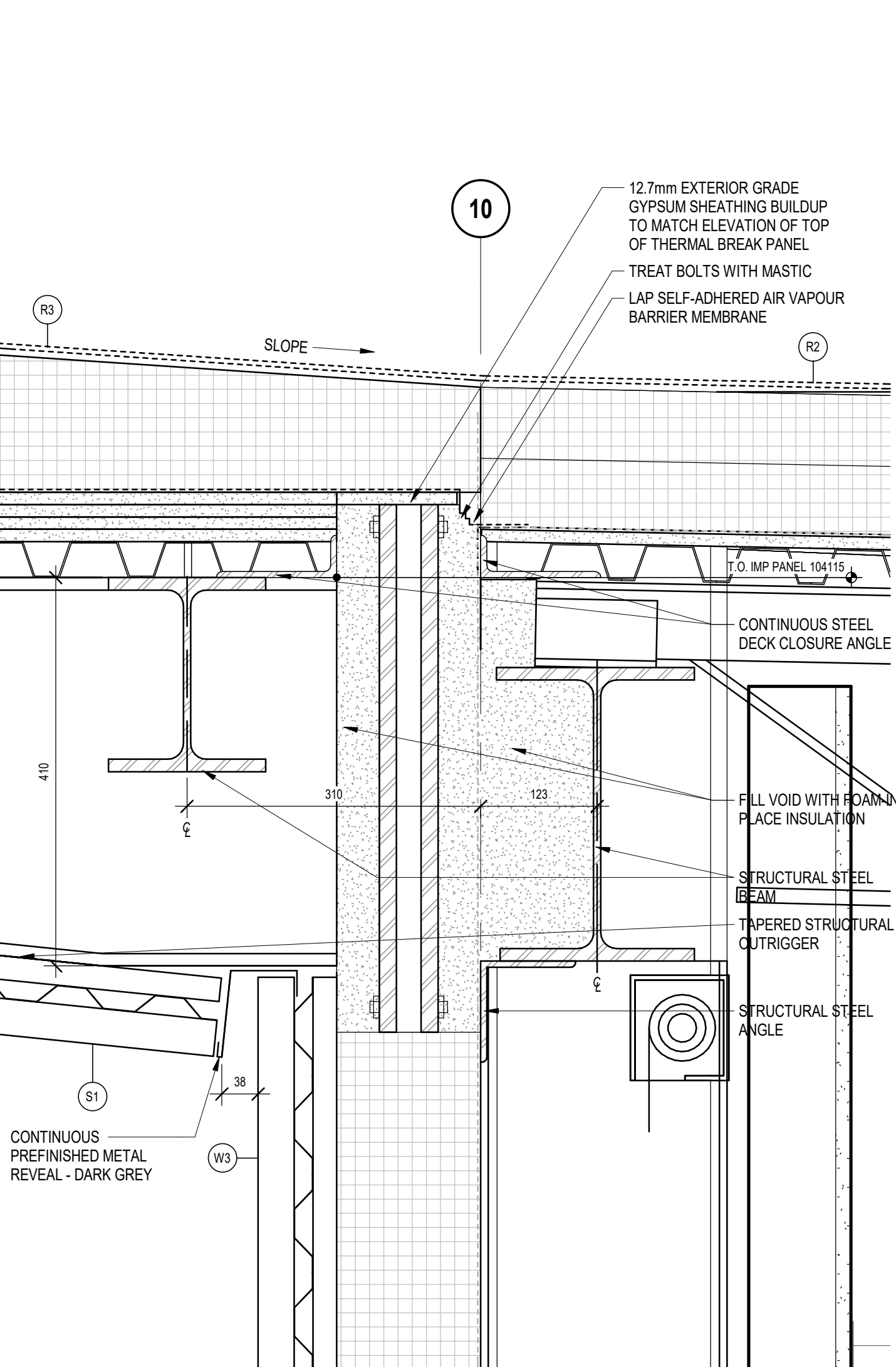
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A607 Scale: 1:5



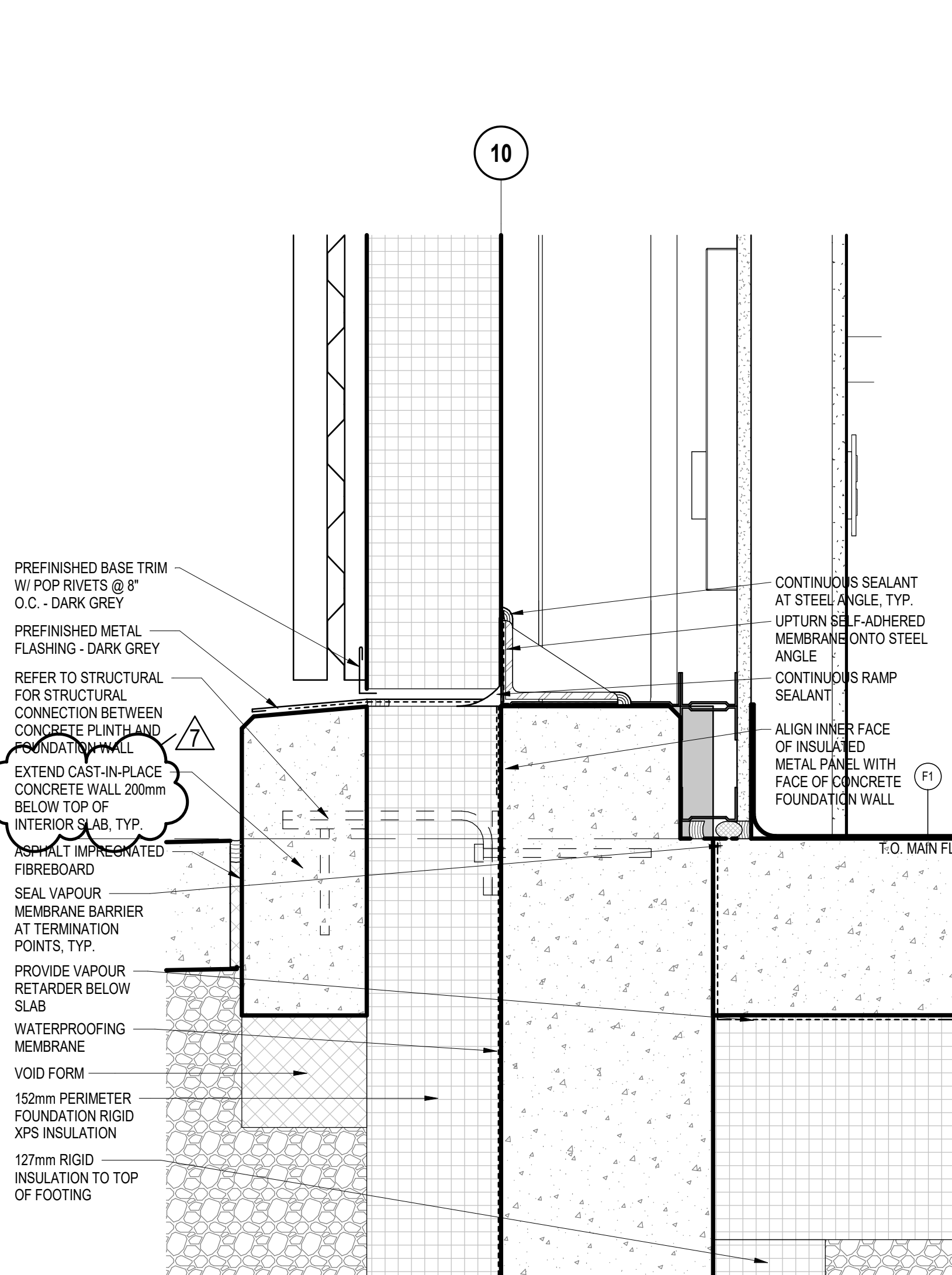
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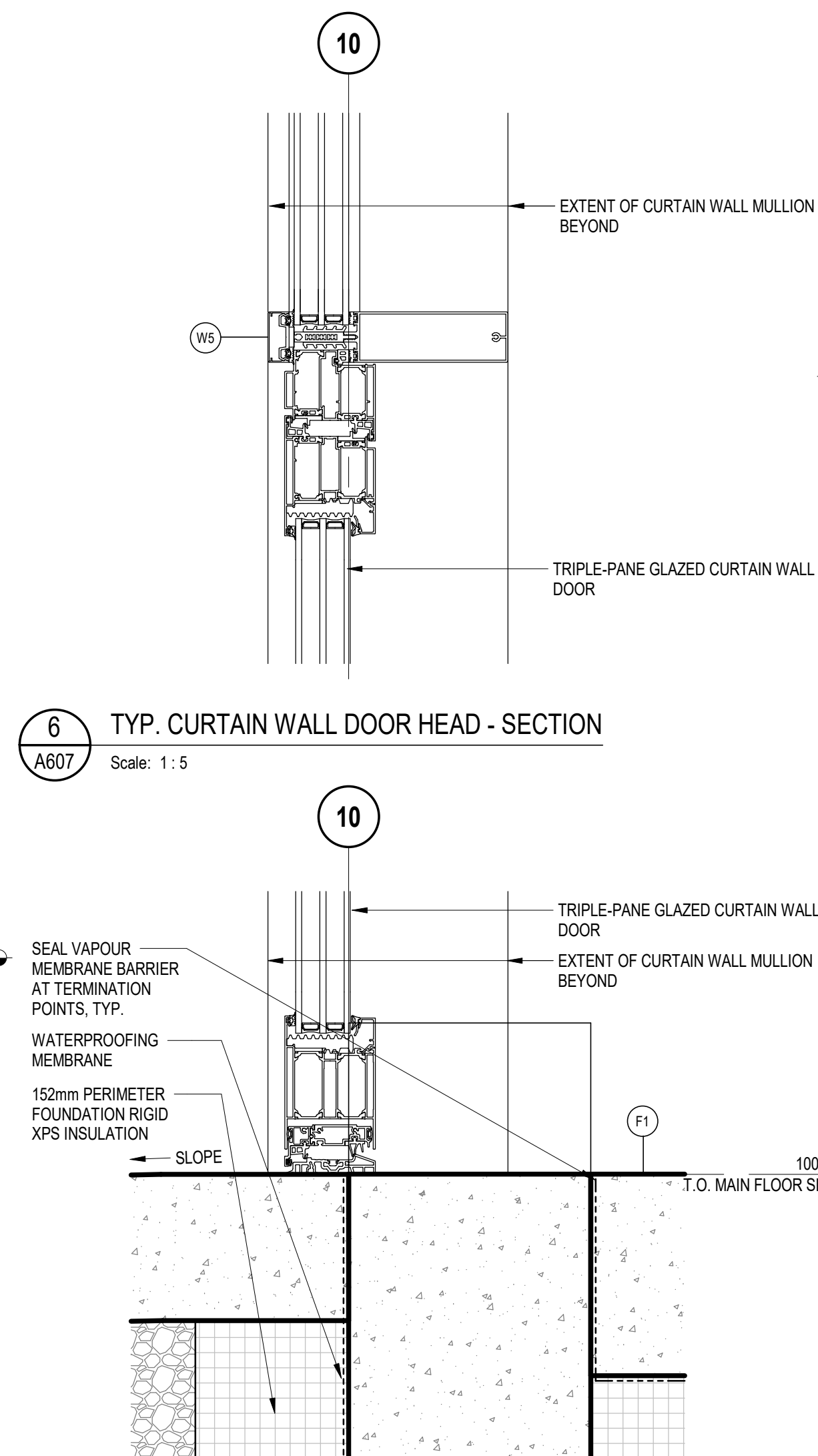
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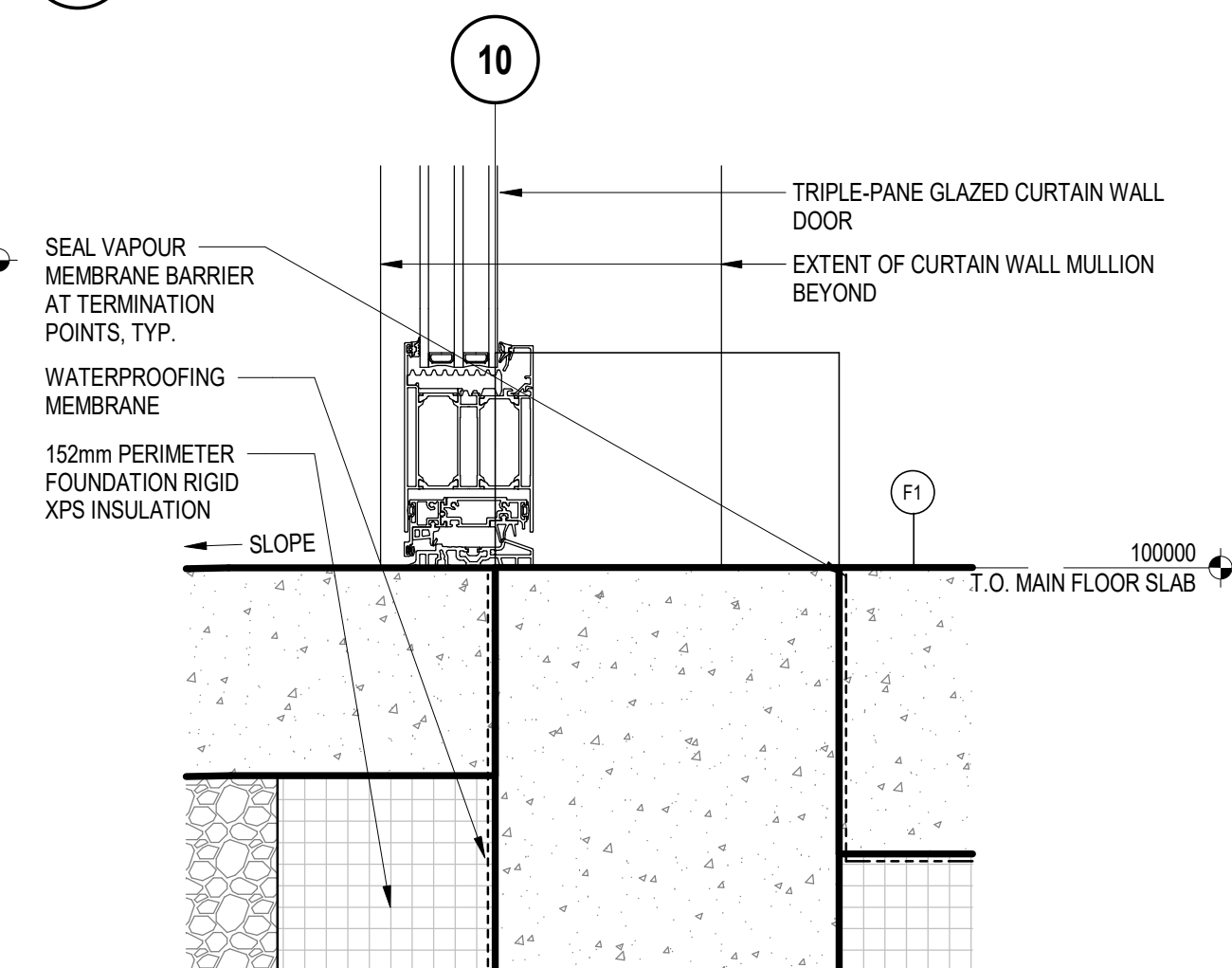
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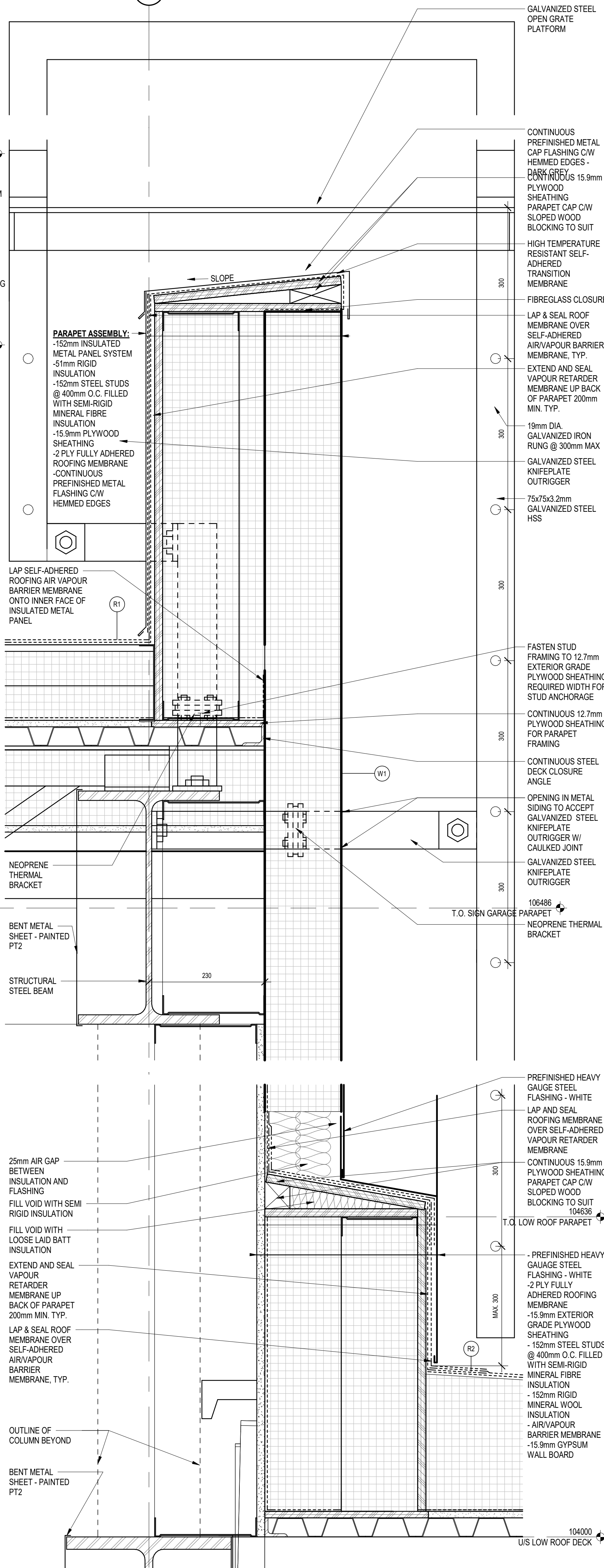
5 TYP. WOOD CLADDING BASE - SECTION
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6 TYP. CURTAIN WALL DOOR HEAD - SECTION
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7 TYP. CURTAIN WALL DOOR SILL - SECTION
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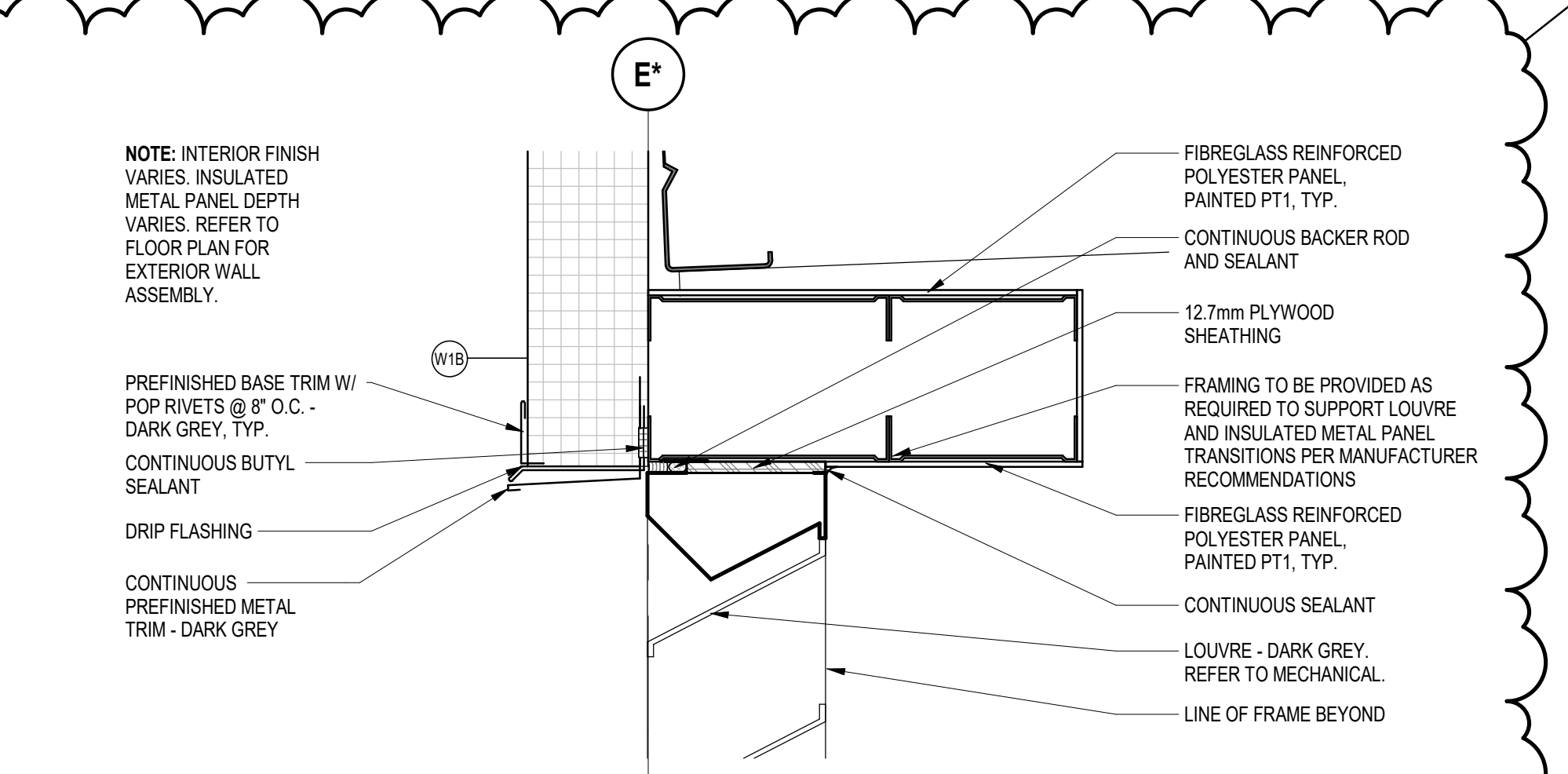
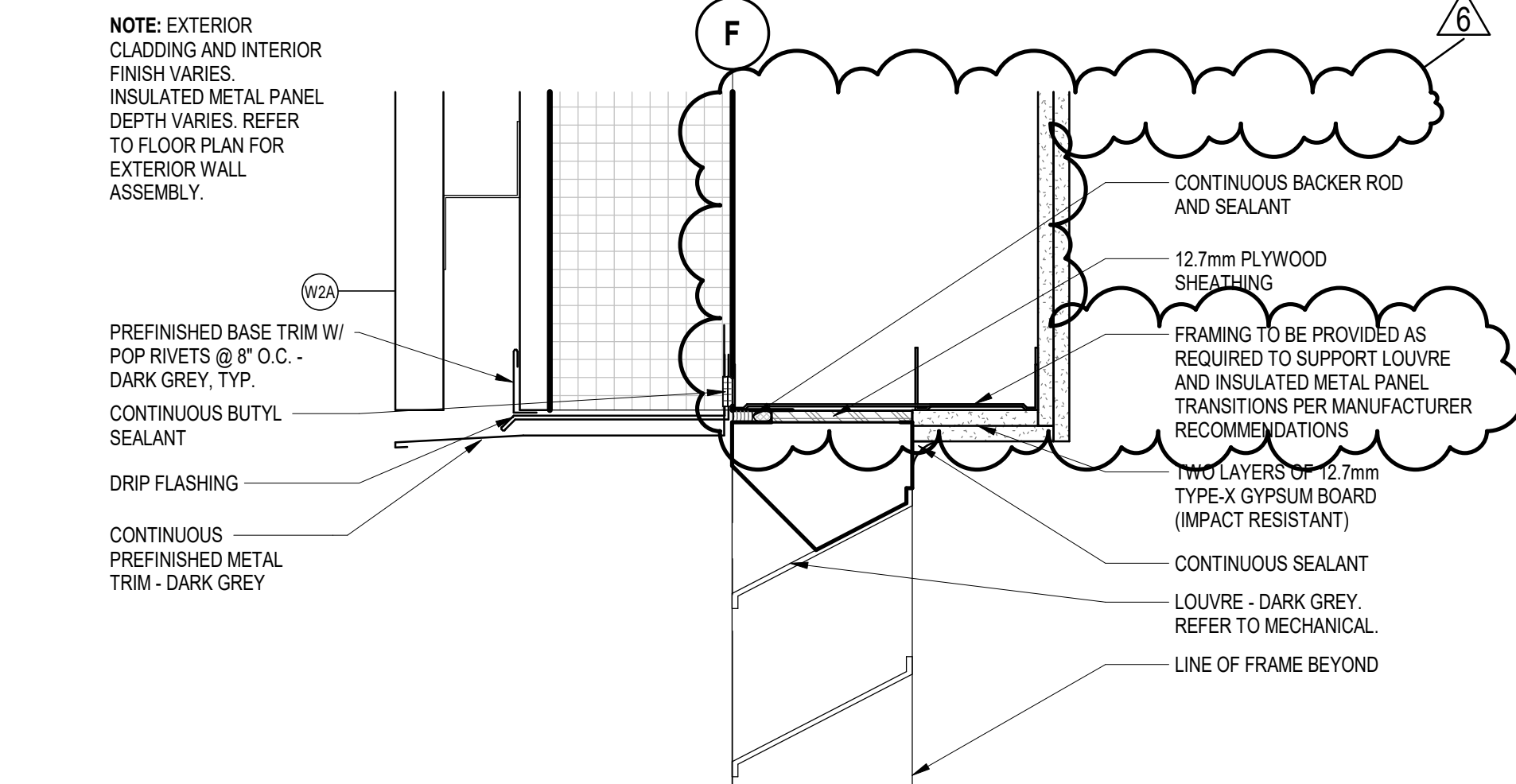
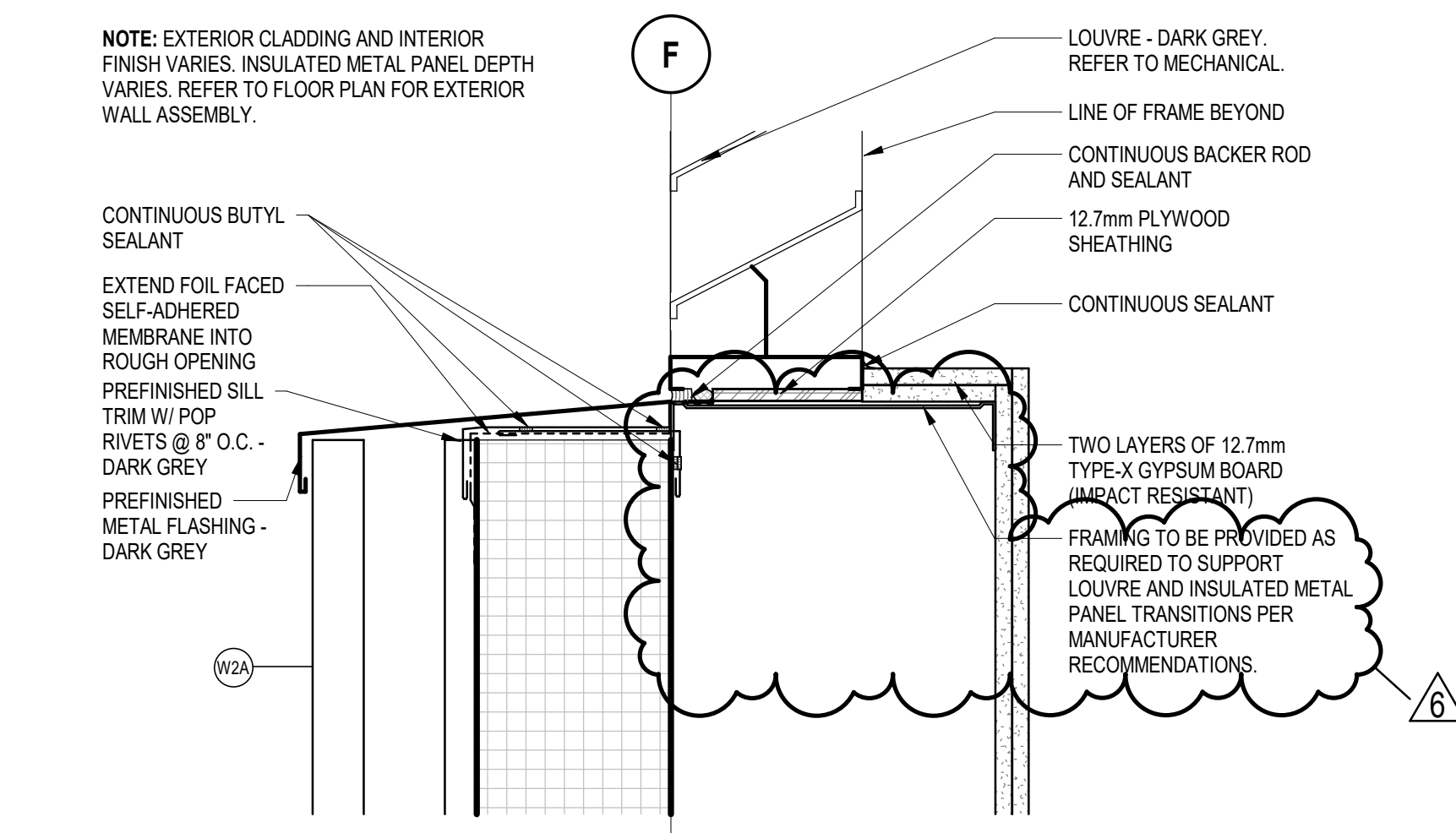
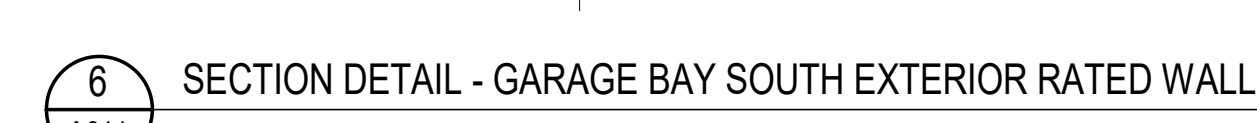
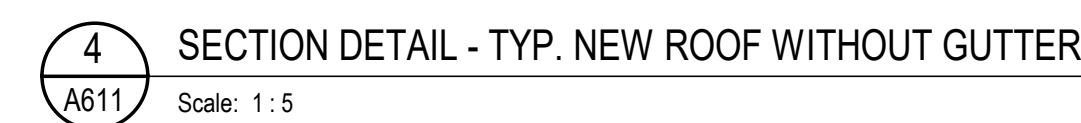
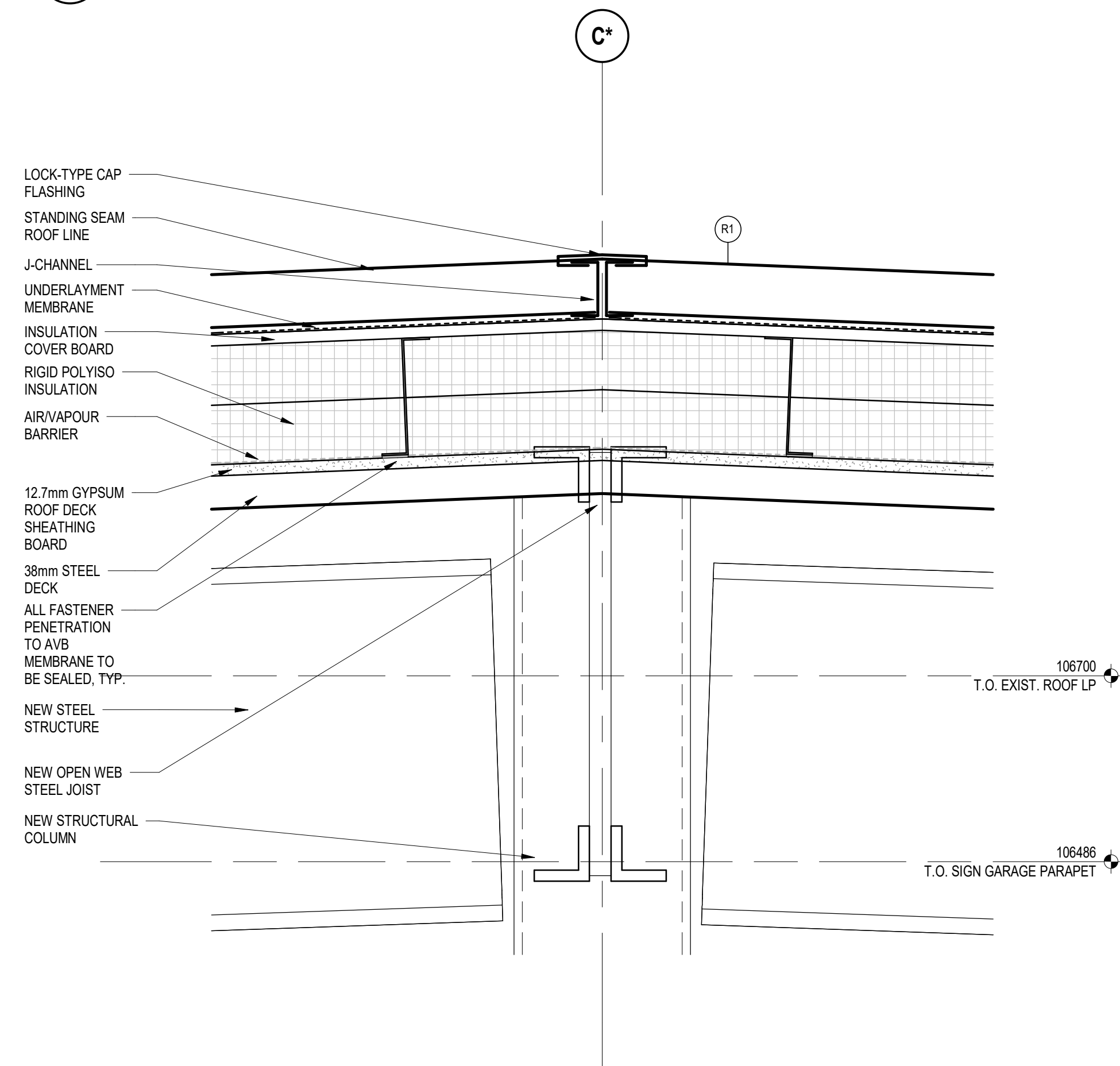
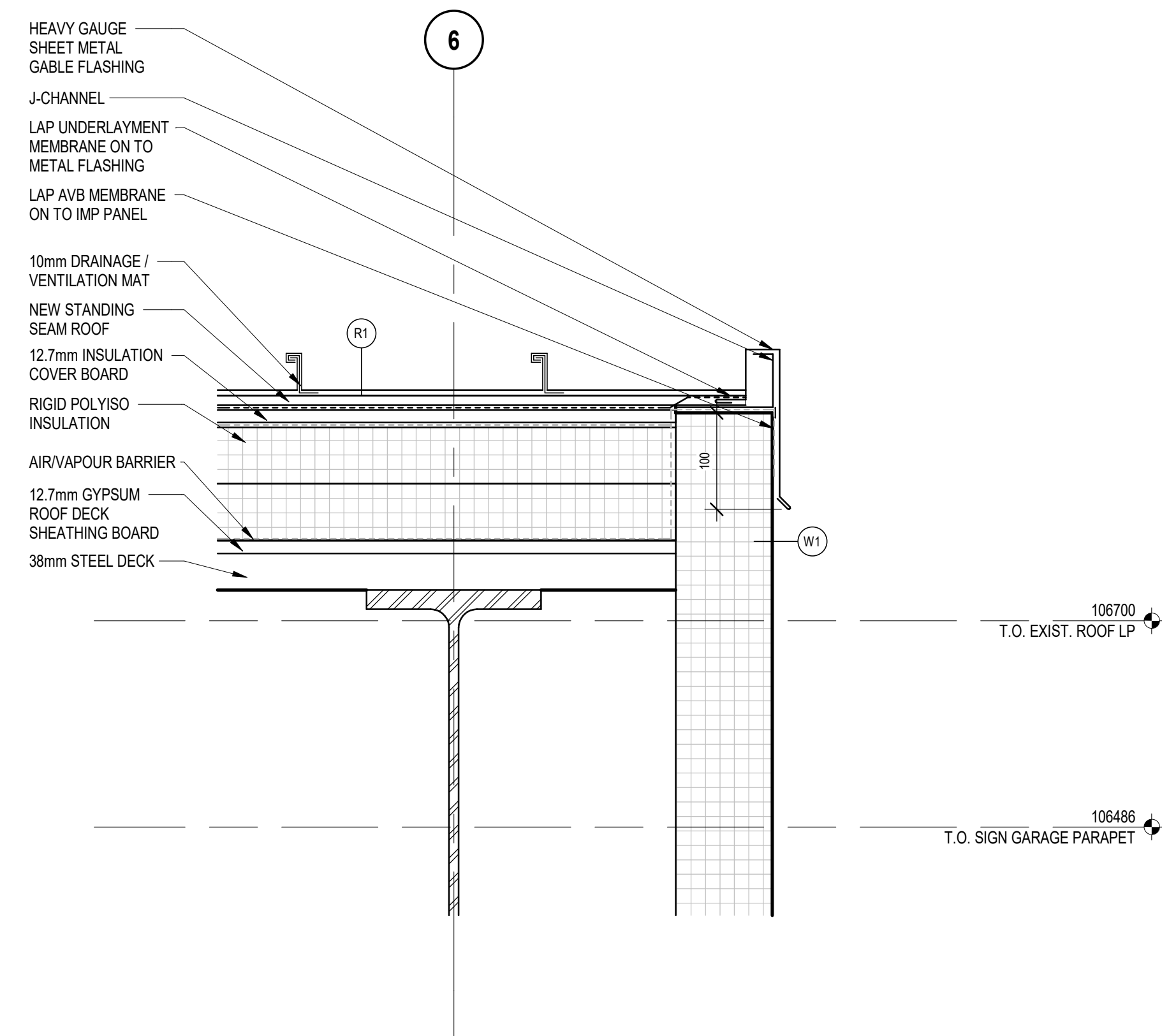
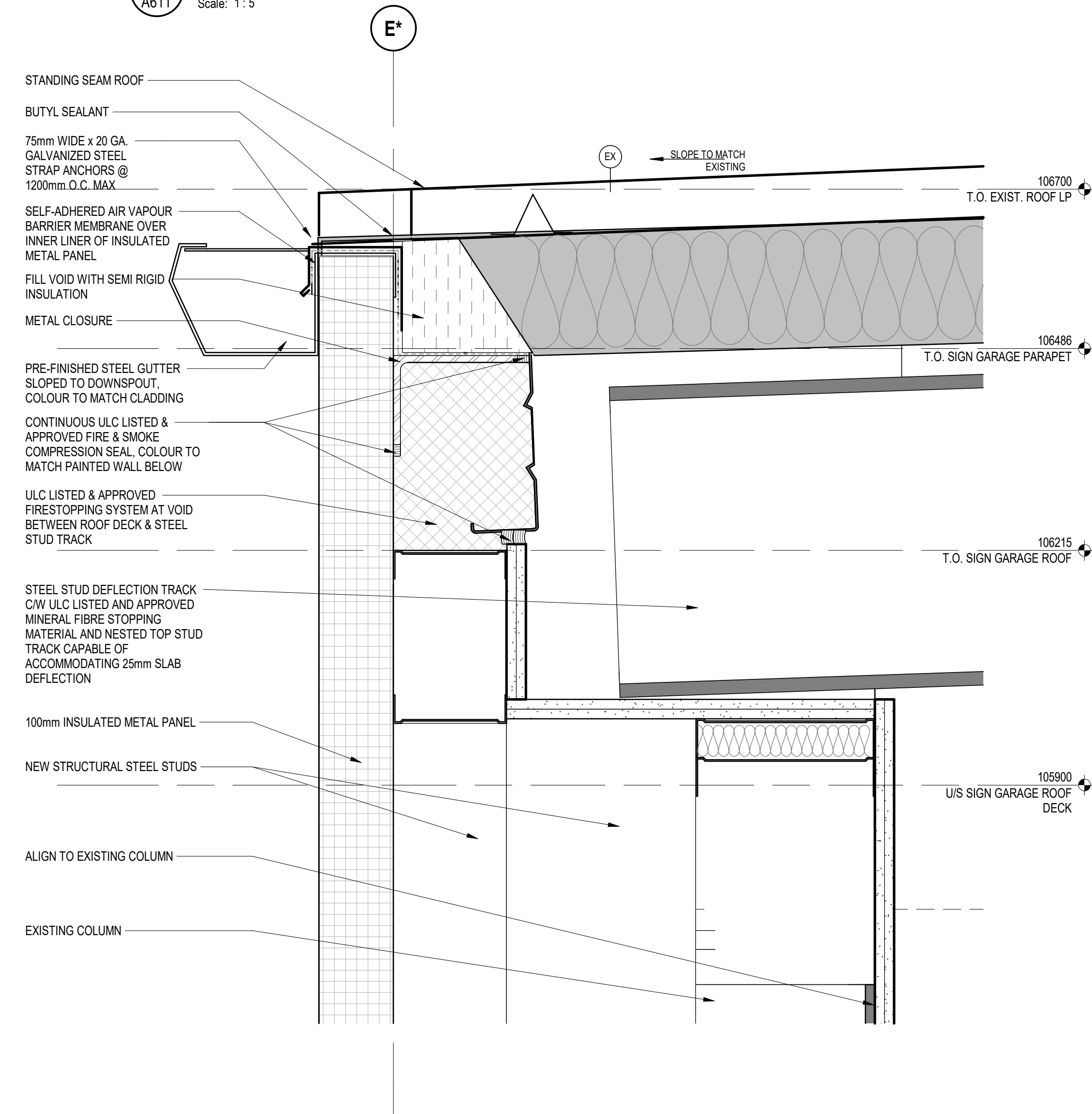
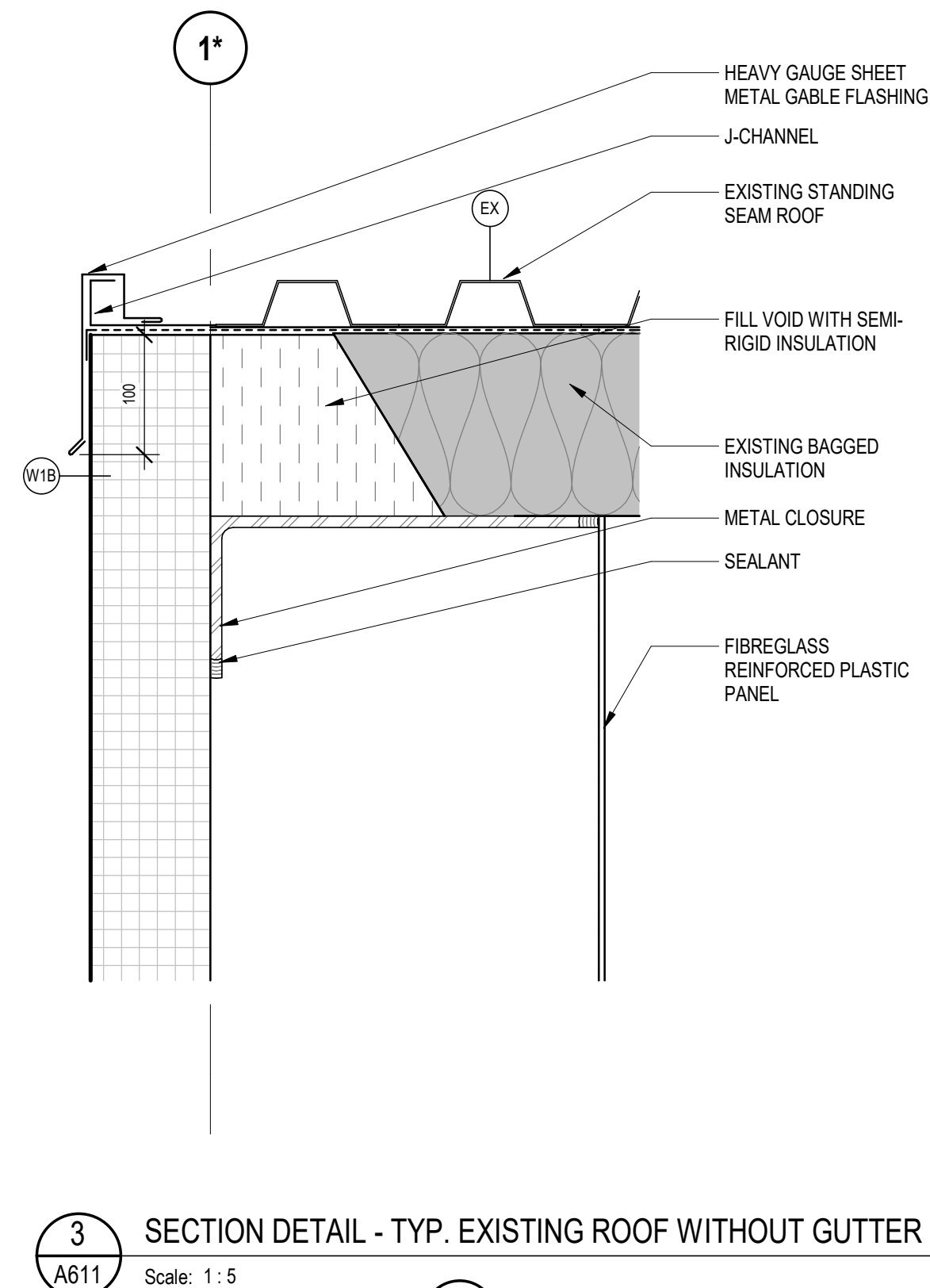
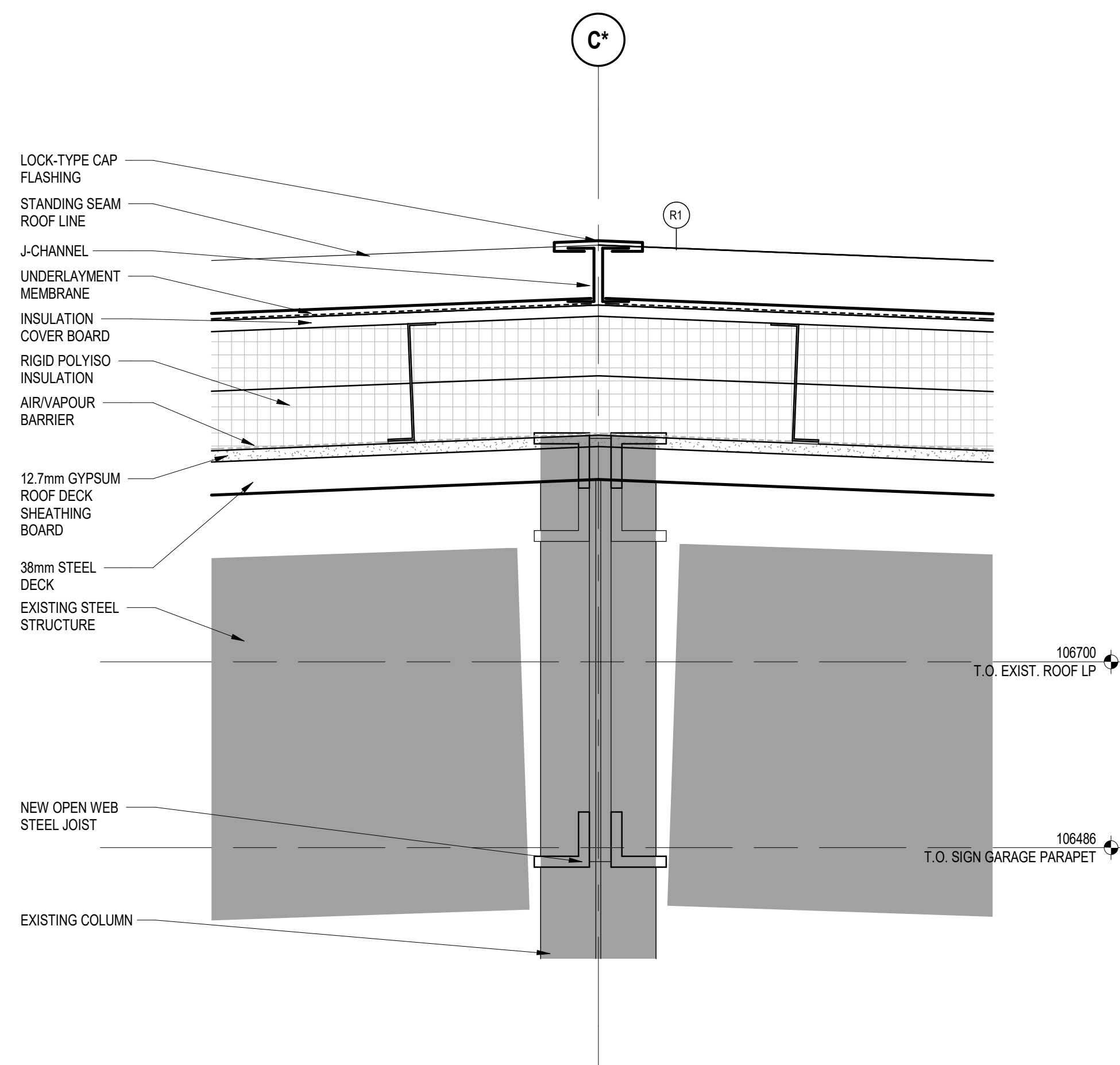
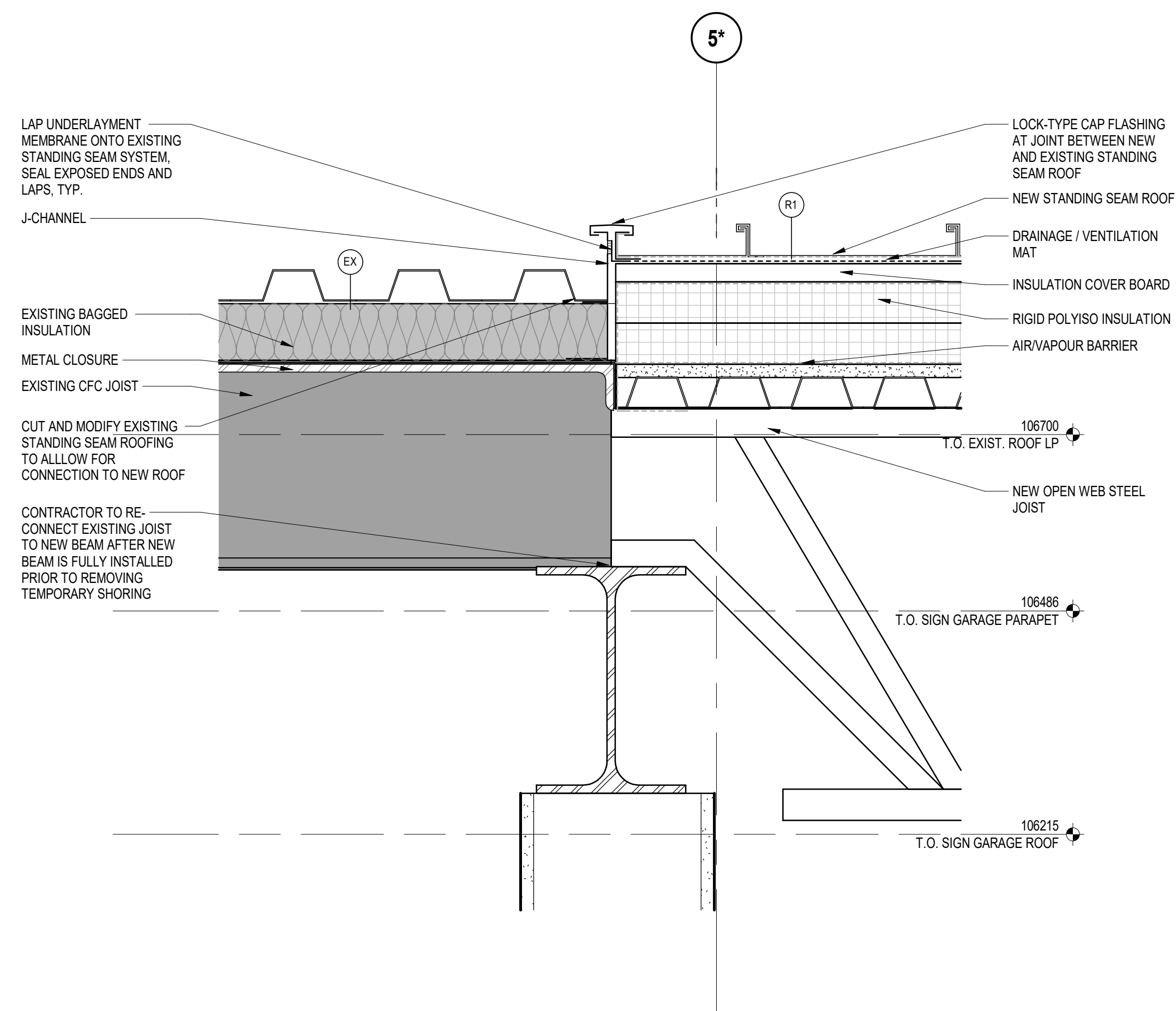


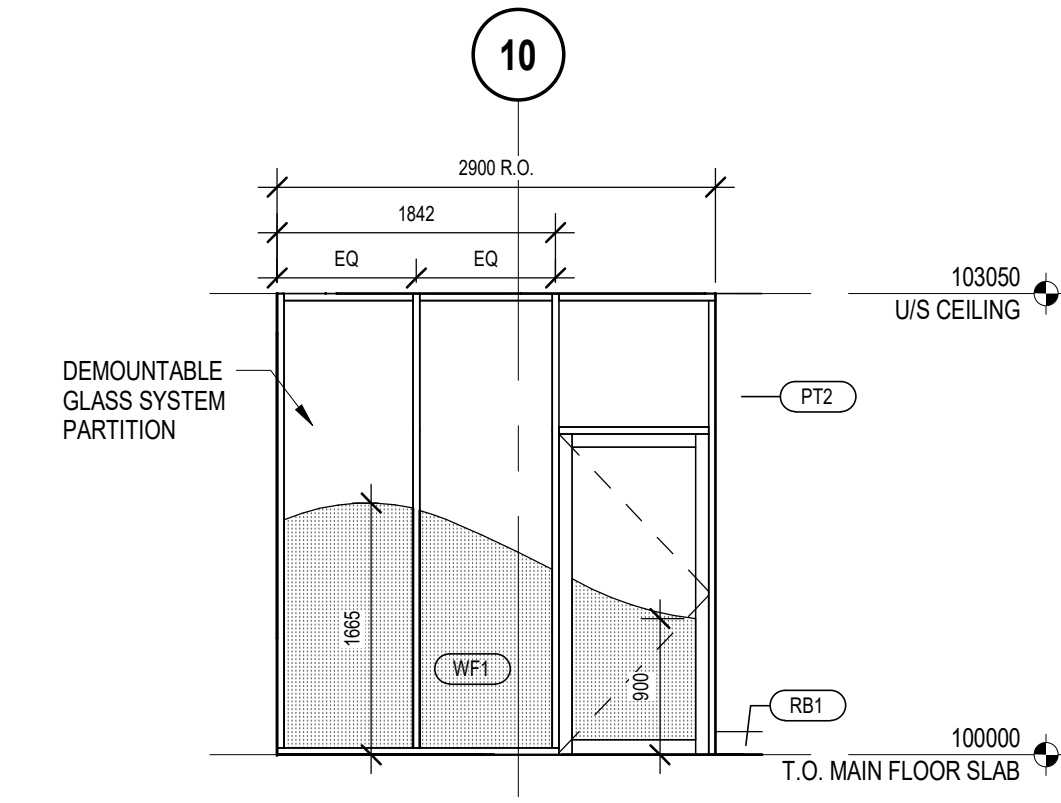
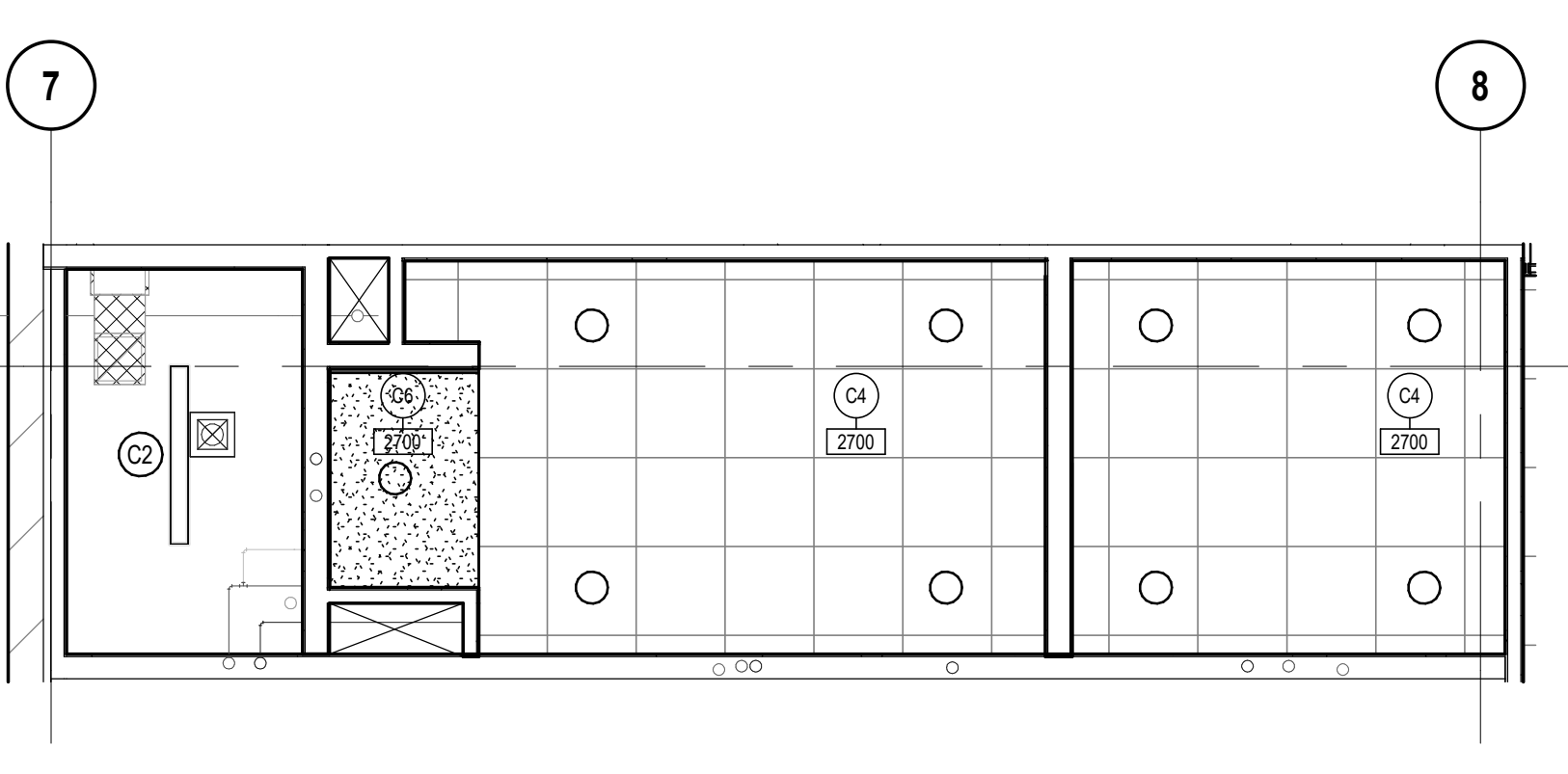
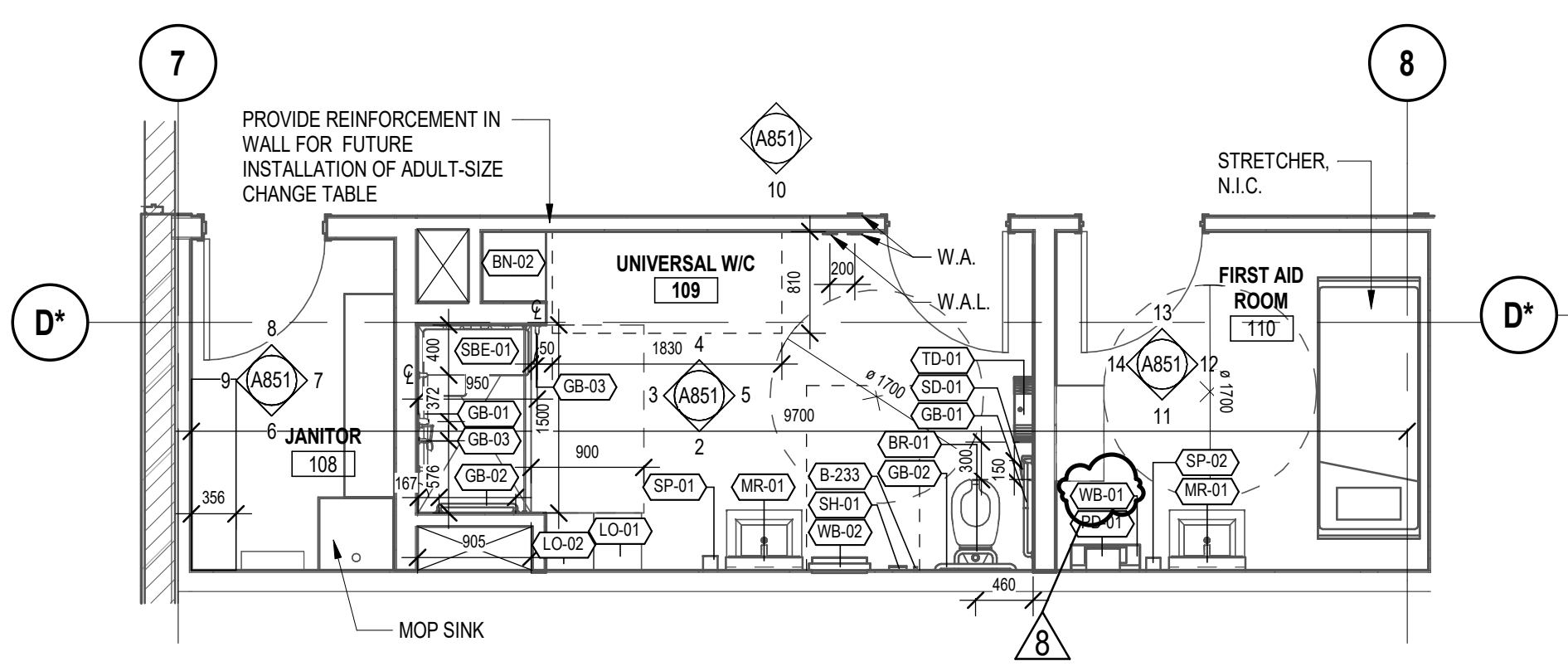
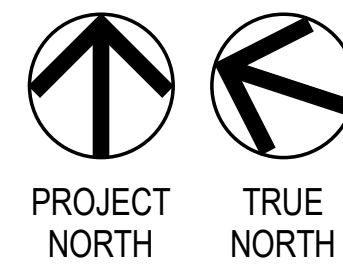
8 ROOF ACCESS LADDER - SECTION
A607 Scale: 1:5



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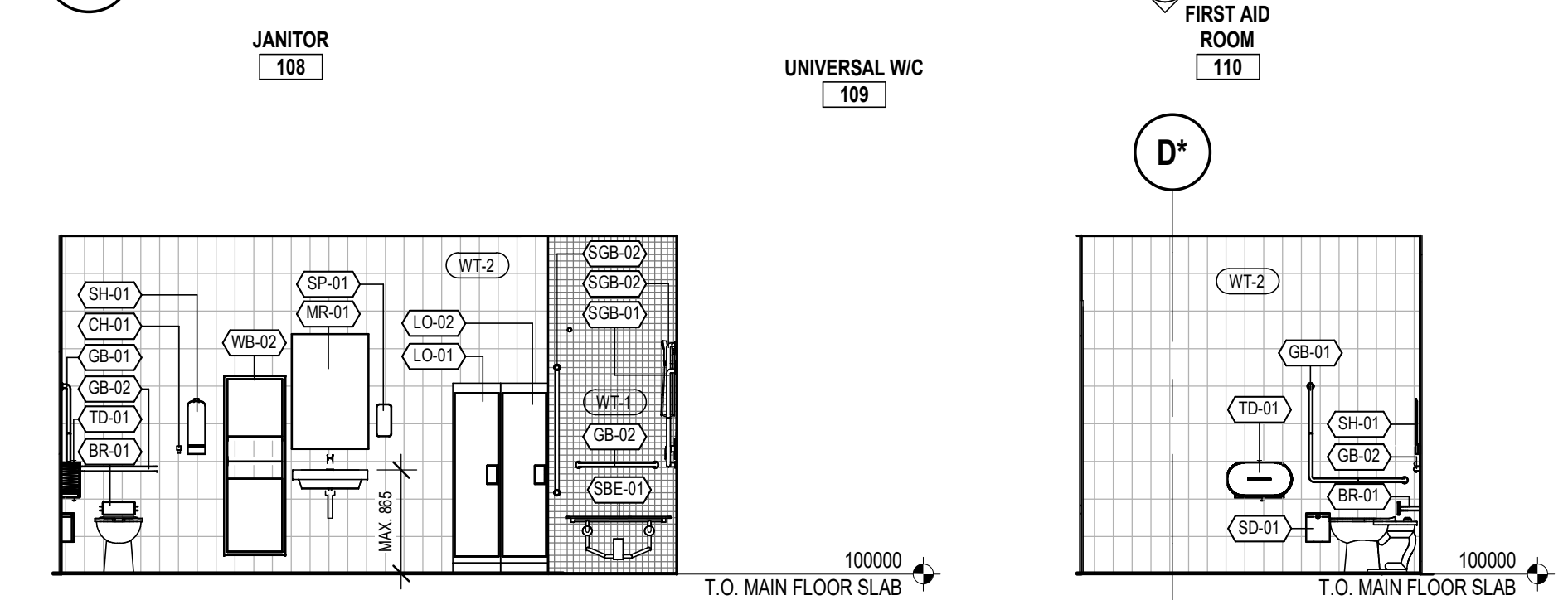




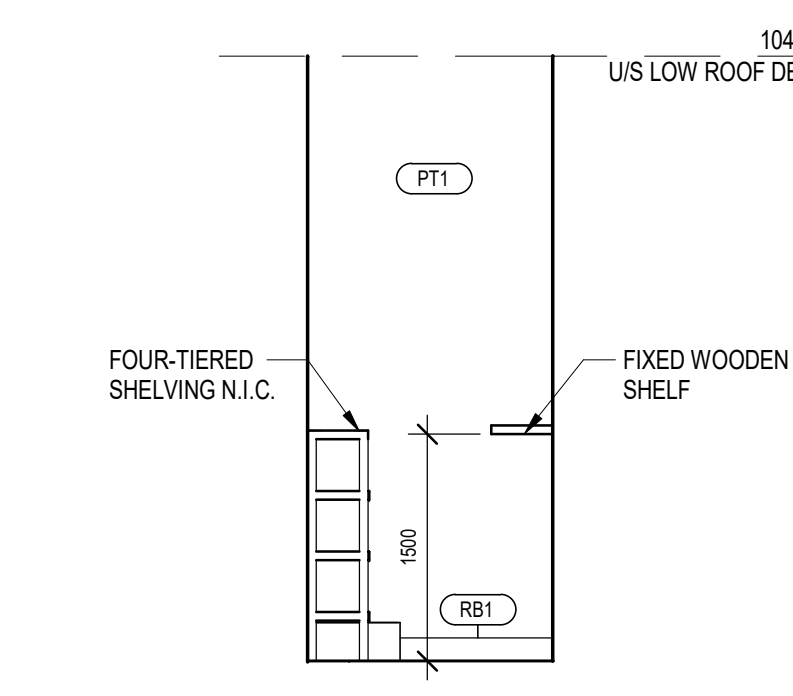
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15 ENLARGED REFLECTED CEILING PLAN
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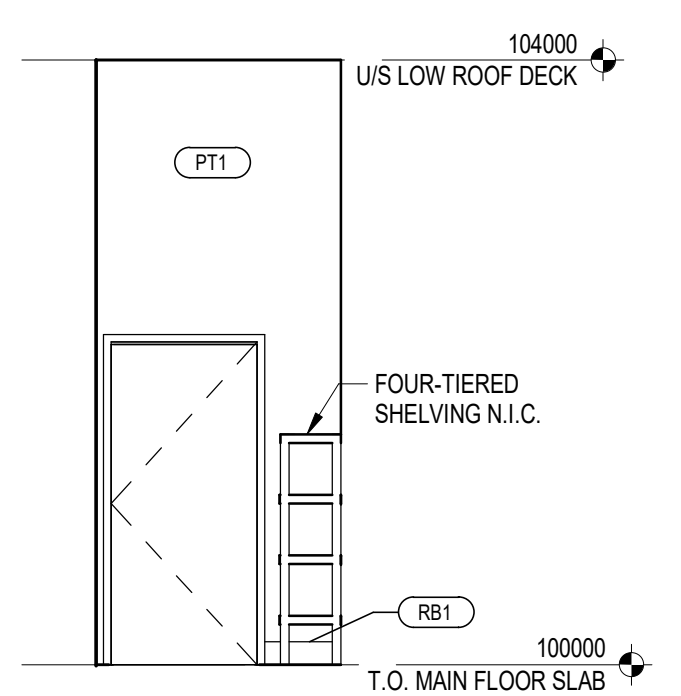
22 MEETING ROOM - SOUTH ELEVATION
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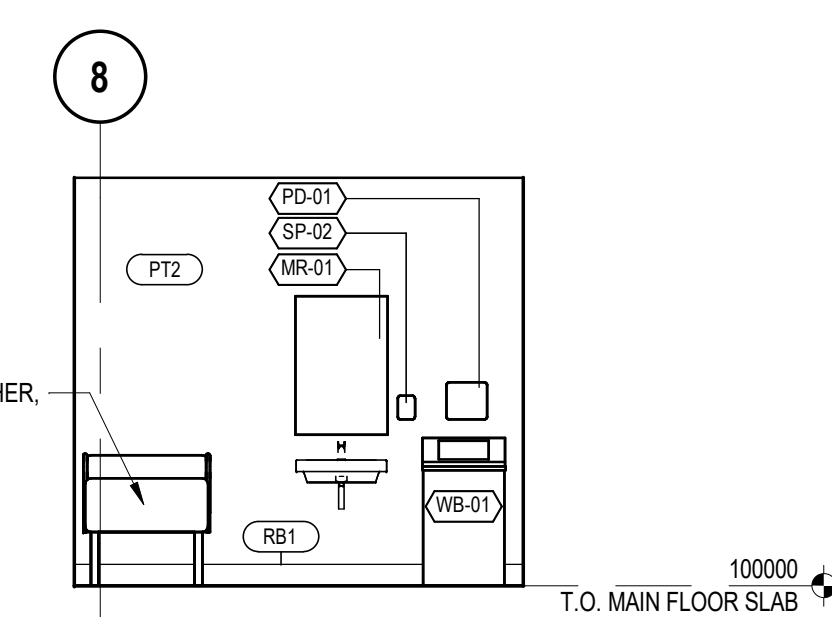
5 UNIVERSAL W/C EAST ELEVATION
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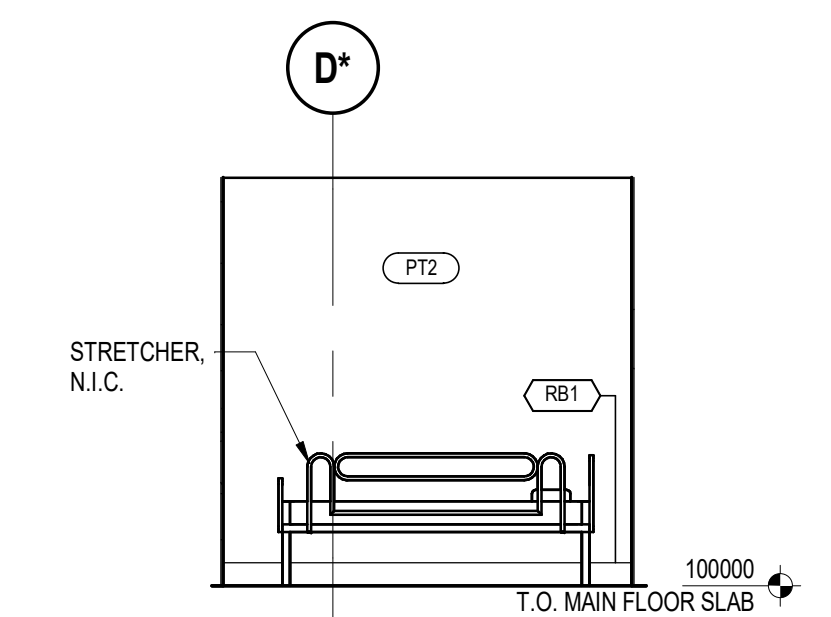
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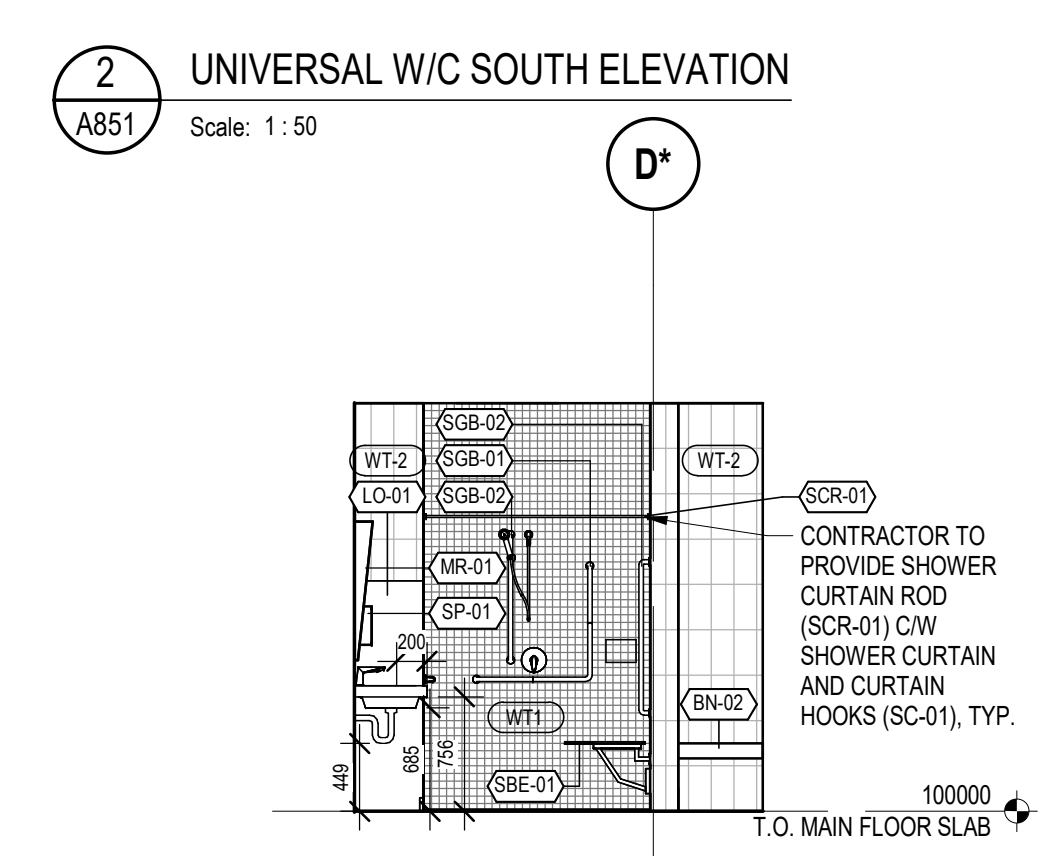
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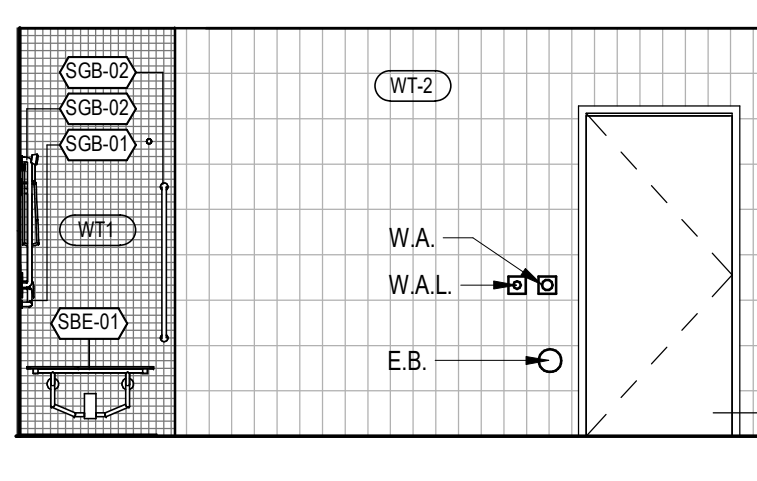
11 FIRST AID SOUTH ELEVATION
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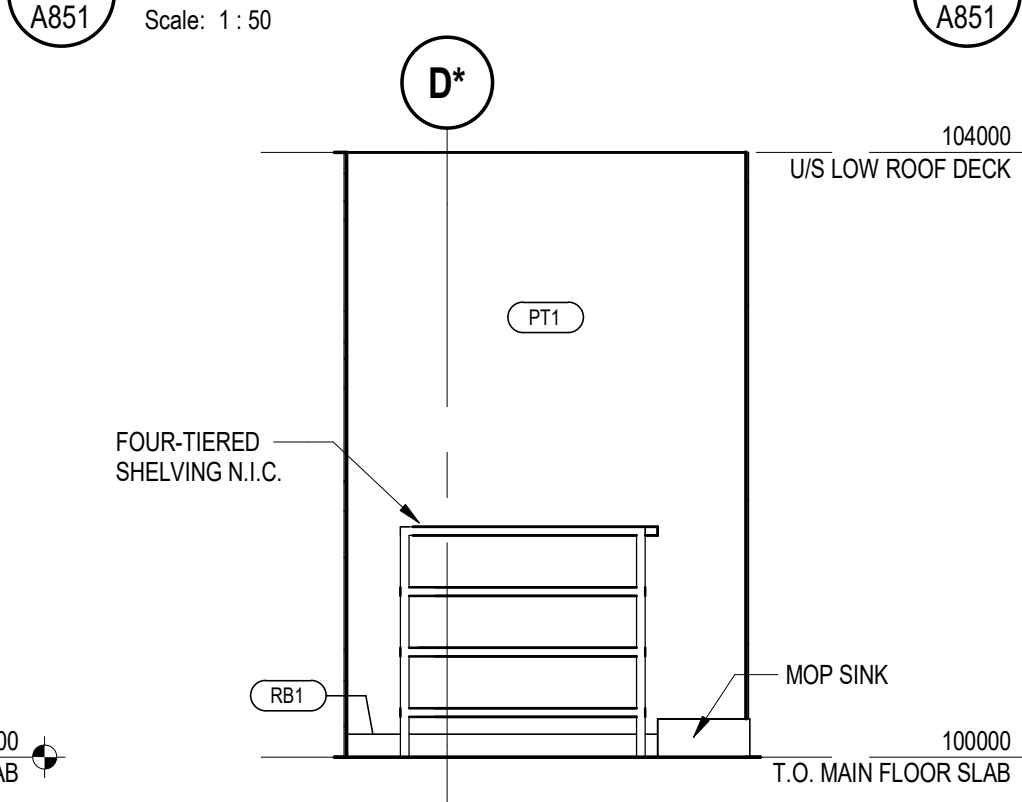
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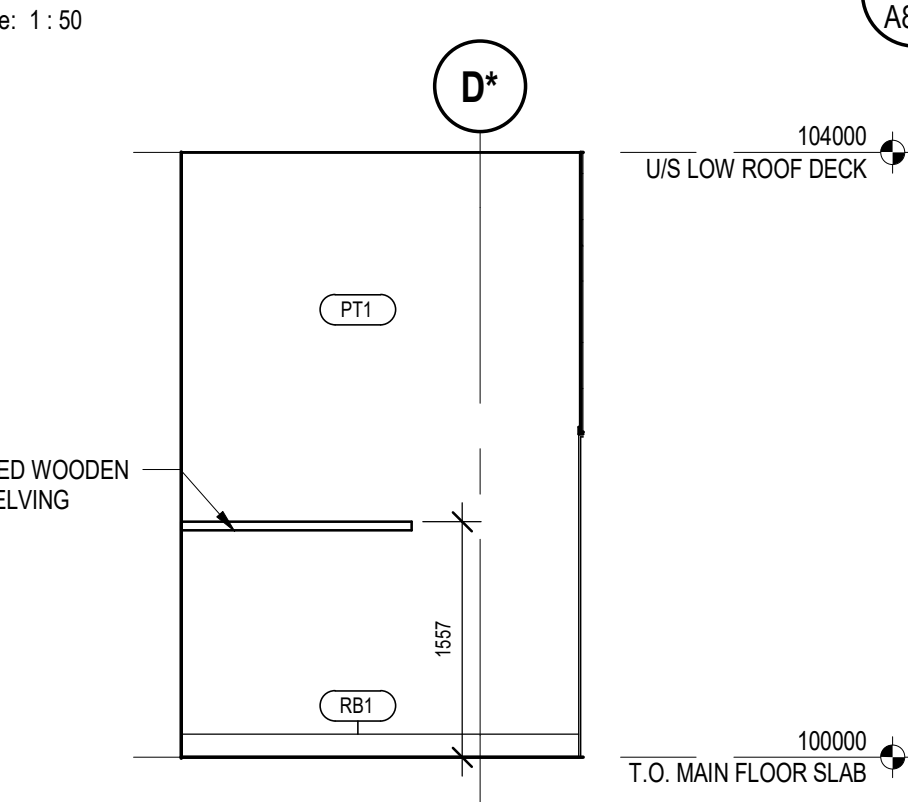
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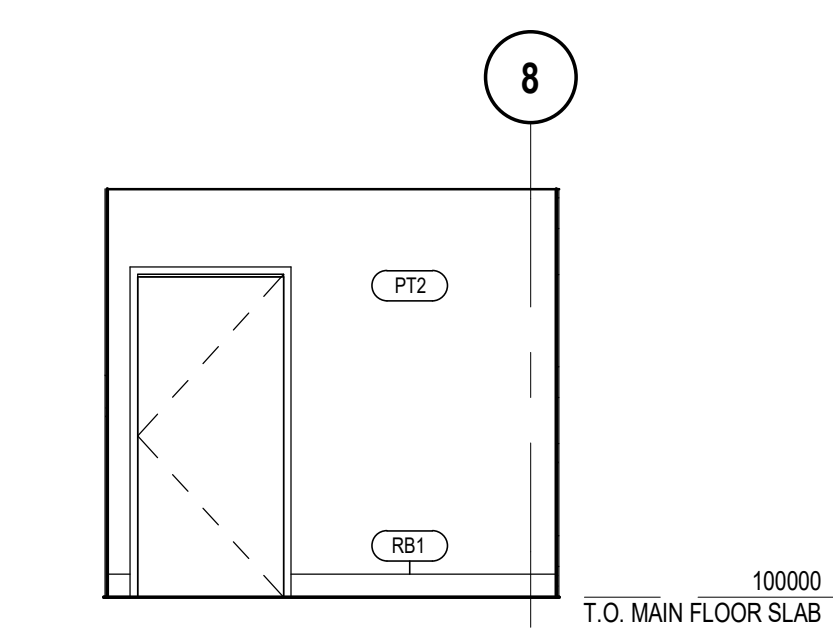
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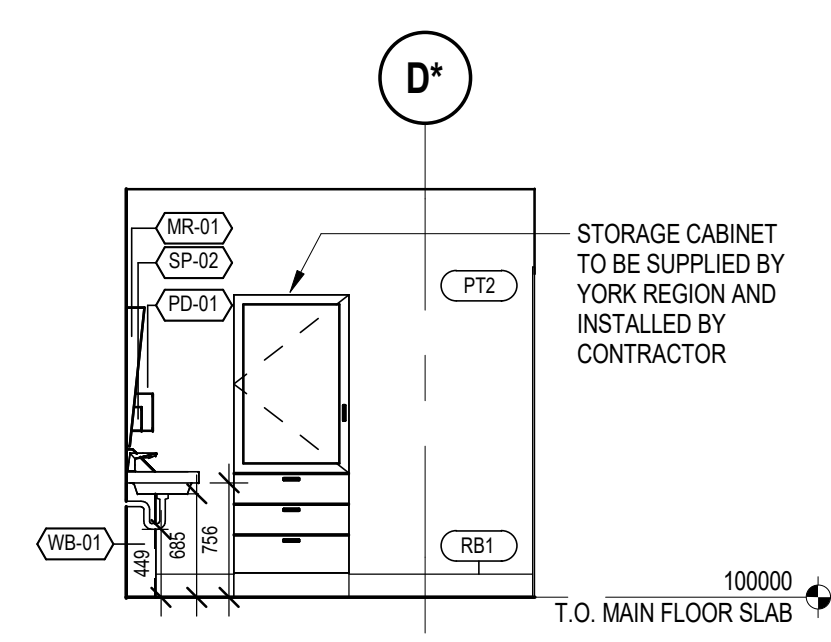
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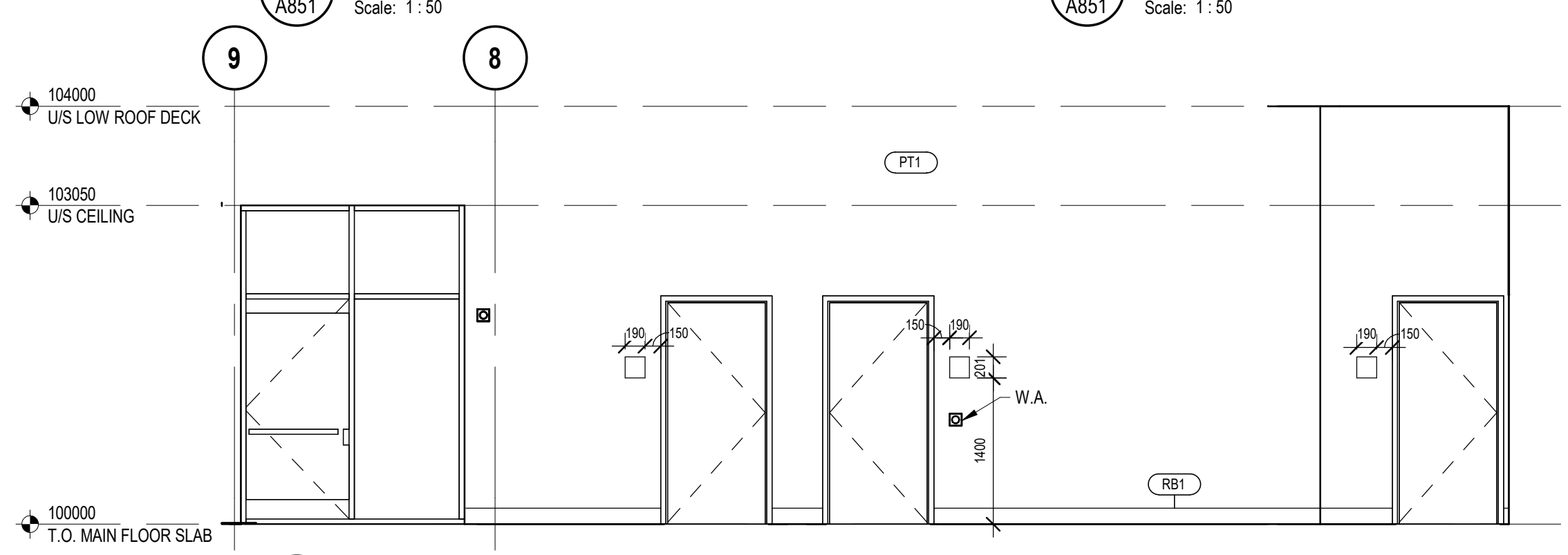
9 JANITOR WEST ELEVATION
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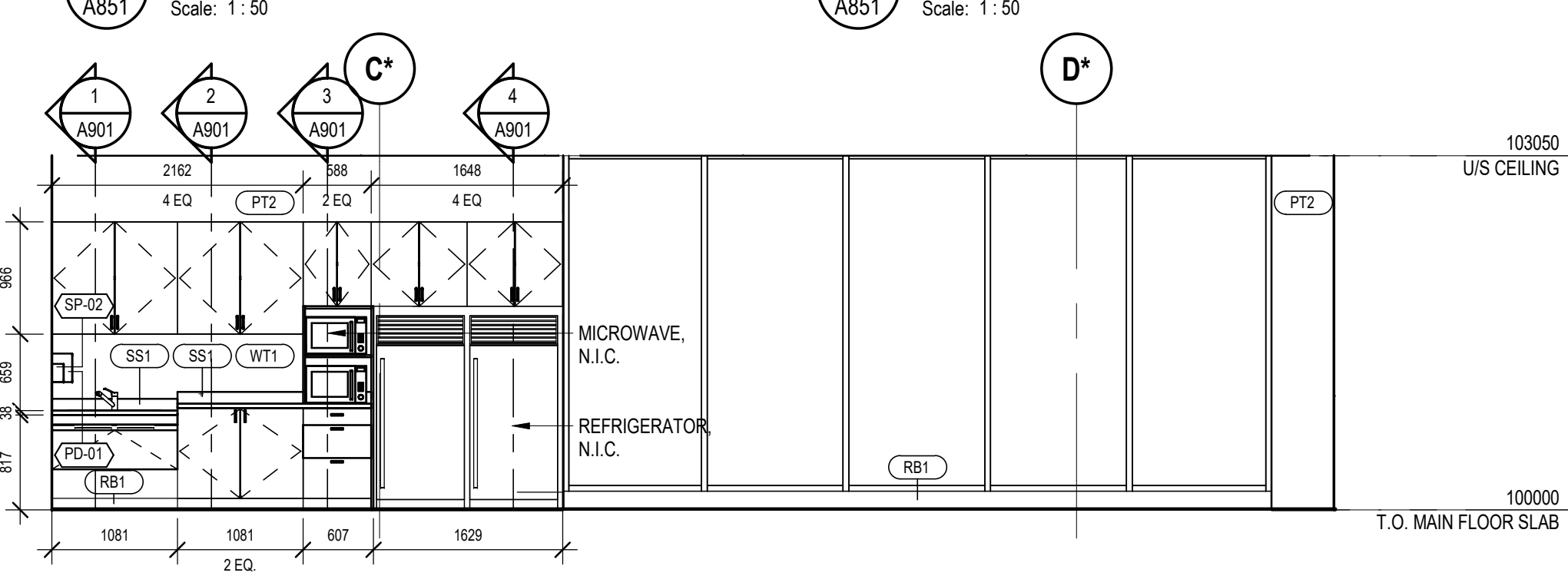
13 FIRST AID NORTH ELEVATION
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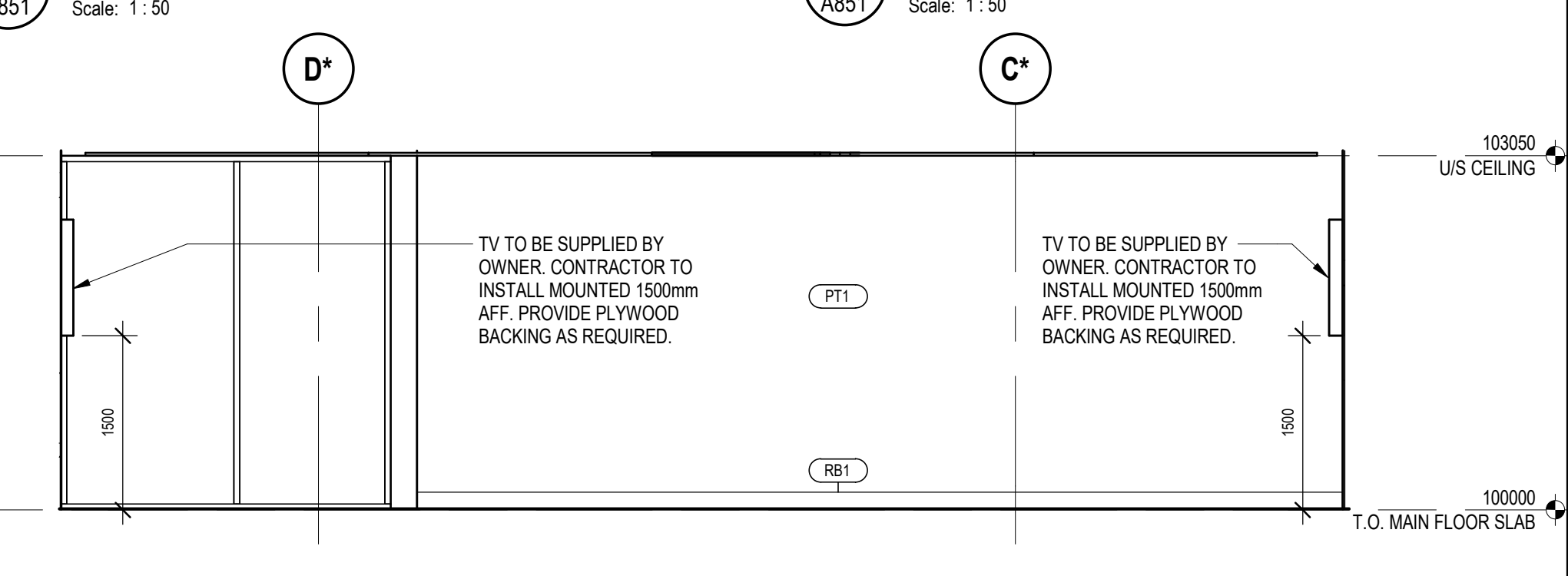
14 FIRST AID WEST ELEVATION
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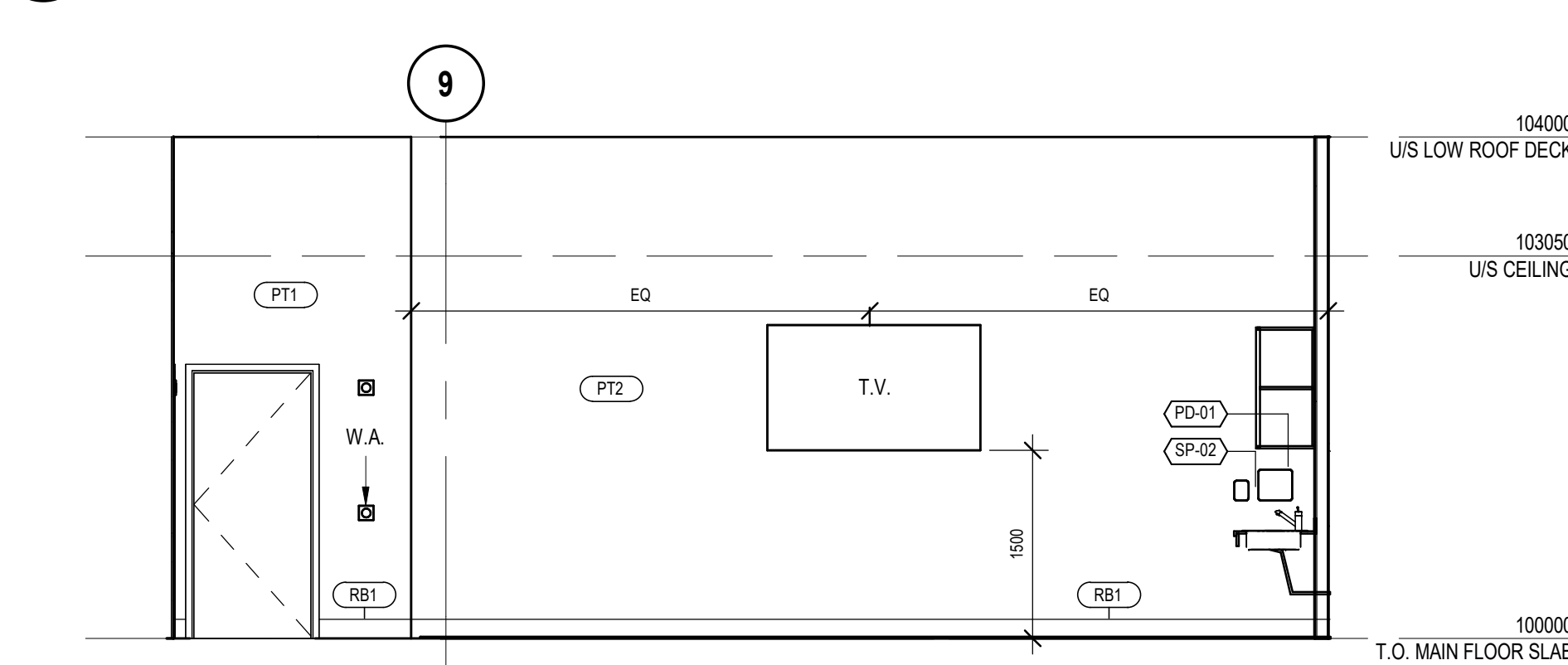
10 JANITOR, FIRST AID, UNIVERSAL W/C EXTERIOR ENTRANCE ELEVATION
Scale: 1:50



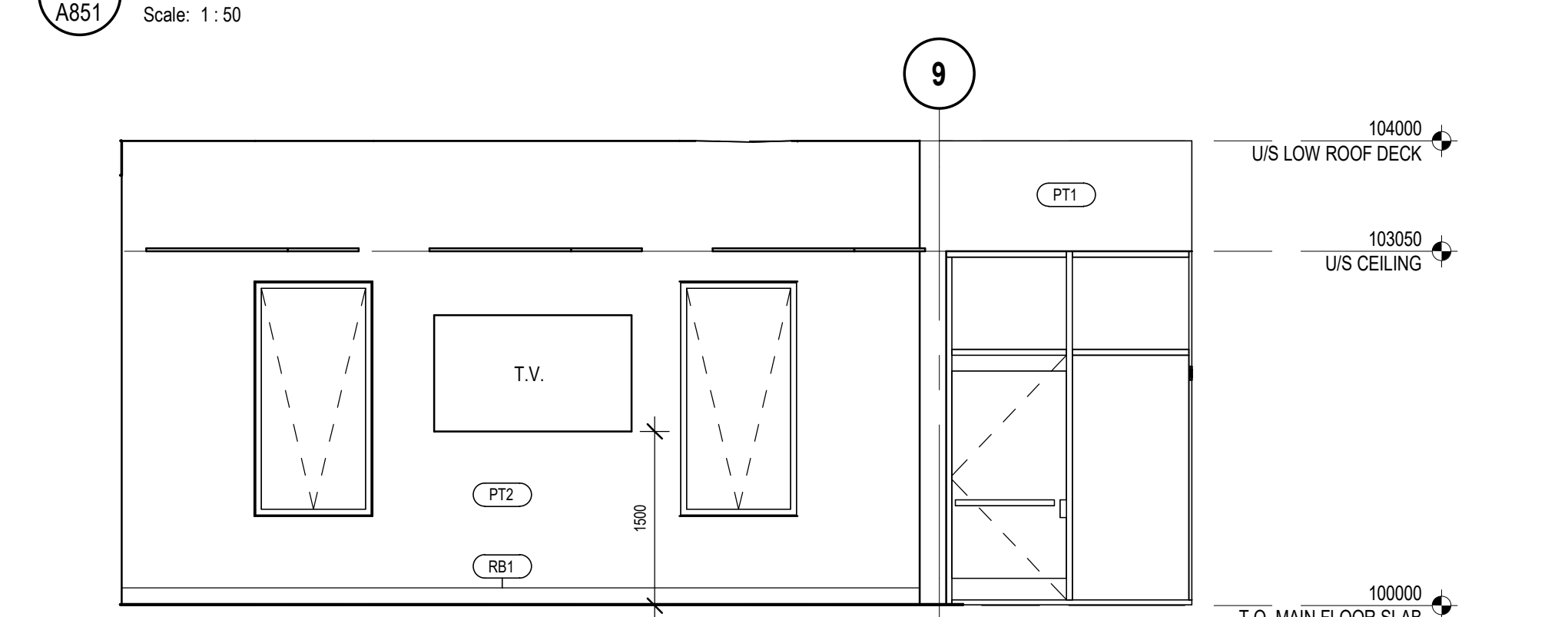
17 LUNCHROOM - EAST ELEVATION
Scale: 1:50



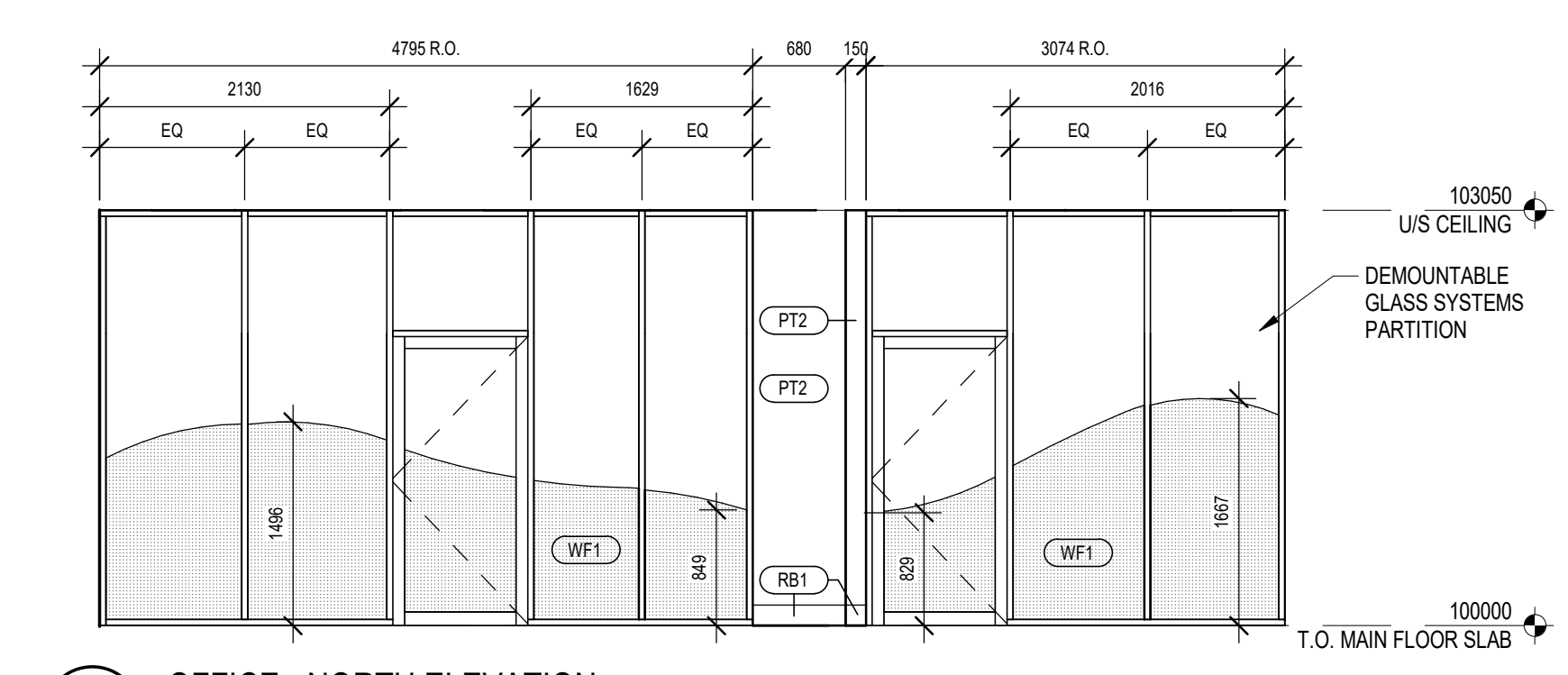
18 LUNCHROOM - WEST ELEVATION
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19 LUNCHROOM - NORTH ELEVATION
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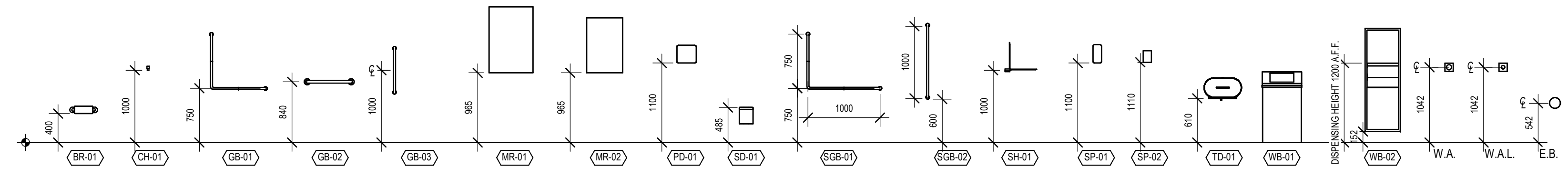


20 LUNCHROOM - SOUTH ELEVATION
Scale: 1:50



21 OFFICE - NORTH ELEVATION
Scale: 1:50

WASHROOM ACCESSORY & FIXTURE LEGEND



WASHROOM ACCESSORY SCHEDULE					
TYPE	DESCRIPTION	TYPE	DESCRIPTION	TYPE	DESCRIPTION
BR-01	BACK REST	LO-03	LOCKER	SP-01	SOAP DISPENSER
BN-01	BENCH	MR-01	TILTED MIRROR	SP-02	SOAP DISPENSER
BN-02	BENCH	MR-02	FLAT MIRROR	TD-01	TOILET TISSUE DISPENSER
CH-01	COAT HOOK	PD-01	PAPER TOWEL DISPENSER	TP-01	TOILET PARTITION
GB-01	GRAB BAR - 90° L SHAPED BAR	GB-01	FOLDING BENCH	UD-01	URINAL DIVIDER
GB-02	GRAB BAR - HORIZONTAL STRAIGHT BAR	SD-01	SANITARY NAPKIN DISPOSAL	WB-01	WASTE BIN
GB-03	GRAB BAR - VERTICAL STRAIGHT BAR	GB-01	SHOWER GRAB BAR - 90° L SHAPED BAR	WB-02	SEMI-RECESSED TOILET PAPER DISPENSER AND WASTE BIN
LO-01	LOCKER	GB-02	SHOWER GRAB BAR - VERTICAL STRAIGHT BAR		
LO-02	LOCKER	SH-01	SURFACE MOUNTED SHELF	SCR-01	SHOWER CURTAIN ROD

WASHROOM ACCESSORY NOTES	
1. REFER TO SPECIFICATION SECTION 10 99 99 WASHROOM ACCESSORY SCHEDULE FOR ADDITIONAL INFORMATION.	
2. WASHROOM ACCESSORY MOUNTING HEIGHTS TO MEET BARRIER FREE REQUIREMENTS UNLESS NOTED OTHERWISE.	
3. ALL WASHROOM ACCESSORIES TO BE INSTALLED UNDER THIS CONTRACT.	
4. PLYWOOD BACKING TO BE SUPPLIED AND INSTALLED BEHIND ALL WASHROOM ACCESSORIES AND GRAB BARS AS REQUIRED.	

8	ISSUED FOR ADDENDUM 5	2025-07-31
7	ISSUED FOR ADDENDUM 4	2025-07-18
6	REISSUED FOR TENDER	2025-05-23
5	ISSUED FOR TENDER	2025-04-25
4	ISSUED FOR BUILDING PERMIT REVIEW	2024-11-27
3	ISSUED FOR PRE-TENDER REVIEW	2024-10-31
2	ISSUED FOR 60% CD	2024-05-02
1	100% DD	2024-02-29

NO.	ISSUED FOR	DATE
As indicated	As indicated	As indicated

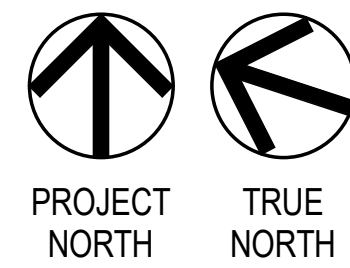
22046	G013-B
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YORK REGION NORTH ROADS OPERATIONS CENTRE

3525 BASELINE RD, SUTTON WEST, ON L0E 1R0

ENLARGED FLOOR PLANS & REFLECTED CEILING PLAN & INTERIOR ELEVATIONS, DETAILS
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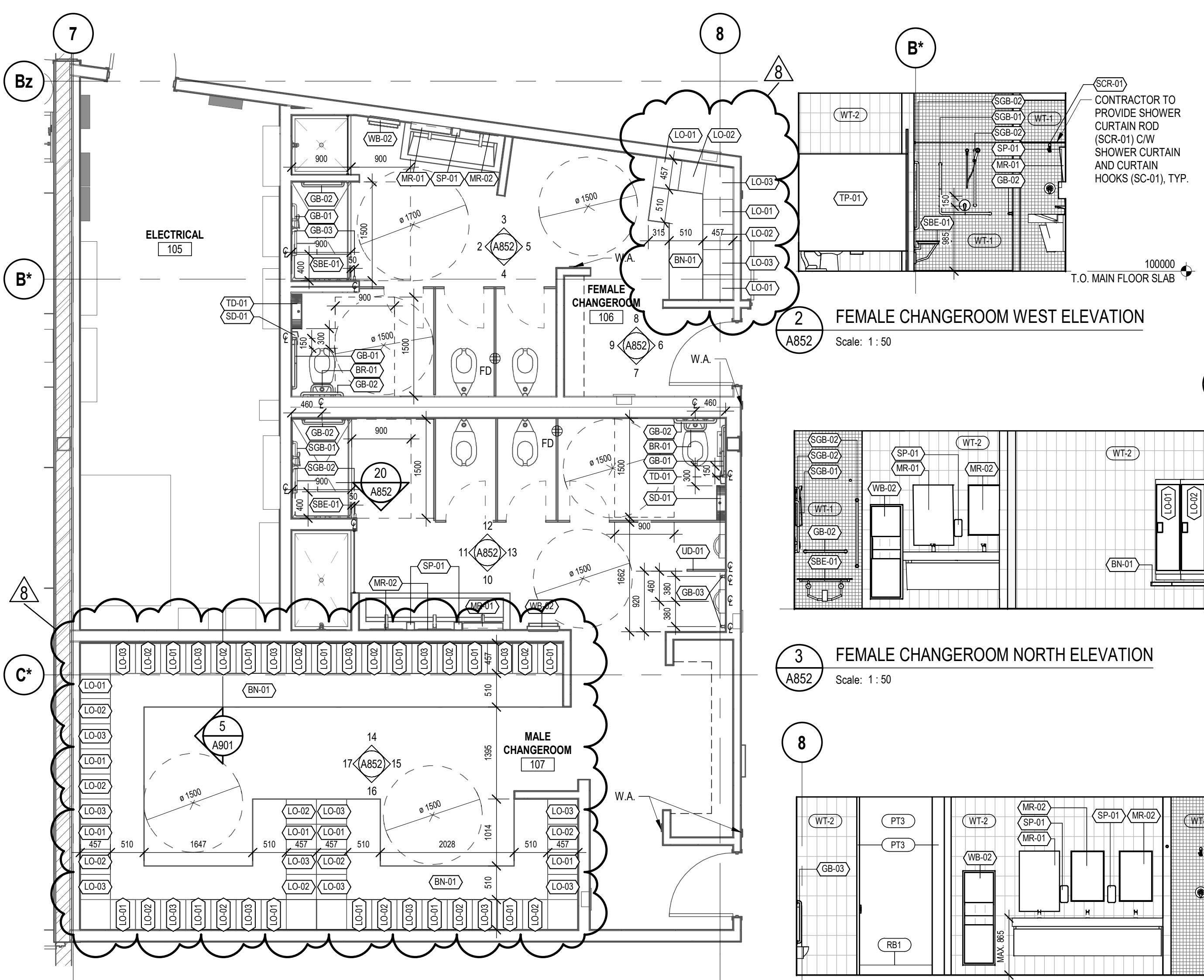
6016	A851
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Project Team:
Prime Consultant
GEC ARCHITECTURE
Structural and Building Envelope Consultant
ENTUITIVE
Mechanical and Electrical Consultant
MCW CONSULTANTS LTD.
Civil Consultant
PLANMAC ENGINEERING
Passive House Consultant
PEEL PASSIVE HOUSE
LEED Consultant
MCW CONSULTANTS LTD.
Landscape Consultant
MHBC

Client
YORK REGION

Seal & Permit

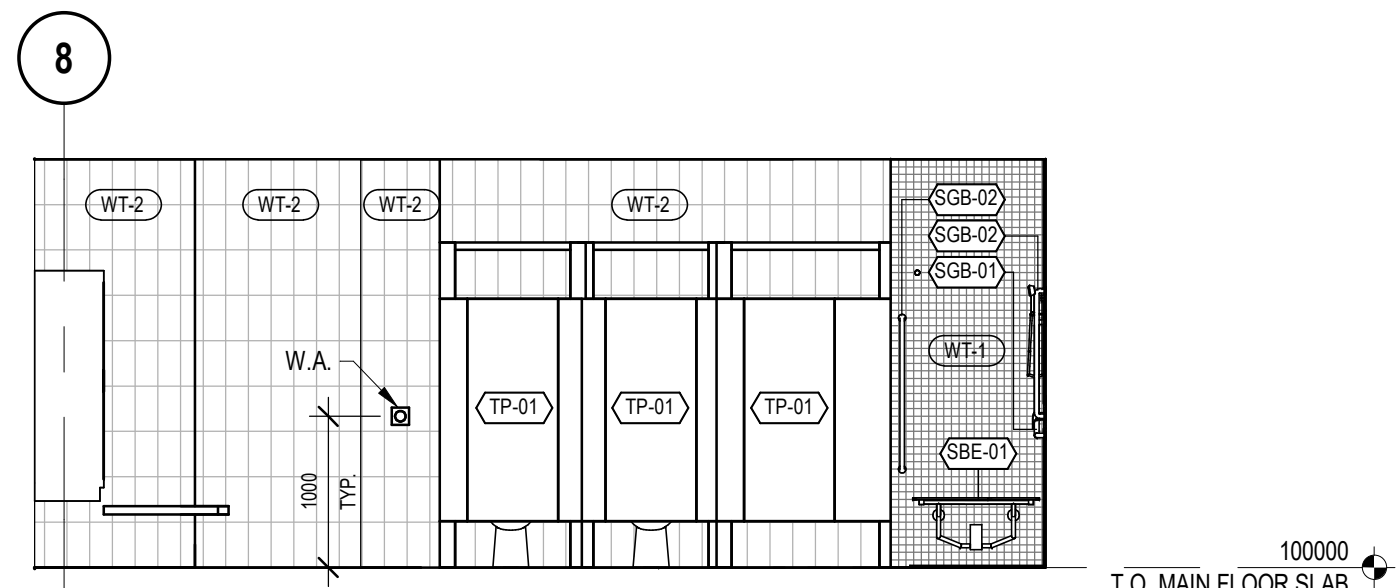


1 ENLARGED GROUND FLOOR PLAN
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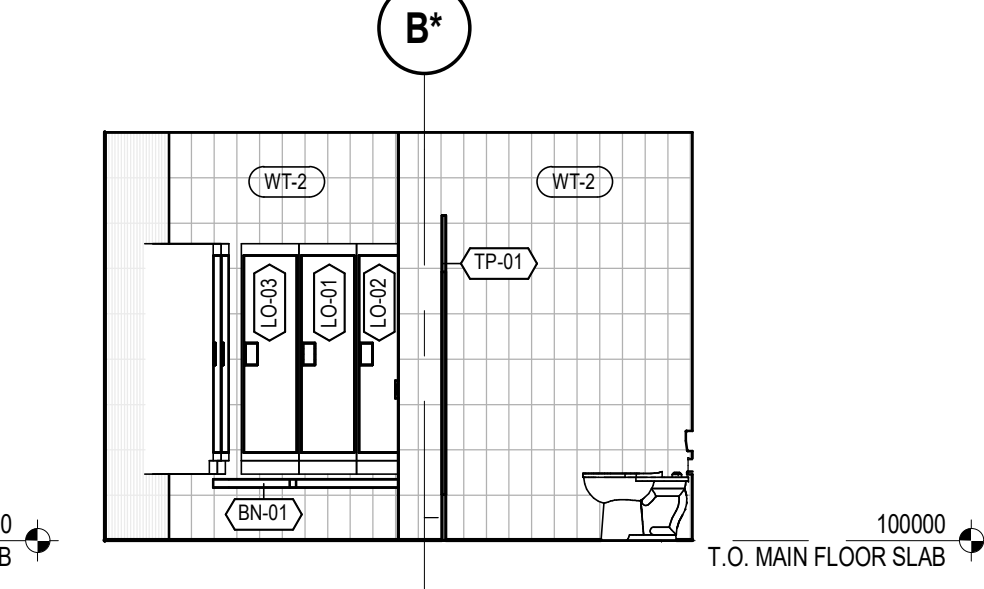
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3 FEMALE CHANGEROOM NORTH ELEVATION
A852 Scale: 1:50

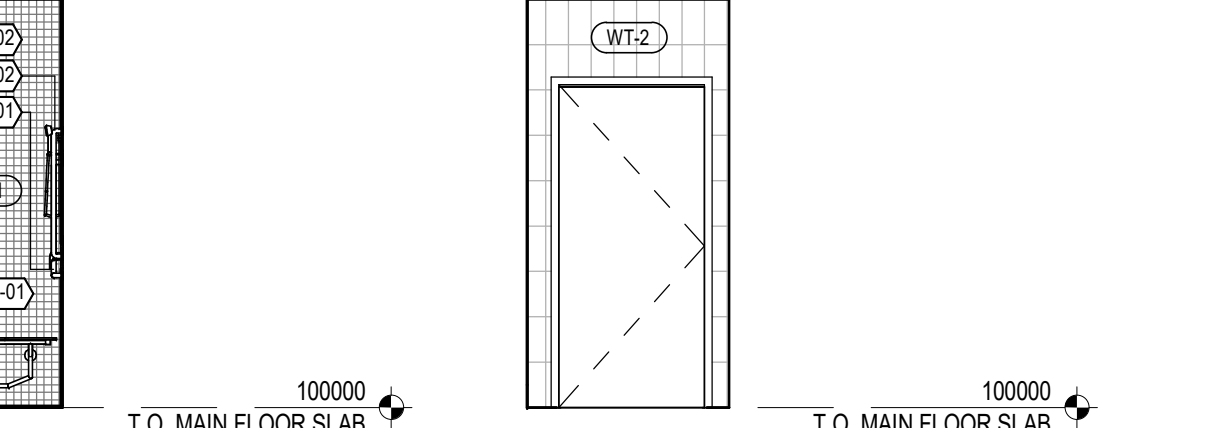
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A852 Scale: 1:50



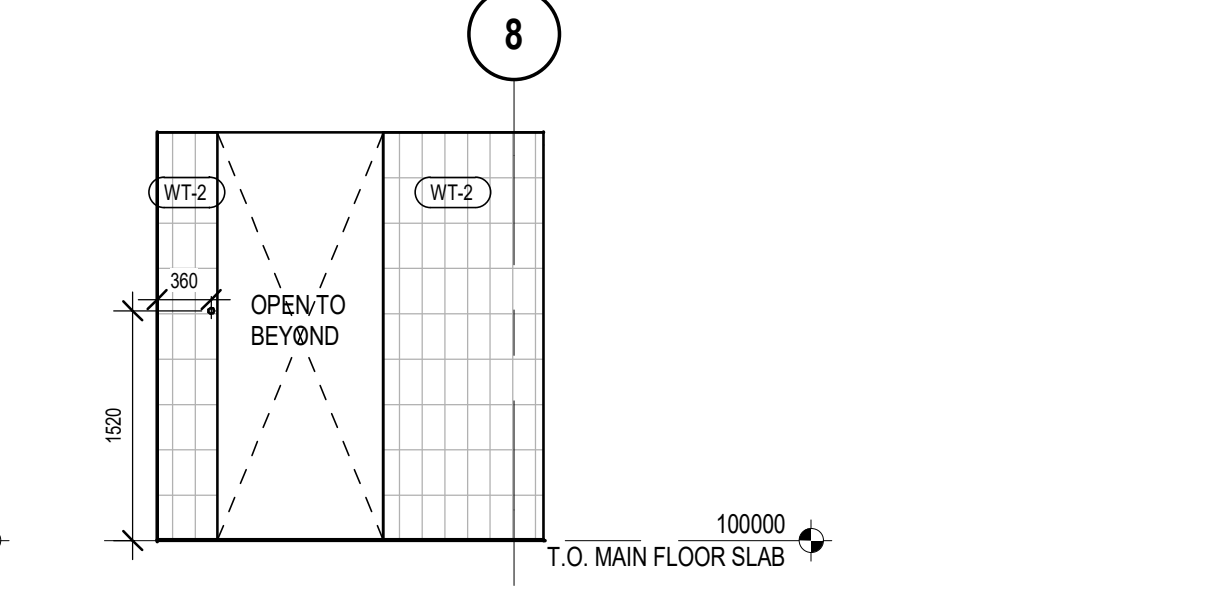
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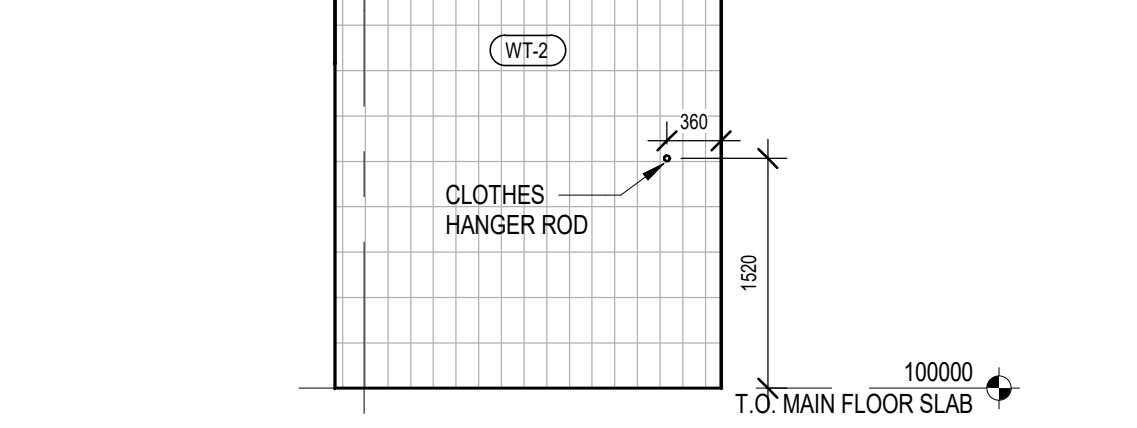
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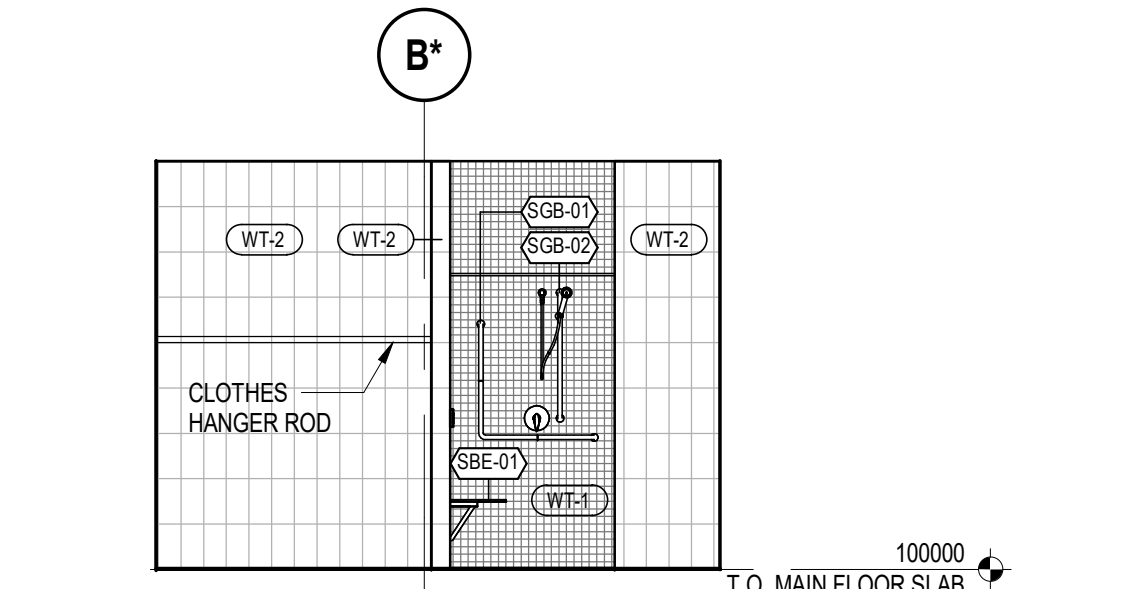
6 FEMALE CHANGEROOM INTERIOR ENTRANCE EAST ELEVATION
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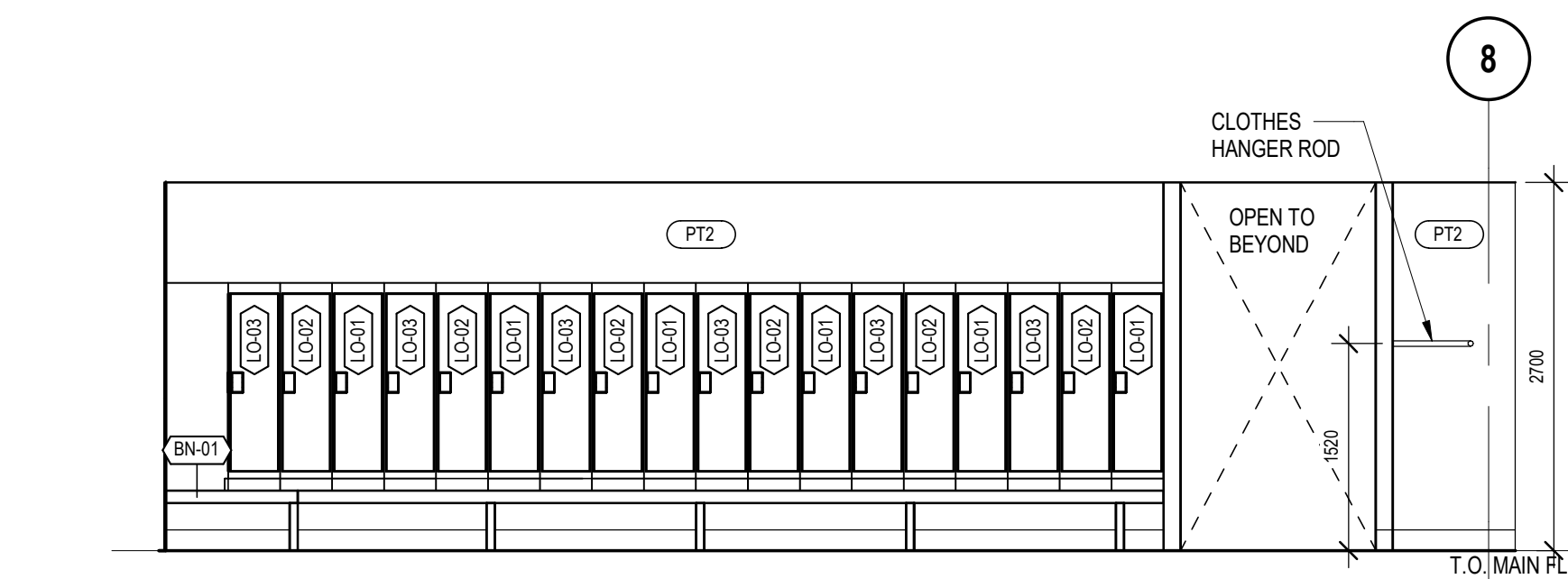
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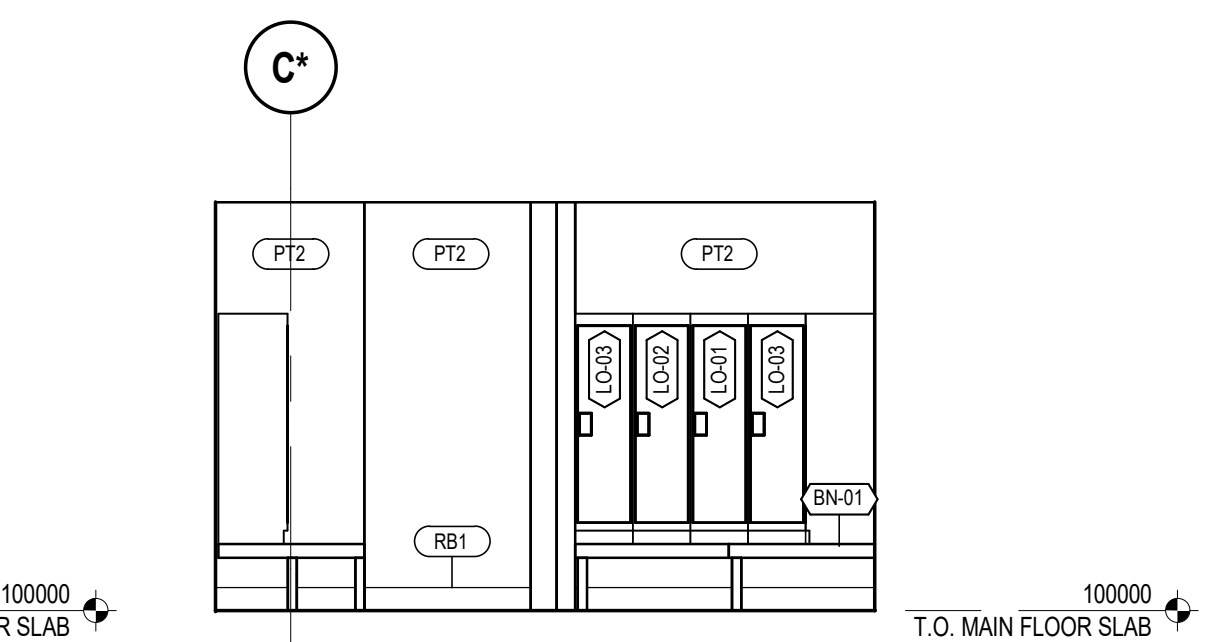
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A852 Scale: 1:50



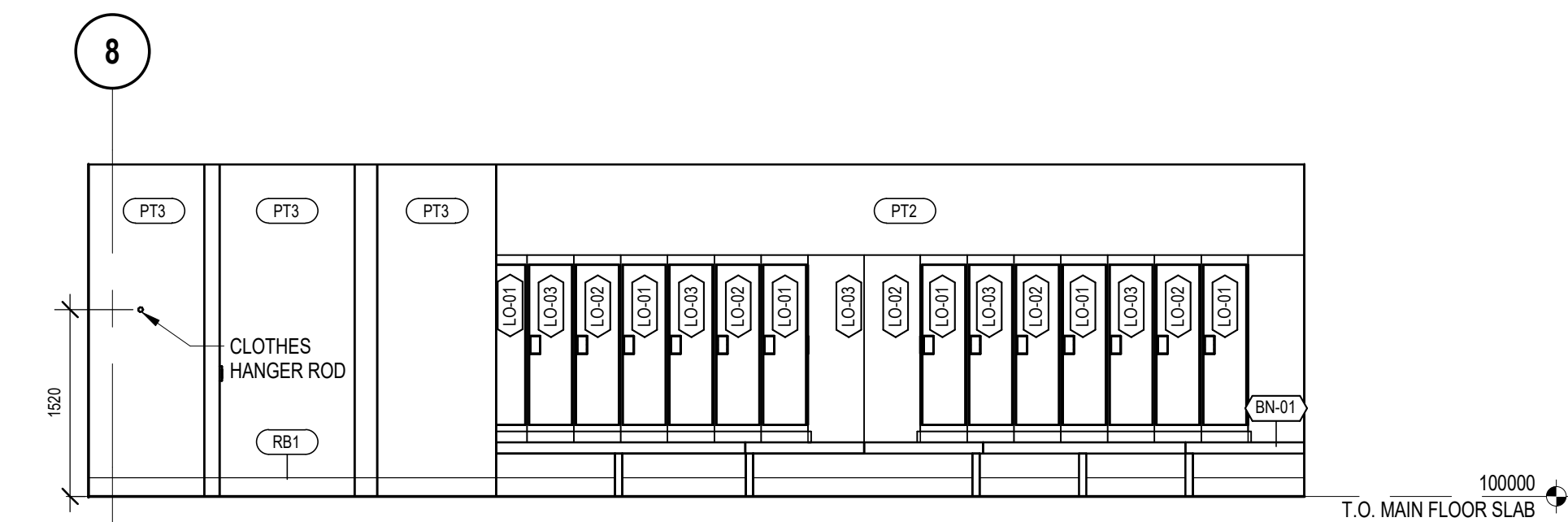
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A852 Scale: 1:50



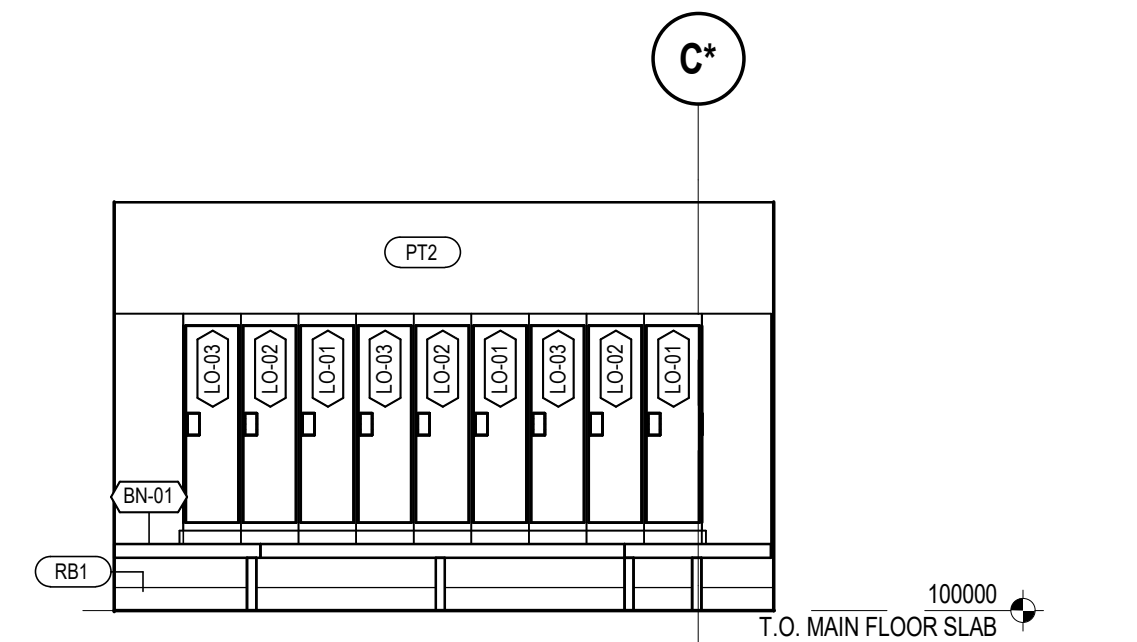
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A852 Scale: 1:50



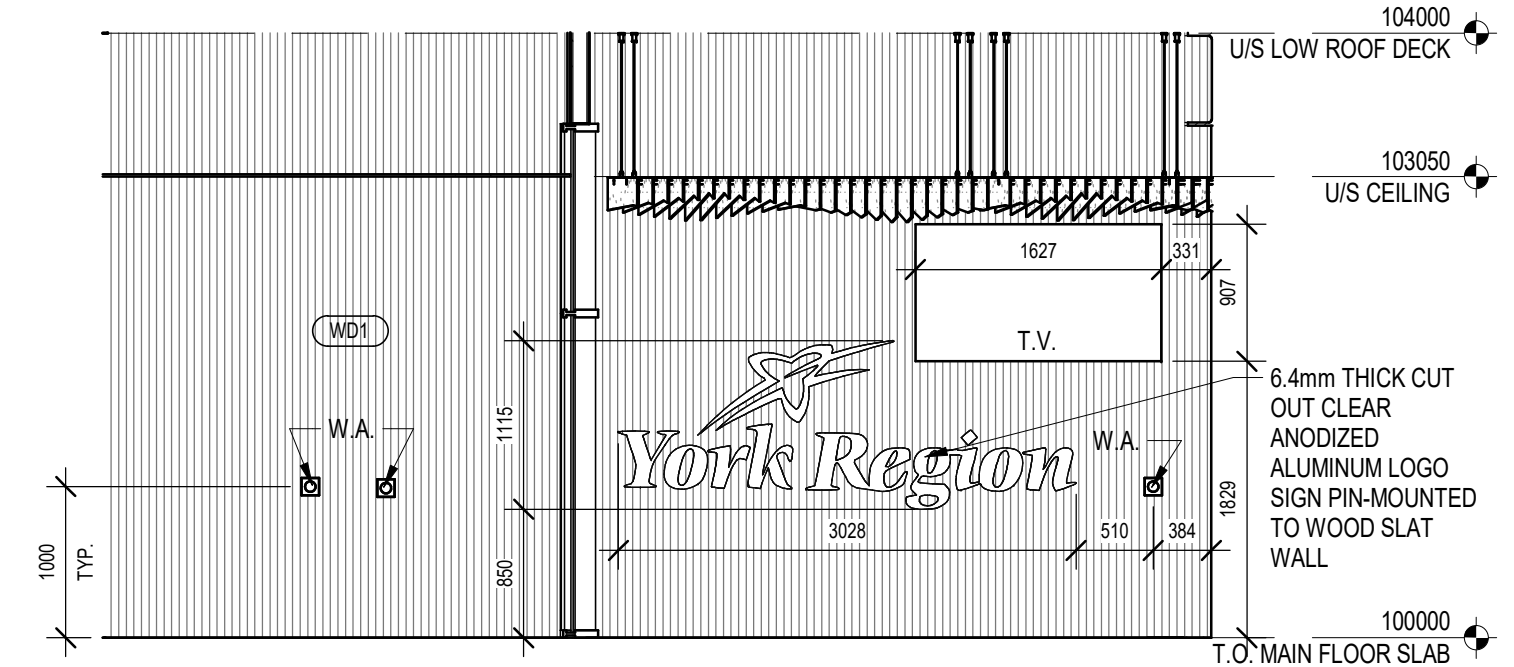
15 MALE CHANGEROOM LOCKERS EAST ELEVATION
A852 Scale: 1:50



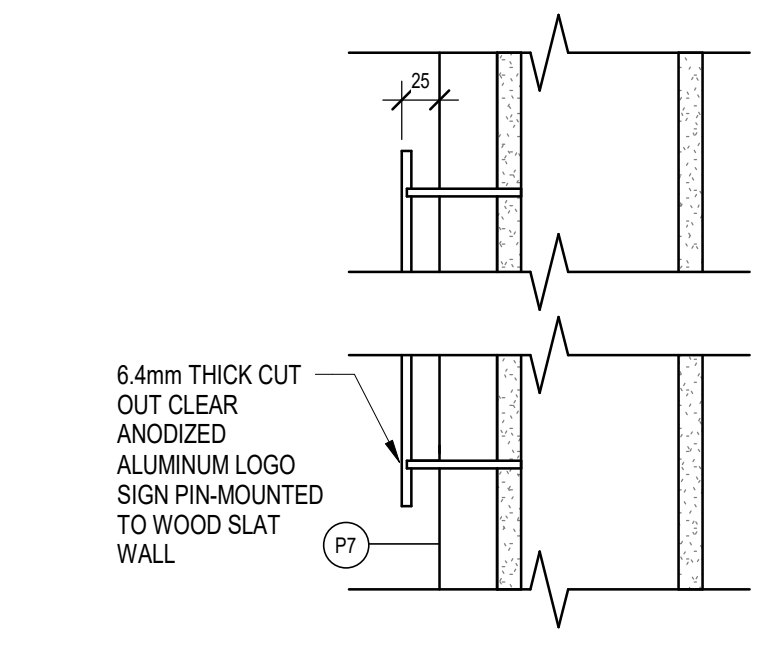
16 MALE CHANGEROOM LOCKERS SOUTH ELEVATION
A852 Scale: 1:50



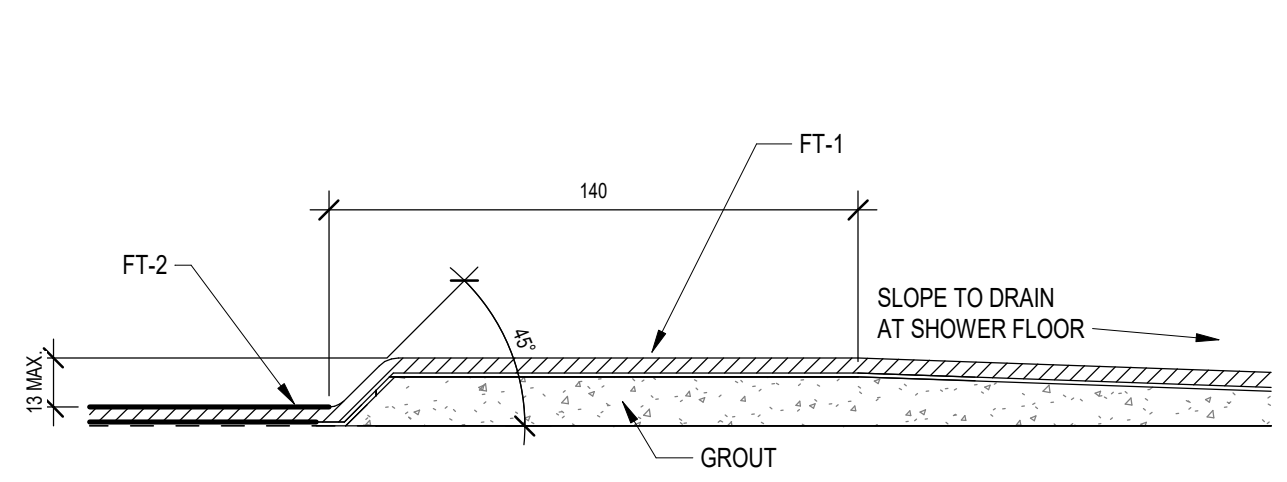
17 MALE CHANGEROOM LOCKERS WEST ELEVATION
A852 Scale: 1:50



18 LOBBY SOUTH ELEVATION
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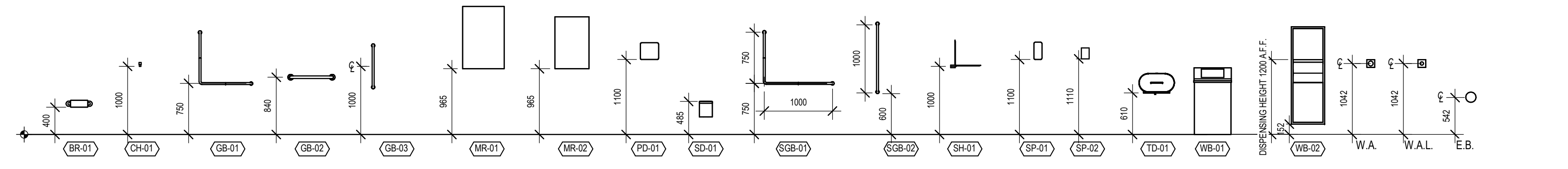


19 SIGNAGE - SECTION
A852 Scale: 1:5



20 SHOWER THRESHOLD
A852 Scale: 1:2

WASHROOM ACCESSORY & FIXTURE LEGEND



WASHROOM ACCESSORY SCHEDULE			
TYPE	DESCRIPTION	TYPE	DESCRIPTION
BR-01	BACK REST	LO-03	LOCKER
BN-01	BENCH	MR-01	TILTED MIRROR
BN-02	BENCH	MR-02	FLAT MIRROR
CH-01	COAT HOOK	PD-01	PAPER TOWEL DISPENSER
GB-01	GRAB BAR - 90° L-SHAPED BAR	SBE-01	FOLDING BENCH
GB-02	GRAB BAR - HORIZONTAL STRAIGHT BAR	SD-01	SANITARY NAPKIN DISPOSAL
GB-03	GRAB BAR - VERTICAL STRAIGHT BAR	SGB-01	SHOWER GRAB BAR - 90° L-SHAPED BAR
LO-01	LOCKER	SGB-02	SHOWER GRAB BAR - VERTICAL STRAIGHT BAR
LO-02	LOCKER	SH-01	SURFACE MOUNTED SHELF
		SP-01	SOAP DISPENSER
		SP-02	SOAP DISPENSER
		TD-01	TOILET TISSUE DISPENSER
		TP-01	TOILET PARTITION
		UR-01	URINAL DIVIDER
		WB-01	WASTE BIN
		WB-02	SEMI-RECESSED TOILET PAPER DISPENSER AND WASTE BIN
		SCR-01	SHOWER CURTAIN ROD

WASHROOM ACCESSORY NOTES	
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2. WASHROOM ACCESSORY MOUNTING HEIGHTS TO MEET BARRIER-FREE REQUIREMENTS UNLESS NOTED OTHERWISE.	
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7	ISSUED FOR ADDENDUM 4	2025-07-18
6	REISSUED FOR TENDER	2025-05-23
5	ISSUED FOR TENDER	2025-04-25
4	ISSUED FOR BUILDING PERMIT REVIEW	2024-11-27
3	ISSUED FOR PRE-TENDER REVIEW	2024-10-31
2	ISSUED FOR 60% CD	2024-05-02
1	100% DD	2024-02-29
NO.	ISSUED FOR	DATE

Scale	Checked By
As indicated	TB

Region of York Project Number	Region of York Building Code
22046	G013-B

Project
YORK REGION NORTH ROADS OPERATIONS CENTRE

Drawing Title

ENLARGED FLOOR PLANS & REFLECTED CEILING PLAN & INTERIOR ELEVATIONS, DETAILS

Project Number	Drawing Number
6016	A852

ENTUITIVE

Structural Addendum

SA No.: 2

	York Region – North District		
PROJECT NAME	Road Facility Expansion	PREPARED BY	Hayden Bellows
PROJECT NO.	EN023-01007	DATE	July 31, 2025
RE	Issued for Addendum #5 (Structural Addendum #2)	PAGES	2 Cover, 2 Drawings
Issued To			
NAME	COMPANY	EMAIL	
Tyson Bolduc	GEC Architecture	Tyson.bolduc@gecarchitecture.com	
Angela Ng	GEC Architecture	Angela.ng@gecarchitecture.com	
Norris Cheng	Entuitive	Norris.cheng@entuitive.com	
Andrew Au-Yeung	Entuitive	Andrew.auyeung@entuitive.com	

Drawings issued:			
DRAWING NO.	DRAWING TITLE	REVISION NO.	DATE
S050	Loading Plans	8	2025-07-31
S200	Roof Framing Plan	10	2025-07-31

Description of Revisions	
DRAWING NO.	
S050	<ul style="list-style-type: none"> EF-1, 2 locations revised. EF-4, 5 added. Mechanical equipment schedule updated
S200	<ul style="list-style-type: none"> Mechanical louvre outlines added along GL A*, E*, F* Plan note #16 added for coordination with new mechanical louvre framing

Reason for Addendum
In coordination with mechanical updates for addendum #5.

End of Structural Addendum

The following Addendum items shall be referred to by all concerned and shall be incorporated as part of the Contract Documents.

Sincerely,
Entuitive

A handwritten signature in black ink, appearing to read 'Bellows', with a stylized, cursive script.

Hayden Bellows, P.Eng.
Engineer
Hayden.Bellows@entuitive.com
C: 647.290.6528

Project Team:

Prime Consultant

GEC ARCHITECTURE

Structural Consultant

ENTUITIVE

Mechanical Consultant

Electrical Consultant

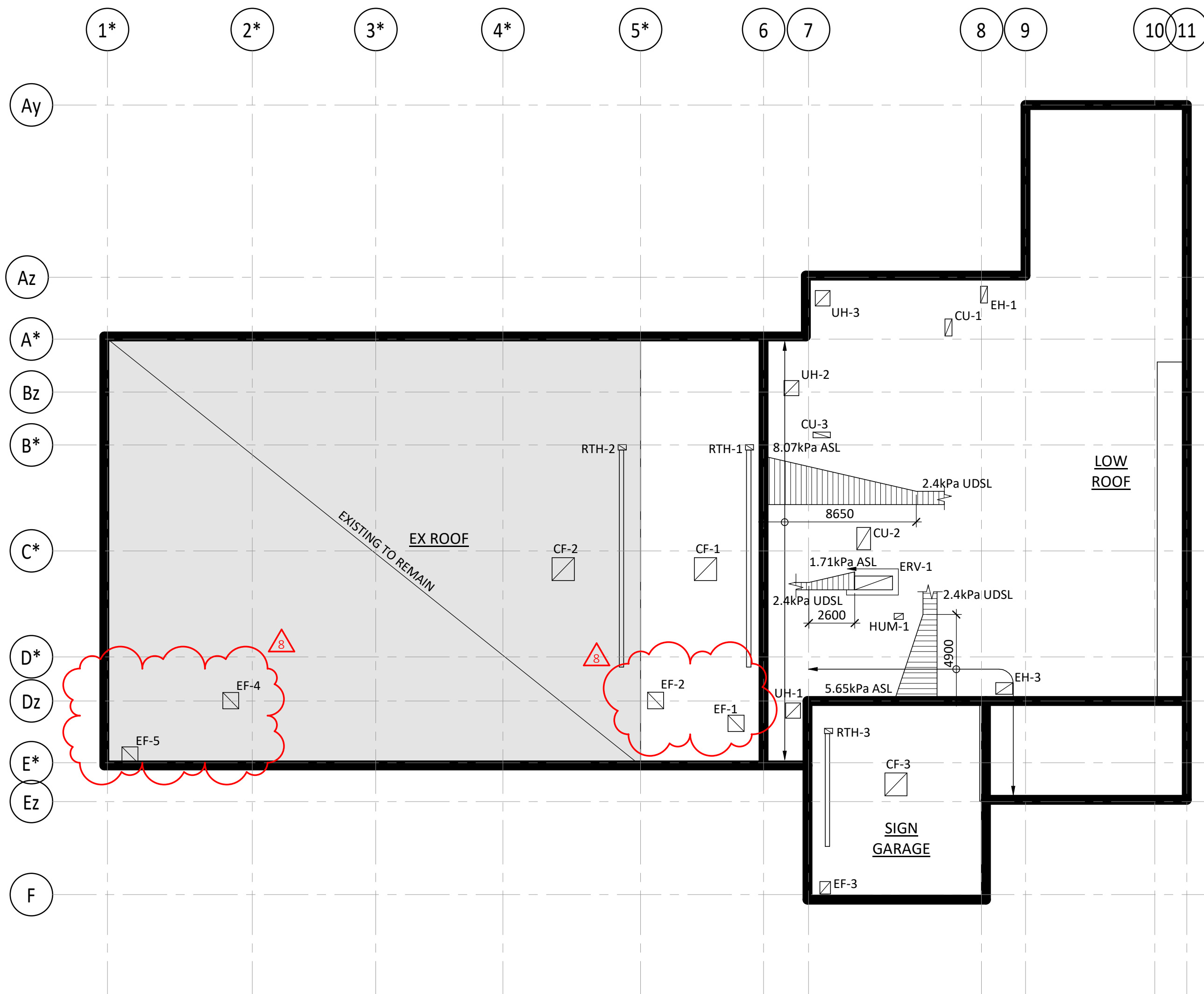
Civil Consultant

Client

OWNER



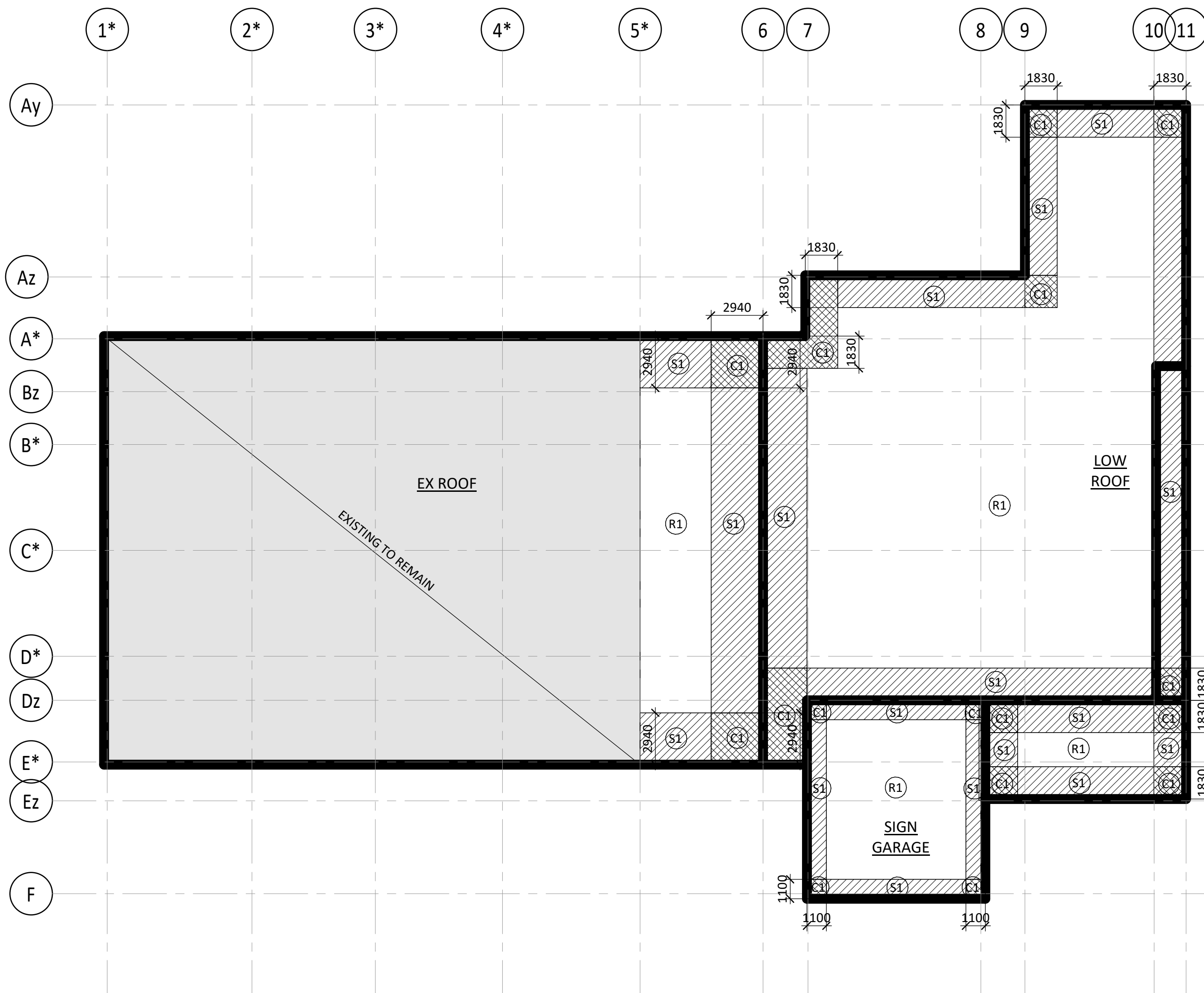
Seal & Permit



1 ROOF LOADING PLAN

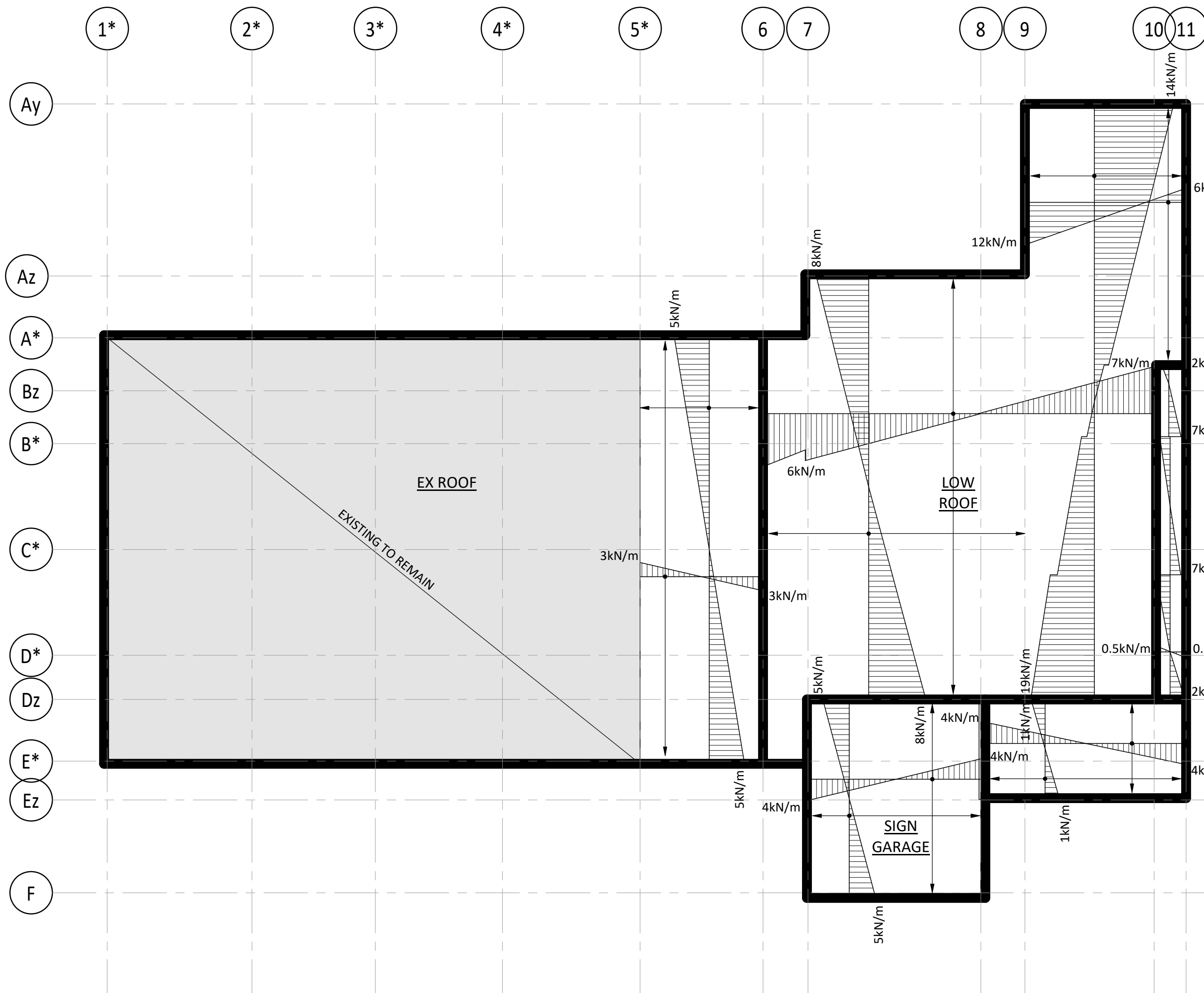
1. REFER TO MECHANICAL UNIT WEIGHT SCHEDULE FOR EQUIPMENT LOADS.
2. MECHANICAL UNITS, EQUIPMENT AND OPENING LOCATIONS SHOWN FOR REFERENCE ONLY. REFER TO MECHANICAL AND ARCHITECTURAL DRAWINGS FOR LOCATION.
3. CONTRACTOR TO ENSURE ALL FAN COIL UNITS ARE DIRECTLY SUPPORTED BY MAIN STRUCTURAL STEEL BEAMS / OWSJ. DO NOT DIRECTLY SUPPORT FAN COIL UNITS FROM METAL DECK. FAN COIL SUPPORT FRAMING BY OTHERS.

MARK	DIMENSIONS (LxWxH)(mm)	WEIGHT, kg (kN)
ERV-1	3886x889x1372	353 (3.46)
CU-2	1240x760x1690	239 (2.35)
CU-3	950x330x834	28 (0.28)
CU-1	950x330x834	67 (0.66)
CF-1, CF-2, CF-3	484x80	125 (1.23)
EF-1	-	58 (0.57)
EF-2	-	106 (1.04)
EF-3	610Ø	88 (0.86)
EF-4	-	106 (1.04)
EF-5	610Ø	88 (0.86)
EH-1, 2, 3	714x660x660	58 (0.52)
UH-1, 2, 3	610x496x559	45 (0.44)
HUM-1	330x508x584	34 (0.33)
RTH-1	12120 LG.	97 (0.95)
RTH-2	12120 LG.	97 (0.95)
RTH-3	6060 LG.	58 (0.562)



2 ROOF LEVEL WIND UPLIFT PLAN

ZONE	DECK FACTORED NET UPLIFT	JOISTS FACTORED NET UPLIFT
R1	1.08 kPa	0.51 kPa
S1	1.10 kPa	0.73 kPa
C1	2.42 kPa	1.10 kPa



3 ROOF LEVEL STEEL DECK SHEAR PLAN

8	ISSUED FOR ADDENDUM #5	2025-07-31
7	ISSUED FOR ADDENDUM #4	2025-07-18
6	REISSUED FOR TENDER	2025-05-23
5	ISSUED FOR TENDER	2025-04-25
4	ISSUED FOR COORDINATION	2025-04-17
3	ISSUED FOR BUILDING PERMIT	2024-11-27
2	ISSUED FOR PRE TENDER REVIEW	2024-10-31
1	ISSUED FOR 60% CD	2024-05-02

NO. ISSUED FOR DATE

Drawing History

Scale 1 : 200 Checked By HB

Region of York Project Number Region of York Building Code

Project

York Region North Roads Operations Centre

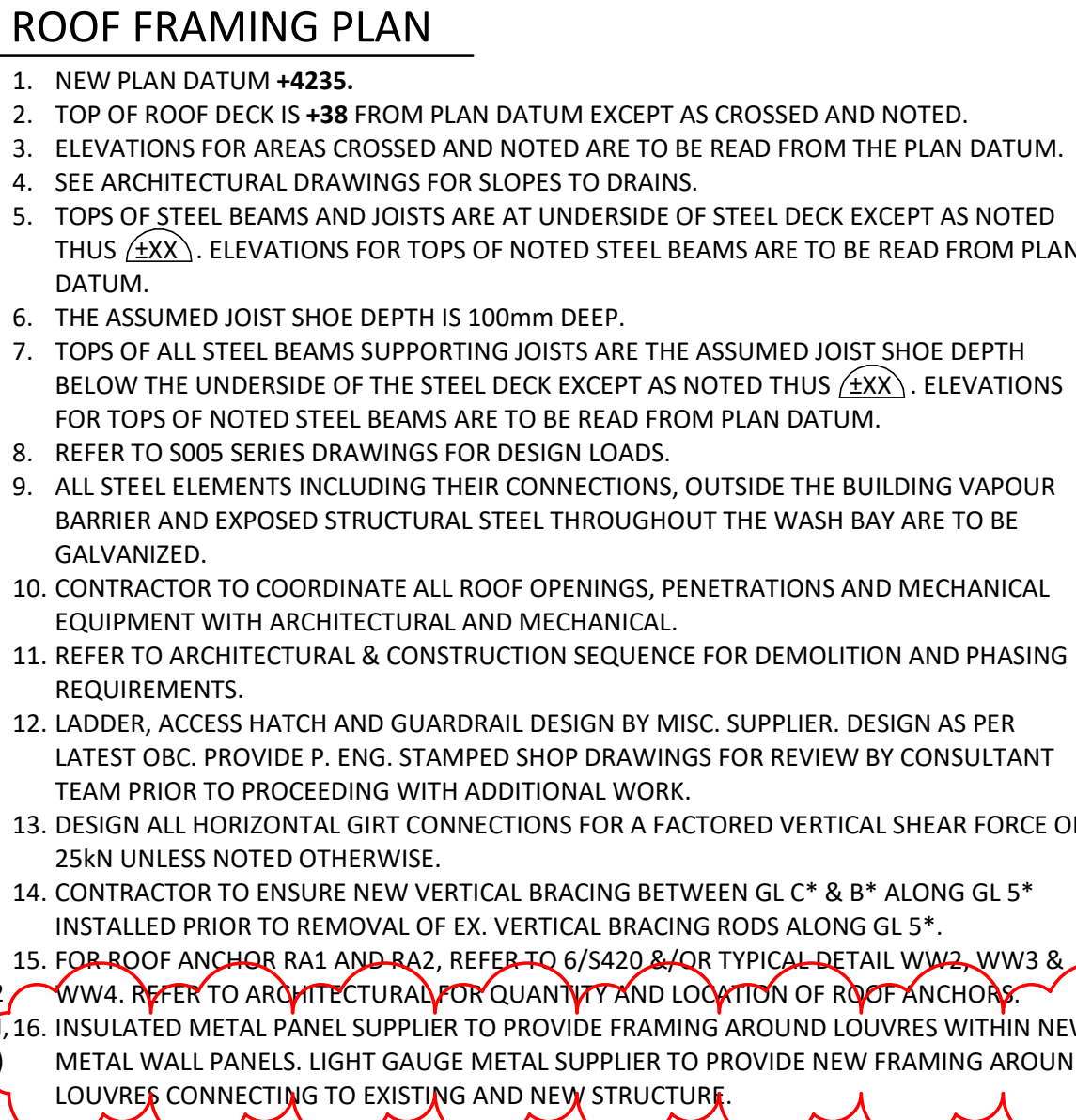
3525 Baseline Road Georgina, ON, L0E 1R0

Drawing Title


LOADING PLANS

Project Number Drawing Number

EN023-01007 S050



STEEL POST SCHEDULE				
MARK	POST SIZE	BASEPLATE SIZE & ANCHORS	CONNECTION FORCE	REMARKS
SP1	HSS178x178x9.5	BP07 - PL200x12.7x320 & 2-16mmØ HILTI HILTI-HY 200 HAS-V-36 (152 EMBED)	Hf=25KN	CONNECT BP07 TO T/G EX. GRADE BEAM. PROVIDE VSC AT TOP
SP2	HSS102x102x7.9	BP06 - PL190x12.7x190 & 4-12.7mmØ HILTI KWIK BOLT T22 (65 EMBED)	Vfy=Vfx=15KN	PROVIDE SLAB THICKENING UNDER POST AS PER TYPICAL DETAIL CT3
SP3	HSS127x127x8.0	N/A	Hf=15KN	PROVIDE VSC AT TOP

2	STAIR PARTIAL FRAMING PLAN
<div>  </div>	1. NEW STAIR DATUM +4400.
	2. STAIR STRINGER, POSTS, BASEPLATES & ANCHORS ARRANGEMENT AND SIZES SHOW ONLY FOR GUIDANCE. FINAL DETAILED DESIGN TO BE BY MISC. METALS SUPPLIER. PROVIDE HANDRAIL AND GUARD TO ALL STAIRS, DESIGN AS PER LATEST OBC. SUBMIT P.ENG. STAMPED SHOP DRAWINGS TO CONSULTANT TEAM FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
	3. ALL STRINGERS AND STAIR FRAMING TO BE DESIGNED TO WITHSTAND GUARD LOADS FROM HANDRAIL AS PER LATEST OBC: <ol style="list-style-type: none"> <li>1. CONCENTRATED HORIZONTAL LOAD OF 1.0KN AT ANY POINT, OR <li>2. DISTRIBUTED HORIZONTAL LOAD OF 0.75KN/m AT ANY POINT, OR <li>3. DISTRIBUTED VERTICAL LOAD OF 1.5KN/m AT ANY POINT
	4. ALL EXPOSED STEEL ELEMENTS FOR THE CATALKAT STRUCTURE WITHIN THE WASH BAY, INCLUDING THEIR CONNECTIONS, ARE TO BE GALVANIZED.
	5. LATERAL LOAD RESTRAINING SYSTEM AND LATERAL STABILITY DESIGN OF STAIR IN N-S, E-W DIRECTION TO BE BY MISC. METALS SUPPLIER.

Queen's Quay Terminal
207 Queen's Quay West, Suite 615
Toronto, Ontario M5J 1A7
Phone 416-598-2920 Fax 416-598-5394
www.mcw.com

Date: July 31, 2025

Project Name: York Region North Roads Operations Centre

Client: York Region

To: GEC Architecture

Attention: Angela Ng - GEC angela.ng@gecarchitecture.com

From: David MacKeracher - MCW dmackeracher@mcw.com

Distribution: Tyson Bolduc - GEC tyson.bolduc@gecarchitecture.com

Nathan Lao - MCW NLao@mcw.com

Julia Kreynin - MCW JKreynin@mcw.com

Vytautas Stasiulevicius - MCW VStasiulevicius@mcw.com

Shivam Bhojak - MCW SBhojak@mcw.com

Desmond Lau - MCW DLau@mcw.com

Project #: 23137

ADD #: M-002

Page #: 1 of 2

+ Attachment

In accordance with the drawings and specifications, provide in the tender all costs required to complete the work including items as listed below.

Title: Mechanical Addendum M-002 – (ADD-005)
Reason for Change: Change of Scope and Direction

Specifications:

Section #	Revisions
22 05 33	<ul style="list-style-type: none"> Added electric heat tracing section.
22 30 10	<ul style="list-style-type: none"> Added sections 2.26 and 2.27 pertaining to pressure washers and hoses and hose reels.
22 40 10	<ul style="list-style-type: none"> Revised waterless urinal model. Added deck-mounted eyewash to SK-1 including associated thermostatic mixing valve for emergency fixtures.
23 33 10	<ul style="list-style-type: none"> Updated specification for combination fire smoke damper with integral smoke detector.
25 05 10	<ul style="list-style-type: none"> Updated section 1.09 <i>Manufacturers and Installers</i>.



Mechanical Drawings:

Drawing #	Revisions
M0-02	<ul style="list-style-type: none">Added ultrasonic level transmitter scope.
M1-01	<ul style="list-style-type: none">Revised DCW supply to urinals.Added notes regarding pressure washer downstream piping and hose-reels, hoses and wands.Added notes regarding metering and sub-metering.
M1-02	<ul style="list-style-type: none">Added missing pipe sizes.Added missing pipe.
M2-01	<ul style="list-style-type: none">Air terminals revised as indicated on plan.CO/Nox sensor scope revised.Added clarification notes.
M2-02	<ul style="list-style-type: none">Intake and Exhaust air louver sizes/locations revisedFire dampers added to intake/exhaust louver assembliesFan locations and types revised as indicated on planDucting to inline fans added
M4-03	<ul style="list-style-type: none">Revised schematic to suit layout on plan drawings.Added shut-off valves.Revised piping and note on the non-freeze roof hydrant.Revised note for the non-freeze hose bibb.
M5-04	<ul style="list-style-type: none">Revised Detail 1.Revised Detail 3.

M / E Schedules:

Drawing #	Revisions
ME-02	<ul style="list-style-type: none">Fan schedule revised
ME-03	<ul style="list-style-type: none">Air terminal schedule revised

End of ADD # M-002



Prime Consultant
GEC ARCHITECTURE

Mechanical Consultant
MCW CONSULTANTS LTD.

Electrical Consultant
MCW CONSULTANTS LTD.

Civil Consultant
PLANMAC ENGINEERING

Passive House Consultant
PEEL PASSIVE HOUSE

LEED Consultant
MCW CONSULTANTS LTD

YORK REGION



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**PRELIMINARY -
NOT FOR
CONSTRUCTION**



9	ISSUED FOR ADDENDUM #5	2025/07/3
8	ISSUED FOR ADDENDUM #4	2025/07/16
7	REISSUED FOR TENDER	2025/05/29
6	ISSUED FOR TENDER	2025/04/24
5	ISSUED FOR BUILDING PERMIT	2024/11/2
4	ISSUED FOR PRE-TENDER REVIEW	2024/10/3
3	ISSUED FOR 60% CD	2024/05/01
2	ISSUED FOR 100% DD	2024/02/28
1	ISSUED FOR 60% DD	2024/01/28
NO.	ISSUED FOR	DATE

Scale	As indicated	Checked By	NL
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Region of York Project Number Region of York Building Code

22046	G013-B
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Project

YORK REGION NORTH ROADS
OPERATIONS CENTRE

3525 BASELINE RD.SUTTON WEST, ON L0E 1R0

Drawing Title

SITE PLAN - MECHANICAL - NEW
WORK

Project Number
23137

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1 : 500

2025-07-31 7:41:21 AM ReAuthor
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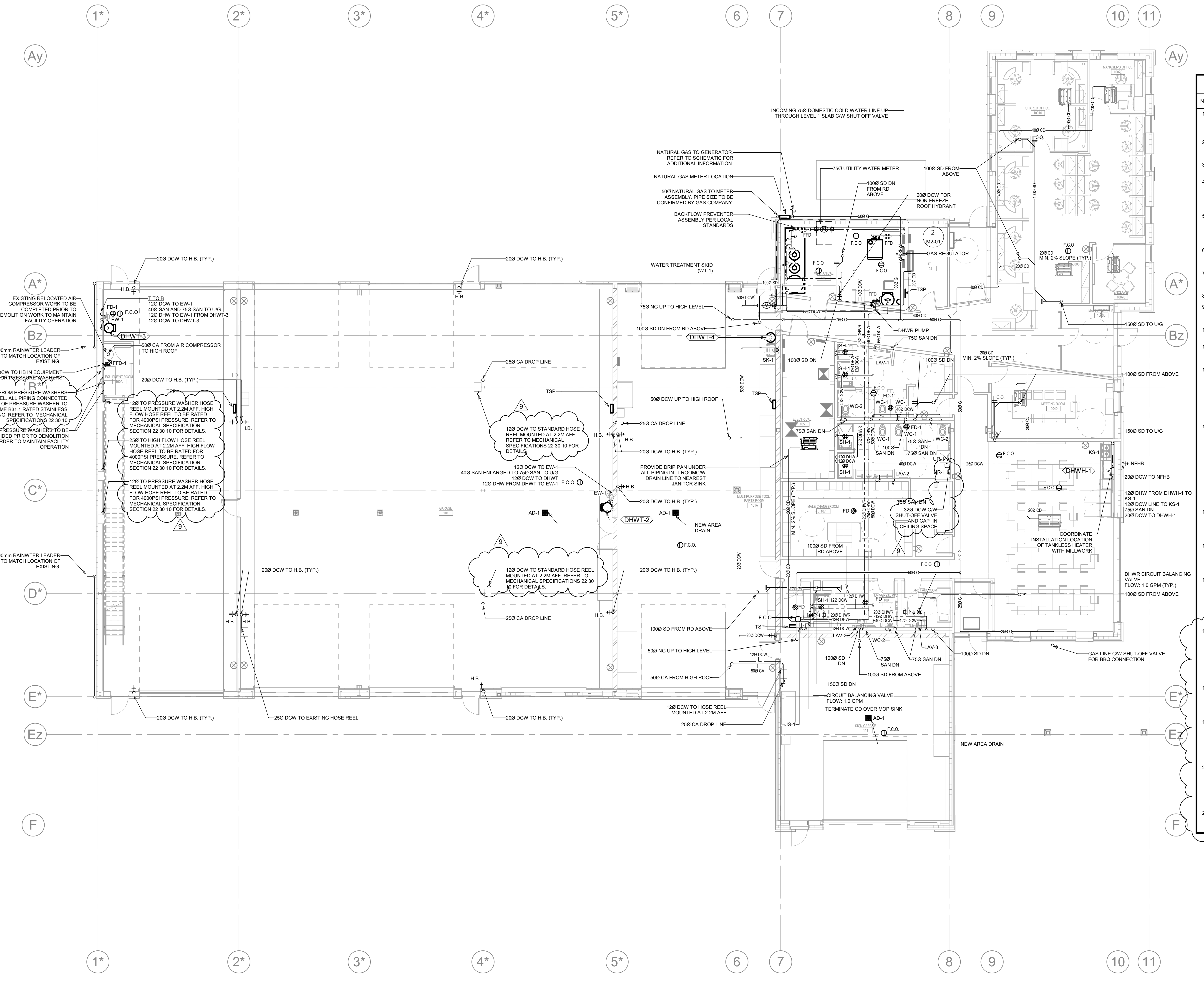
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8	ISSUED FOR ADDENDUM #4	2025/07/18
7	REISSUED FOR TENDER	2025/05/23
6	ISSUED FOR TENDER	2025/04/22
5	ISSUED FOR BUILDING PERMIT	2024/11/27
4	ISSUED FOR PRE-TENDER REVIEW	2024/10/31
3	ISSUED FOR 60% CD	2024/05/02
2	ISSUED FOR 100% DD	2024/02/29
1	ISSUED FOR 60% DD	2024/01/25

Scale	As indicated	Checked By	NL
Region of York Project Number	22046	Region of York Building Code	G013-B

Project
YORK REGION NORTH ROADS
OPERATIONS CENTRE
6525 BASELINE RD, SUTTON WEST, ON L0E 1R0
Drawing Title

LEVEL 1 - PLUMBING & DRAINAGE
PLAN

Project Number
23137
Drawing Number
M1-01
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1 LEVEL 1 - PLUMBING
1 : 100

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Winnipeg Toronto
Thunder Bay
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Quebec/St. John's
Halifax

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207 Queen's Quay West, Suite 615
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Fax: 416-598-5394
www.mcw.com

9	ISSUED FOR ADDENDUM #5	2025/07/11
8	ISSUED FOR ADDENDUM #4	2025/07/11
7	REISSUED FOR TENDER	2025/06/11
6	ISSUED FOR TENDER	2025/04/11
5	ISSUED FOR BUILDING PERMIT	2024/11/11
4	ISSUED FOR PRE-TENDER REVIEW	2024/10/11
3	ISSUED FOR 60% CD	2024/05/11
2	ISSUED FOR 100% DD	2024/02/11
1	ISSUED FOR 60% DD	2024/01/11
NO.	ISSUED FOR	DATE

Scale	Checked By
As indicated	NL

Region of York Project Number	Region of York Building Code
22046	G013-B

Project

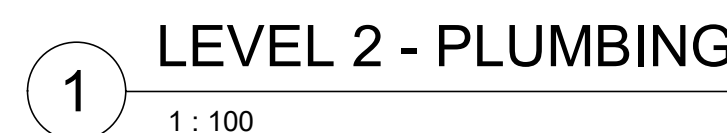
YORK REGION NORTH ROADS
OPERATIONS CENTRE

3525 BASELINE RD.SUTTON WEST, ON L0E 1R0

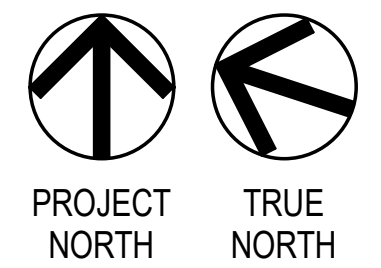
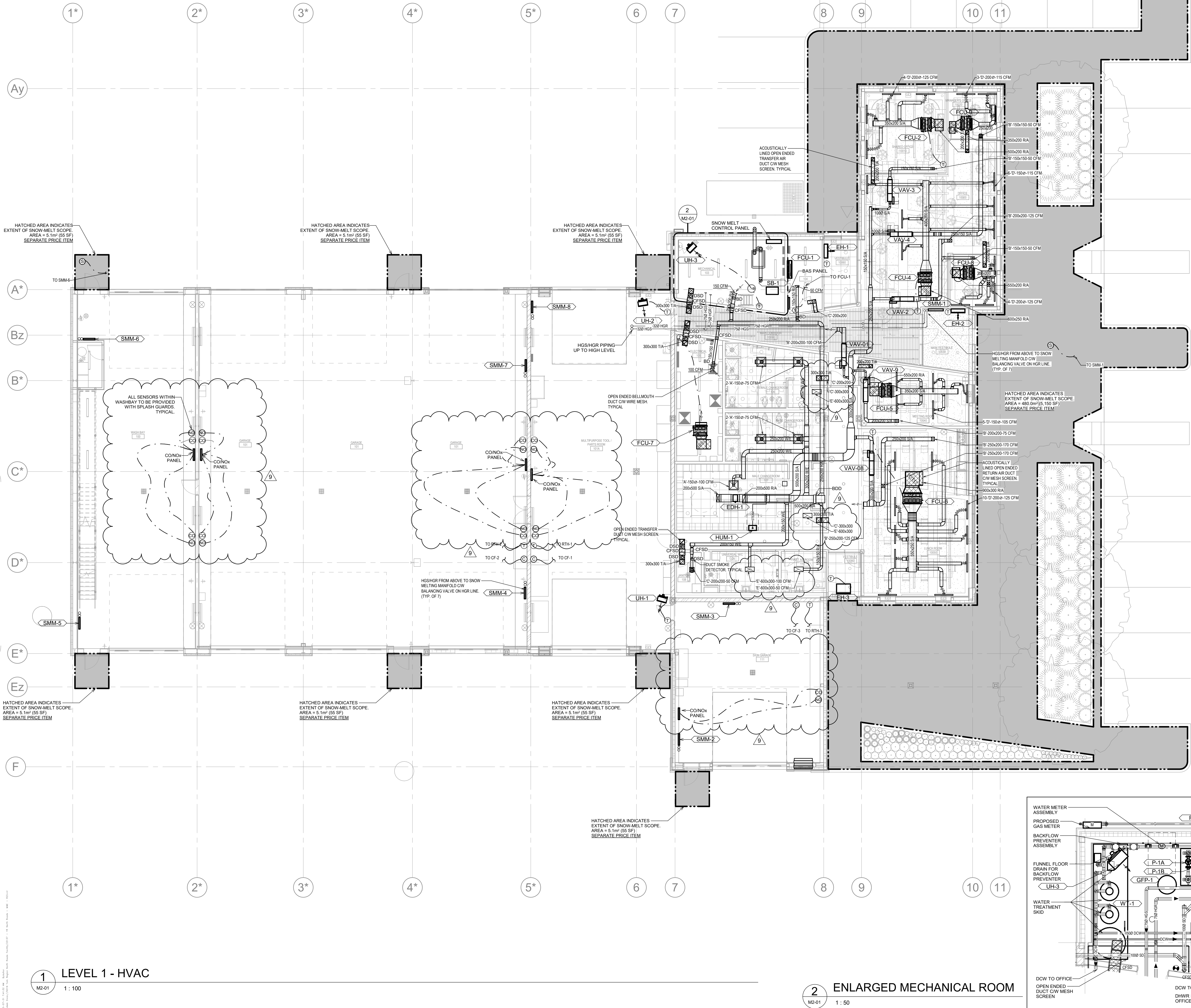
Drawing Title

LEVEL 2 & LOW ROOF - PLUMBING & DRAINAGE PLAN

Project Number	Drawing Number
23137	M1-02



PLUMBING GENERAL NOTES	
NOTE	DESCRIPTION
1.	ALL UNDERGROUND PIPING IS TO BE SLOPED AS FOLLOWS UNLESS OTHERWISE NOTED: - ALL PIPING 750 AND SMALLER TO BE 2% SLOPE. - ALL PIPING 1000 AND LARGER TO BE 1% SLOPE.
2.	MINIMUM SIZE OF UNDERGROUND DRAINAGE PIPING SHALL BE 750. ENLARGE SMALLER PIPING TO 750 BEFORE PENETRATION TO BAS OR SEA LEVEL.
3.	PROVIDE AND CONNECT TRAP SEAL PRIMER AT EACH FLOOR DRAIN.
4.	PIPE ROUTING IS SHOWN DIAGRAMMATICALLY AND INDICATES DESIGN INTENT. CONFIRM EXACT ROUTING TO COORDINATE WITH ALL MECHANICAL SERVICES, HANGERS, ELECTRICAL AND STRUCTURE ON SITE. PROVIDE OFFSETS AND ADJUST ROUTING AS REQUIRED.
5.	PLUMBING VENTING IS NOT SHOWN. ALL PLUMBING VENTS ARE TO BE INSTALLED IN ACCORDANCE WITH THE ON SITE BUILDING CODE AND BASA 101.1. ROUTING TO BE COORDINATED WITH OTHER DISCIPLINES ON SITE BY CONTRACTOR.
6.	COORDINATE FINAL LOCATIONS OF DRAIN DRAINS AND CLEANOUTS WITH ARCHITECTURAL FLOOR FINISHING PLANS.
7.	NOT ALL PLUMBING CLEANOUTS ARE SHOWN. INSTALL CLEANOUTS IN ACCORDANCE WITH THE ONTARIO BUILDING CODE.
8.	DO NOT ROUTE PIPE OVER ELECTRICAL EQUIPMENT.
9.	PROVIDE DRIP PAN UNDER ALL PIPING IN ELECTRICAL / IT / MECHANICAL ROOMS CIVIL AND LINE TO CLOSEST MOP SINK OR FUNNEL FLOOR DRAIN.
10.	REFER TO ARCHITECTURAL DRAWINGS FOR PROJECT PHASING AND CONSTRUCTION SCHEDULE.
11.	COORDINATE INSTALLATION OF GENERATOR AND NATURAL GAS METER. ENSURE CLEARANCES ARE MET IN ACCORDANCE WITH GAS AND BASA 101.1.
12.	SCOPE OF WORK TO BE PERFORMED IN A PHASED AND SEQUENTIAL FASHION IN ORDER TO AVOID DISRUPTION TO THE CURRENT CLIENT OPERATIONS. REFER TO ARCHITECTURAL PHASING PLANS FOR DETAILS. CONTRACTOR TO PROPOSE PHASING PLAN ALONG WITH CONSTRUCTION SCHEDULE TO ACCOMMODATE THIS. NO DEMOLITION OF EXISTING MECHANICAL SERVICES ARE TO BE CARRIED OUT WITHOUT SUFFICIENT NOTICE AND CLIENT SIGN-OFF.
13.	CONTRACTOR TO COORDINATE WITH NATURAL GAS PROVIDER FOR ALL PHASING AND CONSTRUCTION UPGRADE REQUIREMENTS DUE TO ADDITIONAL GAS LOADS. THIS INCLUDES ANY INCOMING PIPING UPGRADE REQUIREMENTS TO THE BUILDING AND APPROPRIATE METERING STATION AND SERVICE DEMOLITION OF EXISTING MECHANICAL SERVICES AND SERVICE AND METERING STATION TO BE COORDINATED AND INCORPORATED INTO THE GENERAL PHASING CONSTRUCTION PLAN. DEMOLITION OF EXISTING CLIENT OPERATIONS. DEMOLITION OF EXISTING INFRASTRUCTURE TO BE INSTALLED AND IS OPERATIONAL.
14.	ALL OTHER EXISTING MECHANICAL SERVICES (DOMESTIC WATER) TO REMAIN IN PLACE AND BE COORDINATED TO ACCOMMODATE CONSTRUCTION PHASING PLANS. REFER TO CIVIL AND ARCHITECTURAL DRAWINGS FOR DETAILS.
15.	ALL EXISTING UNDERGROUND SERVICES TO BE VERIFIED BY THE CONTRACTOR ON SITE. INVERT ELEVATIONS AND DRAIN SLOPES TO BE CARRIED FOR TO CONFIRM PIPE SIZES. EXISTING SANITARY UNDERGROUND DRAINAGE.
16.	EXISTING FUEL OIL PIPING SERVING GENERATOR TO BE CUT, CAPPED AND ABANDONED SAFELY. DEMOLITION TO BE ACCORDANCE WITH THE CONSTRUCTION UPGRADE PLAN DEFINED DURING CONSTRUCTION. EXISTING GENERATOR TO REMAIN IN SERVICE UNTIL PROVISION HAS BEEN MADE FOR THE NEW GENERATOR. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR PROPOSED PHASING PLAN DETAILS.
17.	ALL PRESSURE HOSES AND REELS TO BE PROVIDED IN ACCORDANCE WITH THE MECHANICAL SPECIFICATIONS 29 30 10. ALL PIPING DOWNSTREAM PIPING CONNECTED TO THE PRESSURE WASHERS SHALL BE ASME B31.1 RATED STEEL PIPING. PIPING TO BE PROVIDED BETWEEN PRESSURE WASHERS AND HIGH-LOW, HIGH-LOW AND HOSE REELS TO BE PROVIDED BETWEEN HOSE REELS AND HOSEWANDS TO BE IN ACCORDANCE WITH MECHANICAL SPECIFICATIONS SECTION 22 30 10.
18.	ENBRIDGE TO PROVIDE UTILITY GAS METER COMPLETE WITH MEANS FOR CONTROLS. MEANS FOR CONTROLS GATEWAY OR HARD-WIRE SIGNAL. CONTROLS CONTRACTOR RESPONSIBLE FOR ALL CONTROLS WIRING AND CONFIGURATION FROM METERING DEVICE TO THE BAS.
19.	CONFORM WITH AHJ WHO IS TO PROVIDE THE INCOMING WATER METER (CONTRACTOR OR TOWNSHIP). METER TO BE PROVIDED WITH MEANS FOR CONTROLS TO BAS SIGNAL GATEWAY OR HARD-WIRE SIGNAL. CONTRACTOR RESPONSIBLE FOR ALL CONTROLS WIRING AND CONFIGURATION FROM METERING DEVICE TO THE BAS.
20.	ALL SUB-METERS TO BE PROVIDED BY THE MECHANICAL CONTRACTOR AND SUPPLIED WITH A MEANS FOR COMMUNICATING TO BAS VIA GATEWAY AND/OR HARD-WIRE SIGNAL. CONTRACTOR RESPONSIBLE TO BE CAPABLE OF PULSE AND TOTALIZATION CONSUMPTION MONITORING. REFER TO MECHANICAL SPECIFICATION SECTION 02 10 00 FOR DETAILS.
21.	ALL ELECTRICAL METERING SIGNALS AND COMMUNICATION GATEWAYS TO BE CONNECTED TO THE BAS BY THE CONTROLS CONTRACTOR.



HVAC GENERAL NOTES	
NOTE	DESCRIPTION
1.	DUCT ROUTING INDICATES DESIGN INTENT. CONFIRM EXACT ROUTING AND CO-ORDINATE WITH DUCTWORK, PIPING, EQUIPMENT, ELECTRICAL AND STRUCTURE ON SITE. PROVIDE OFFSETS AND ADJUST ROUTING AS REQUIRED.
2.	CO-ORDINATE EXACT TIE-IN AND SHUT DOWN DATES WITH OWNER. PROVIDE A MINIMUM OF ONE WEEK WRITTEN NOTICE PRIOR TO ANY SERVICE INTERRUPTIONS OR SHUT DOWNS.
3.	DUCTWORK SIZES INDICATE CLEAR INSIDE DIMENSIONS.
4.	BALANCE ALL GRILLES AND DIFFUSERS IN PROJECT AREA TO VOLUMES INDICATED.
5.	REFER TO ARCHITECTURAL FOR PROJECT PHASING AND CONSTRUCTION SCHEDULE.
6.	PROVIDE INSULATION FOR ALL DUCTWORK IN ACCORDANCE WITH MECHANICAL SPECIFICATIONS.
7.	PROVIDE DRIP PAN UNDER ALL PIPING IN ELECTRICAL / IT / COMMS ROOMS C/W DRAIN LINE TO CLOSEST MOP SINK OR FUNNEL FLOOR DRAIN.
8.	SCOPE OF WORK TO BE PERFORMED IN A PHASED AND SEQUENTIAL FASHION IN ORDER TO AVOID DISRUPTION TO THE CURRENT CLIENT OPERATIONS. REFER TO ARCHITECTURAL PHASING PLANS FOR DETAILS. CONTRACTOR TO PROPOSE PHASING PLAN ALONG WITH CONSTRUCTION SCHEDULE TO ACCOMMODATE THIS. NO DEMOLITION OF EXISTING MECHANICAL SERVICES ARE TO BE CARRIED OUT WITHOUT SUFFICIENT NOTICE AND CLIENT SIGN-OFF.
9.	ALL HVAC EQUIPMENT INCLUDING VAV-BOXES TO BE INSTALLED WITH ADEQUATE CLEARANCES AS PER MANUFACTURER'S RECOMMENDATIONS.
10.	REFER TO MECHANICAL SCHEMATICS FOR PIPING INTENT, INSTRUMENTATION AND SIZING DETAILS.

Project Team:
Prime Consultant
GEC ARCHITECTURE
Structural Consultant
ENTUITIVE
Mechanical Consultant
MCW CONSULTANTS LTD.
Electrical Consultant
MCW CONSULTANTS LTD.
Civil Consultant
PLANMAC ENGINEERING
Passive House Consultant
PEEL PASSIVE HOUSE
LEED Consultant
MCW CONSULTANTS LTD.

Client
YORK REGION

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9	ISSUED FOR ADDENDUM #5	2025/07/31
8	ISSUED FOR ADDENDUM #4	2025/07/18
7	REISSUED FOR TENDER	2025/05/23
6	ISSUED FOR TENDER	2025/04/22
5	ISSUED FOR BUILDING PERMIT REVIEW	2024/11/27
4	ISSUED FOR PRE-TENDER	2024/10/31
3	ISSUED FOR 60% CD	2024/05/02
2	ISSUED FOR 100% DD	2024/02/29
1	ISSUED FOR 60% DD	2024/01/25

Drawing History

Scale
As indicated

Checked By
NL

Region of York Project Number
22046

Region of York Building Code
G013-B

Project
YORK REGION NORTH ROADS OPERATIONS CENTRE

3525 BASELINE RD SUITON WEST, ON L0E 1R0

Drawing Title
LEVEL 1 - HVAC PLAN

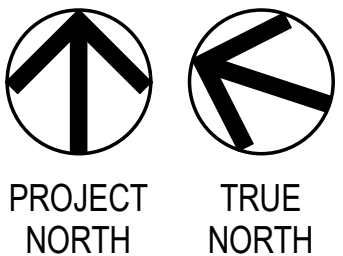
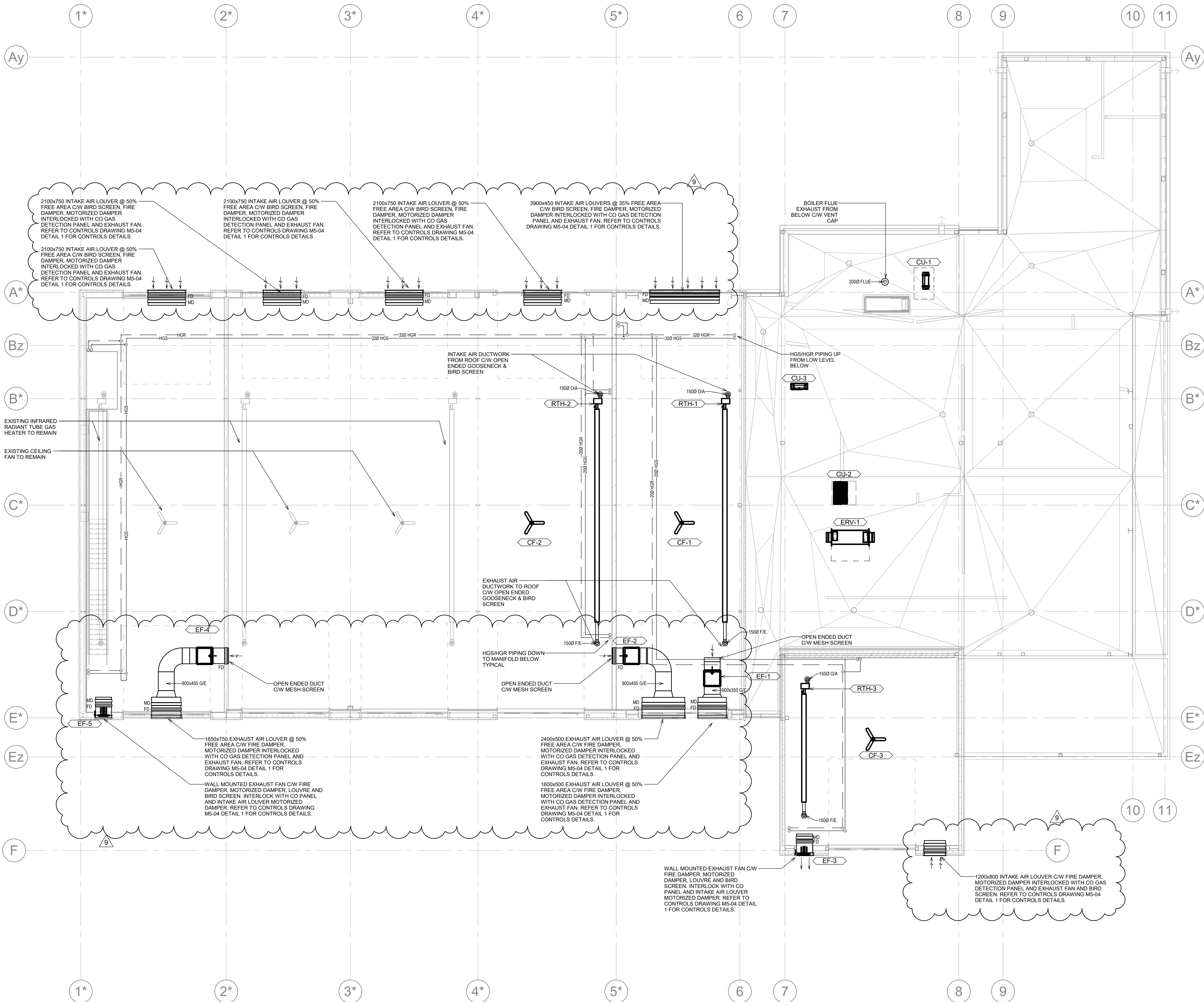
Project Number
23137

Drawing Number
M2-01

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1 LEVEL 1 - HVAC
M2-01 1 : 100

2 ENLARGED MECHANICAL ROOM
M2-01 1 : 50



HVAC GENERAL NOTES	
NOTE	DESCRIPTION
1.	DUCT ROUTING INDICATES DESIGN INTENT. CONFIRM EXACT ROUTING AND CO-ORDINATE WITH DUCTWORK PIPING, EQUIPMENT, ELECTRICAL AND STRUCTURE ON SITE. PROVIDE OFFSETS AND ADJUST ROUTING AS REQUIRED.
2.	CO-ORDINATE EXACT TIE-IN AND SHUT DOWN DATES WITH OWNER. PROVIDE A MINIMUM OF ONE WEEK WRITTEN NOTICE PRIOR TO ANY SERVICE INTERRUPTIONS OR SHUT DOWNS.
3.	DUCTWORK SIZES INDICATE CLEAR INSIDE DIMENSIONS.
4.	BALANCE ALL GRILLES AND DIFFUSERS IN PROJECT AREA TO VOLUMES INDICATED.
5.	REFER TO ARCHITECTURAL FOR PROJECT PHASING AND CONSTRUCTION SCHEDULE.
6.	PROVIDE INSULATION FOR ALL DUCTWORK IN ACCORDANCE WITH MECHANICAL SPECIFICATIONS.
7.	PROVIDE DRIP PAN UNDER ALL PIPING IN ELECTRICAL / IT / COMMS ROOMS C/W DRAIN LINE TO CLOSEST MOP SINK OR FUNNEL FLOOR DRAIN.
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9.	ALL HVAC EQUIPMENT INCLUDING EXHAUST FANS AND ROOF TOP EQUIPMENT INSTALLED WITH ADEQUATE CLEARANCES AS PER MANUFACTURER'S RECOMMENDATIONS.
10.	ALL ROOFTOP EQUIPMENT TO BE PLACED ON ISOLATED ROOF CURBS UNLESS NOTED OTHERWISE.
11.	ALL ROOF PENETRATIONS TO BE MADE GOOD.
12.	ALL DUCTWORK ON ROOF TO BE MOUNTED AT MINIMUM 24" ABOVE THE ROOF SURFACE FOR TO ACCOMMODATE FOR SNOW BUILD.
13.	EXACT PLACEMENT OF EQUIPMENT TO BE COORDINATED ON SITE BASED ON EXISTING SITE CONDITIONS.



Project Team:
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Civil Consultant
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CONSTRUCTION**



9	ISSUED FOR ADDENDUM #5	2025/07/31
8	ISSUED FOR ADDENDUM #4	2025/07/18
7	REISSUED FOR TENDER	2025/05/23
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3	ISSUED FOR 60% CD	2024/05/02
2	ISSUED FOR 100% DD	2024/02/29
1	ISSUED FOR 60% DD	2024/01/25
NO.	ISSUED FOR	DATE

Drawing History	
Scale	As indicated
Checked By	NL
Region of York Project Number	22046
Region of York Building Code	G013-B
Project	
YORK REGION NORTH ROADS OPERATIONS CENTRE	
6525 BASELINE RD SUTTON WEST, ON L0E 1R0	
Drawing Title	
LEVEL 2 & LOW ROOF - HVAC PLAN	
Project Number	23137
Drawing Number	M2-02

IN-SLAB SNOW MELT HEATING SCHEDULE

MANIFOLD DESIGNATION	ZONE	CAPACITY (BTU/HF2)	TOTAL CAPACITY (MBH)	AREA SERVED (SQ.FT.)	MANIFOLD LOCATION	FLUID	EWT (°F)	LWT (°F)	FLOW (GPM)	FLUID PD (FT.HD.)	PIPE SPACING (IN.)	MOTOR SIZE (HP)	POWER SUPPLY					STARTER			CONTROLS			OTHER REQUIREMENTS			REMARKS	NOTES:	
													FLA	MOP	VOLTS	PHASE	LS	NLS	SUPPLIED BY:	INSTALLED BY:	TYPE	MANUAL	AUTO.	INTERLOCK BY:	DISC. AT MOTOR	W.P. DISC. AT MOTOR			F.A. SHUT DOWN
SMA-1	1	185	94.9	5,132	MAIN VESTIBULE	40% PG	140	115	81.8	60	9	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-	1. 120V CONNECTION TO MAIN SNOW MELT CONTROLLER LOCATED IN MECHANICAL ROOM	
SMA-2	2	185	10.2	55	GARAGE BAY	40% PG	140	115	0.9	15	6	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-		
SMA-3	3	185	10.2	55	GARAGE BAY	40% PG	140	115	0.9	15	6	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-		
SMA-4	4	185	10.2	55	GARAGE BAY	40% PG	140	115	0.9	15	6	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-		
SMA-5	5	185	10.2	55	GARAGE BAY	40% PG	140	115	0.9	15	6	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-		
SMA-6	6	185	10.2	55	GARAGE BAY	40% PG	140	115	0.9	15	6	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-		
SMA-7	7	185	10.2	55	GARAGE BAY	40% PG	140	115	0.9	15	6	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-		
SMA-8	8	185	10.2	55	GARAGE BAY	40% PG	140	115	0.9	15	6	-	-	15	120	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	-	-		
NOTES: 1. IN SLAB ON GRADE AREAS LASH 3/4" RAUPEX PIPING TO A 6" WIRE MESH GRID AT 6" O.C. (WIRE MESH PROVIDED BY GENERAL CONTRACTOR) 2. MINIMUM 1 1/2" CONCRETE TO COVER THE SAND COVERINGS OVER THE RAUPEX PIPES. 3. SLEEVE RAUPEX ACROSS EXPANSION JOINTS AND WHEREVER PIPE PASSES OUT OF THE SLAB. 4. INSTALL MANIFOLDS IN SERVICEABLE LOCATION. ENSURE CABINETS ARE LEVEL AND SQUARE. PURGE ALL AIR FROM SYSTEM WHEN FILLING / ALTERNATE MANIFOLD CONFIGURATION MAY BE NECESSARY AS PER MANUFACTURER'S RECOMMENDATION 5. ONLY EVERLOK COUPLERS SHALL BE USED IF PIPE SPLICE IS REQUIRED. 6. MANUFACTURER SHALL PROVIDE DETAILED SYSTEM LOOP DESIGN SHOP DRAWINGS FOR SUBMITTAL AND CONSTRUCTION. CONTRACTOR SHALL NOT DEVIATE FROM APPROVED DRAWINGS. 7. APPLY A 68 LB AIR PRESSURE TEST TO MANIFOLDS AND PIPE FIELD FOR CONCRETE POURS AND THE DURATION OF BUILDING CONSTRUCTION 8. CONTACT MANUFACTURER TO WITNESS INSTALLATION AND PROVIDE INSPECTION REPORT FOR EACH AREA IMMEDIATELY PRIOR TO CONCRETE EMPLACEMENT 9. FILL WITH A 40% MINIMUM GLYCOL. SNOW MELT SYSTEM SHALL BE FILLED AT THE MANIFOLD ONE LOOP AT A TIME ENSURING ALL AIR IS PURGED PRIOR TO FILLING NEXT LOOP. FILL MAINS LAST.																													

FAN SCHEDULE

REFERENCE	DESCRIPTION	LOCATION	SERVING	WEIGHT (LBS)	AIRFLOW (CFM)	PRESSURE (kPa)		FAN RPM	DIAMETER (FT.)	MANUFACTURER	MODEL	MOTOR SIZE		POWER SUPPLY						STARTER			CONTROLS			OTHER REQUIREMENTS:			REMARKS:	NOTES:	
						EXTERNAL STATIC (ESP)	HP					BHP	FLA	MCA	MCOP	VOLTS	PHASE	EMERGENCY		SUPPLIED BY:	INSTALLED BY:	TYPE	MANUAL	AUTO.	INTERLOCK BY:	DISC. AT MOTOR	W.P. DISC. AT MOTOR	F.A. SHUT			
																		LS	NLS												
CEILING FANS																															
CF-1	PARTS/STORAGE BAY CEILING FAN	PARTS ROOM	PARTS ROOM	275	-	-	-	80	16	ENVIRA-NORTH SYSTEMS LTD.	EN675X5010	1.5	-	-	3.60	15	600	3	-	YES	DIV. 20	DIV. 20	PKG	YES	NO	DIV. 20	-	-	-	C/W LOW VOLTAGE MANUAL SPEED CONTROLLER	
CF-2	PARTS/STORAGE BAY CEILING FAN	GARAGE	GARAGE	275	-	-	-	80	16	ENVIRA-NORTH SYSTEMS LTD.	EN675X5010	1.5	-	-	3.60	15	600	3	-	YES	DIV. 20	DIV. 20	PKG	YES	NO	DIV. 20	-	-	-	C/W LOW VOLTAGE MANUAL SPEED CONTROLLER	
CF-3	SIGN GARAGE CEILING FAN	SIGN GARAGE	SIGN GARAGE	275	-	-	-	80	16	ENVIRA-NORTH SYSTEMS LTD.	EN675X5006	1	-	-	3.00	15	600	3	-	YES	DIV. 20	DIV. 20	PKG	YES	NO	DIV. 20	-	-	-	C/W LOW VOLTAGE MANUAL SPEED CONTROLLER	
PROPELLER FANS																															
EF-3	SIGN GARAGE EXHAUST FAN	SIGN GARAGE	SIGN GARAGE	192	2,500	0.4	-	1750	24"	TWIN CITY FAN	21B105	1/4	0.59	-	-	-	208	3	-	YES	DIV. 20	DIV. 20	VFD	NO	YES	DIV. 20	-	-	-	INTERLOCK WITH EXHAUST AIR MOTORIZED DAMPER	
EF-5	GARAGE BAY EXHAUST FAN	WASH BAY	WASH BAY	192	4,000	0.4	-	1750	24"	TWIN CITY FAN	24B105	1/4	0.59	-	-	-	208	3	-	YES	DIV. 20	DIV. 20	VFD	NO	YES	DIV. 20	-	-	-	INTERLOCK WITH EXHAUST AIR MOTORIZED DAMPER	9
INLINE FANS																															
EF-1	GARAGE BAY EXHAUST FAN	PARTS ROOM	PARTS ROOM	126	4,000	0.5	-	1750	-	TWIN CITY FAN	DSI	1	0.66	-	-	-	208	3	-	YES	DIV. 20	DIV. 20	VFD	NO	YES	DIV. 20	-	-	-	INTERLOCK WITH EXHAUST AIR MOTORIZED DAMPER	
EF-2	GARAGE BAY EXHAUST FAN	GARAGE	GARAGE	232	6,000	0.5	-	1750	-	TWIN CITY FAN	BSI	1.5	1.20	-	-	-	208	3	-	YES	DIV. 20	DIV. 20	VFD	NO	YES	DIV. 20	-	-	-	INTERLOCK WITH EXHAUST AIR MOTORIZED DAMPER	
EF-4	GARAGE BAY EXHAUST FAN	GARAGE	GARAGE	232	6,000	0.5	-	1750	-	TWIN CITY FAN	BSI	1.5	1.20	-	-	-	208	3	-	YES	DIV. 20	DIV. 20	VFD	NO	YES	DIV. 20	-	-	-	INTERLOCK WITH EXHAUST AIR MOTORIZED DAMPER	

VAV TERMINAL SCHEDULE

REFERENCE	AREA SERVED	AIR QUANTITY (CFM)		INLET SIZE (mm)	MAX. N.C. LEVEL		PRESSURE DROP (Pa)	MANUFACTURER	MODEL	REMARKS:	NOTES:
		MIN.	MAX.		DISCHARGE						
VAV-1	MAIN CORRIDOR	40	100	100	20	125	NALOR	D3001	CW 3 FT. SOUND ATTENUATOR	1. REFER TO SECTION 23.36.00. 2. C/W 90dbm LONG SOUND ATTENUATOR. 3. DISCHARGE MAXIMUM SOUND POWER LEVEL IN 250Hz OCTAVE BAND (AT 250Pa) w/ 90dbm LONG INTEGRAL SOUND ATTENUATION. 4. WHERE TERMINALS ARE DESIGNATED "CAV" PROVIDE NORMALLY CLOSED (100% SHUT-OFF) CONSTANT VOLUME TERMINAL UNIT. 5. ALL BOXES SHALL BE PRESSURE INDEPENDENT WITH ELECTRIC ACTUATOR AND DIGITAL CONTROLS. CONTROLLER PROVIDED BY CONTROLS SUB-CONTRACTOR AND FIELD INSTALLED. 6. LOW VOLTAGE FROM JUNCTION BOXES TO BE CARRIED BY MECHANICAL CONTRACTOR. 7. STEP DOWN TRANSFORMER FROM JUNCTION BOX BY MECHANICAL CONTRACTOR.	
VAV-2	OPEN OFFICE	70	175	150	21	125	NALOR	D3001	CW 3 FT. SOUND ATTENUATOR		
VAV-3	SHARED OFFICE	25	50	100	-	125	NALOR	D3001	CW 3 FT. SOUND ATTENUATOR		
VAV-4	DISTRICT MANAGERS' OFFICE	25	50	100	-	125	NALOR	D3001	CW 3 FT. SOUND ATTENUATOR		
VAV-5	RESERVED										
VAV-6	RESERVED										
VAV-7	RESERVED										
VAV-8	LUNCH AREA	190	465	200	23	125	NALOR	D3001	CW 3 FT. SOUND ATTENUATOR		
VAV-9	MEETING ROOM	25	75	100	-	125	NALOR	D3001	CW 3 FT. SOUND ATTENUATOR		

DX/VRF INDOOR FAN COIL UNIT SCHEDULE

REFERENCE	LOCATION	SERVING	SUPPLY AIR (CFM)	E.S.P. (IN.WC)	REFRIGERANT	COOLING (DX COIL)			HEATING		MANUFACTURER	MODEL	MCA	MOP	POWER SUPPLY				STARTER		CONTROLS			OTHER REQUIREMENTS			REMARKS:	NOTES:			
						TOTAL (MBH)	SENS (MBH)	E.A.T. (°F)		TOTAL (MBH)					E.A.T. (°F)	VOLTS	PHASE	FED FROM	EMERGENCY		SUPPLIED BY:	INSTALLED BY:	TYPE	MANUAL	AUTO.	INTERLOCK BY:			DISC. AT MOTOR	W.P. DISC. AT MOTOR	F.A. SHUT DOWN
								DB	WB										LS	NLS											
FCU-1	IT ROOM	IT ROOM	742	-	R410A	26.70	-	72	60	-	70.00	LG	LSN363HLV3	-	-	208	1	OUTDOOR UNIT CU-1	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR COOLING OPERATION.		
FCU-2	SHARED OFFICE	SHARED OFFICE	494	0.25	R410A	9.4	8.3	72	60	8.5	70.00	LG	ARNU123MAA4	2.2	208	1	SEE FLOOR PLANS FOR CIRCUIT NUMBER	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR HEATING OPERATION.			
FCU-3	DISTRICT MANAGER OFFICE	DISTRICT MANAGER OFFICE	353	0.25	R410A	7.3	6.5	72	60	6.6	70.00	LG	ARNU003MAA4	2.2	208	1	SEE FLOOR PLANS FOR CIRCUIT NUMBER	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR HEATING OPERATION.			
FCU-4	OPEN OFFICE	OPEN OFFICE	706	0.5	R410A	18.4	15.2	72	60	16.7	70.00	LG	ARNU243MAA4	2.2	208	1	SEE FLOOR PLANS FOR CIRCUIT NUMBER	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR HEATING OPERATION.			
FCU-5	MEETING ROOM	MEETING ROOM	530	0.25	R410A	11.7	10.4	72	60	10.6	70.00	LG	ARNU153MAA4	2.2	208	1	SEE FLOOR PLANS FOR CIRCUIT NUMBER	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR HEATING OPERATION.			
FCU-6	LUNCH ROOM AREA	LUNCH ROOM AREA	1260	0.5	R410A	32	26.7	72	60	29	70.00	LG	ARNU423MDA4	2.9	208	1	SEE FLOOR PLANS FOR CIRCUIT NUMBER	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR HEATING OPERATION.			
FCU-7	ELECTRICAL ROOM	ELECTRICAL ROOM	530	0.25	R410A	17	-	72	60	5.1	70.00	LG	LHN18BH/V1	-	-	208	1	OUTDOOR UNIT CU-3	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR COOLING OPERATION.		
FCU-8	ENCLAVE	ENCLAVE	494	0.25	R410A	9.4	8.3	72	60	8.5	70.00	LG	ARNU123MAA4	2.2	208	1	SEE FLOOR PLANS FOR CIRCUIT NUMBER	-	YES	DIV 23	DIV 23	T-STAT	YES	DIV 23	YES	NO	NO	COMPLETE WITH REMOTE THERMOSTAT. COMPLETE WITH LOW-AMBIENT TEMPERATURE KIT FOR HEATING OPERATION.			

AIR COOLED CONDENSER SCHEDULE (OUTDOOR UNIT)

REFERENCE	DESCRIPTION	ROOF	SERVING	WEIGHT (LBS)	REFRIGERANT	HEATING CAPACITY (kW)	COOLING CAPACITY (kW)	MANUFACTURER	MODEL	POWER SUPPLY				STARTER			CONTROLS			OTHER REQUIREMENTS			REMARKS:	NOTES:
										MCA	MOP	VOLTS	PHASE	SUPPLIED BY:	INSTALLED BY:	TYPE	MANUAL	AUTO.	INTERLOCK BY:	DISC. AT MOTOR	W.P. DISC. AT MOTOR	F.A. SHUT DOWN		
CU-1	AIR-COOLED CONDENSER	ROOF	FCU-1	-	R410A	-	2.8	LG	LSU363HLV3	23	30	208	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	YES	C/W LOW AMBIENT KIT FOR COOLING OPERATION. TO BE PLACED ON ISOLATED ROOF STANDS.
CU-2	AIR-COOLED CONDENSER	ROOF	VRF SYSTEM - OFFICE SPACE	527	R410A	7.60	3.40	LG	ARUM09KCTE5	18.4	25.5	660	3	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	YES	C/W LOW AMBIENT KIT FOR COOLING OPERATION. TO BE PLACED ON ISOLATED ROOF STANDS.
CU-3	AIR-COOLED CONDENSER	ROOF	FCU-7	-	R410A	-	1.30	LG	LUU18BH/V	20	30	208	1	-	YES	DIV. 20	DIV. 20	PKG	-	YES	DIV. 20	-	YES	C/W LOW AMBIENT KIT FOR COOLING OPERATION. TO BE PLACED ON ISOLATED ROOF STANDS.

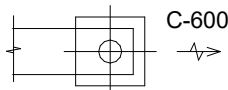
VRF FCU BRANCH SELECTOR SCHEDULE

REFERENCE	DESCRIPTION
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HEAT TRACING AND INSULATION IN EXPOSED BELOW GRADE PARKING AREAS

PIPING SYSTEM	HEAT TRACE	INSULATE	REMARKS:	NOTES:	
POTABLE WATER SYSTEMS				REFER TO SECTION 230533 FOR FURTHER DETAILS	
DOMESTIC COLD WATER	YES	YES			
DOMESTIC HOT WATER	NO	YES			
DOMESTIC HOT WATER RECIRCULATION	NO	YES			
FIRE PROTECTION SYSTEMS					
WET SYSTEM PIPE	YES	YES			
DRY SYSTEM PIPE	NO	NO			
HVAC PIPING SYSTEMS					
CHILLED WATER PIPES (4 PIPE SYSTEM)	YES	YES			
HEATING WATER PIPES (4 PIPE SYSTEM)	NO	YES			
HEATING & COOLING WATER PIPES (2 PIPE CHANGEOVER)	NO	YES			
HEATING & COOLING WATER PIPES (HEAT PUMP SYSTEM)	NO	YES			
DRAINAGE SYSTEMS					
STORM	NO	YES			
SANITARY	NO	YES			
<u>EXCEPTIONS:</u>					
* HEAT TRACE AND INSULATE ANY WET PIPING & DRAINAGE PIPING WITHIN 5 METER RADIUS FROM A PARKING INLET OR EXHAUST AIR VENTILATION SHAFT.					
* ALL PIPING INSTALLED WITHIN A SOFFIT SHALL BE HEAT TRACED AND INSULATED.					

REGISTERS, GRILLES AND DIFFUSERS SCHEDULE

REFERENCE	FUNCTION	CONFIGURATION	MODEL NUMBER	MOUNTING TYPE	REMARKS:
A	SUPPLY AIR	SQUARE PLAQUE	UN-600x600	T-BAR CEILING	REFER TO PLANS FOR NECK SIZE
B	SUPPLY AIR	LOUVERED FACE GRILLE	#10H-O	DRYWALL / SIDEWALL	REFER TO PLANS FOR SIZE
C	RETURN / EXHAUST / TRANSFER AIR	LOUVERED FACE GRILLE	#149H-O	DRYWALL / SIDEWALL	REFER TO PLANS FOR SIZE
D	SUPPLY AIR	1" SLOT LINEAR	S319-1219mm x19mm	EXPOSED	C/W PLENUM & DCG CABLE OPERATED DAMPER
* FOR SUITE DATA AND DIMENSIONS REFER TO MANUFACTURER					
SYMBOL CLARIFICATION				NOTES: 1 - PROVIDE OPPOSED BLADE DAMPER 2 - PROVIDE CABLE OPERATED BALANCING DAMPER	
SELECTION BASED ON		NAILOR INDUSTRIES		C - DIFFUSER/GRILLE TYPE 600x600 - GRILLE SIZE 500 - AIR QUANTITY L/S	

600V, 3 PHASE MOTOR SIZING DATA FOR STARTER

MOTOR		COMBINATION MAGNETIC STARTER				VFD	UNF. DISC. SW. AT MOTOR AMPS	FEEDER & WIRING				REMARK	NOTES
HP	FLA	SIZE	TYPE	CLASS 'J' TIME DELAY FUSE AMPS	BREAKER AMPS (HAGR RATED)	FAST ACTING SWITCH/ FUSE SIZE AMPS		POWER FEEDER		MIN. CONDUIT SIZE			
								MIN. AMPS	MIN. WIRE SIZE	(INCH)	(mm)		
1/2	0.8	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
3/4	1.1	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
1	1.4	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
1 1/2	2.0	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
2	2.7	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
3	3.9	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
5	6.1	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
7 1/2	9	1	FVNR	30/15	20		30	15	3 # 12	1/2"	12		
10	11	1	FVNR	30/15	30		30	15	3 # 12	1/2"	12		
15	17	2	FVNR	30/25	40		30	22	3 # 10	1/2"	12		
20	22	2	FVNR	60/35	50		60	28	3 # 10	1/2"	12		
25	27	2	FVNR	60/45	70		60	34	3 # 8	3/4"	20		
30	32	3	FVNR	60/50	80		60	40	3 # 8	3/4"	20		
40	41	3	FVNR	100/70	100		100	52	3 # 6	1"	25		
50	52	3	FVNR	100/90	125		100	65	3 # 6	1"	25		
60	62	4	RVNR	200/110	150		200	78	3 # 4	1"	25		
75	77	4	RVNR	200/150	175		200	97	3 # 3	1 1/4"	30		
80	82	4	RVNR	200/125	200		200	103	3 # 2	1 1/4"	30		
100	99	4	RVNR	200/175	250		200	124	3 # 1	1 1/4"	30		
GENERAL NOTES: 1. SIZE OF FUSE BASED ON BUSSMAN CLASS 'J' DUAL ELEMENT TIME DELAY FUSES. 2. PROVIDE MANUAL STARTERS FOR ALL 120V MOTORS TO SUIT. 3. ALL STARTERS AND/OR DISCONNECT SWITCHES LOCATED IN PARKING LEVELS SHALL BE MOUNTED BEHIND A LOCKABLE, KEYED ALIKE, SEE-THROUGH COVER. PROVIDE A MINIMUM 10 KEYS.								STARTER TYPES: FVNR - FULL VOLTAGE NON REVERSING RVNR - REDUCED VOLTAGE NON REVERSING PCK - PACKAGED SUPPLIED WITH EQUIPMENT 2SSW - TWO (2) SPEED SINGLE WINDING NOTE: PROVIDE 6 WIRES ON THE LOAD SIDE OF THE STARTER SSMC - SOFT START MOTOR CONTROLLERS RV-SS - DENOTES REDUCED VOLTAGE / SOFT START STARTERS					

208 VOLT, 3 PHASE MOTOR SIZING DATA FOR FULL VOLTAGE STARTING

MOTOR		COMBINATION MAGNETIC STARTER				VFD	UNF. DISC. SW. AT MOTOR AMPS	FEEDER & WIRING				REMARK	NOTES
HP	FLA	SIZE	TYPE	CLASS 'J' TIME DELAY FUSE AMPS	BREAKER AMPS (HACR RATED)	FAST ACTING SWITCH / FUSE SIZE AMPS		POWER FEEDER		MIN. CONDUIT SIZE			
								MIN. AMPS	MIN. WIRE SIZE	(INCH)	(mm)		
1/2	2.2	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
3/4	3.1	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
1	4.0	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
1 1/2	5.7	1	FVNR	30/15	15		30	15	3 # 12	1/2"	12		
2	7.5	1	FVNR	30/15	20		30	15	3 # 12	1/2"	12		
3	10.6	1	FVNR	30/15	25		30	15	3 # 12	1/2"	12		
5	16.7	1	FVNR	30/ 25	40		30	22	3 # 10	3/4"	20		
7 1/2	24.2	1	FVNR	60/ 40	60		60	30	3 # 8	3/4"	20		
10	30.8	2	FVNR	60/ 50	80		60	40	3 # 8	3/4"	20		
15	46.2	2	FVNR	100/ 80	110		100	58	3 # 6	1"	25		
20	59.4	2	FVNR	100/ 100	150		100	75	3 # 4	1"	25		
25	74.8	3	FVNR	200/ 125	175		200	95	3 # 3	1 1/4"	32		
30	88.0	3	FVNR	200/ 150	200		200	110	3 # 2	1 1/4"	32		
40	114.4	4	FVNR	200/ 200	250		200	144	3 #1 0	1 1/2"	38		
50	143.0	4	FVNR	400/ 200	350		400	181	3 #3 0	2"	50		
GENERAL NOTES:								STARTER TYPES:					
1. SIZE OF FUSE BASED ON BUSSMAN CLASS 'J' DUAL ELEMENT TIME DELAY FUSES. 2. PROVIDE MANUAL STARTERS FOR ALL 120V MOTORS TO SUIT. 3. ALL STARTERS AND/OR DISCONNECT SWITCHES LOCATED IN PARKING LEVELS SHALL BE MOUNTED BEHIND A LOCKABLE, KEYED ALIKE, SEE-THROUGH COVER. PROVIDE A MINIMUM 10 KEYS.								FVNR - FULL VOLTAGE NON REVERSING RVNR - REDUCED VOLTAGE NON REVERSING PCK - PACKAGED SUPPLIED WITH EQUIPMENT 2SSW - TWO (2) SPEED SINGLE WINDING NOTE: PROVIDE 6 WIRES ON THE LOAD SIDE OF THE STARTER SSMC - SOFT START MOTOR CONTROLLERS RV-SS - DENOTES REDUCED VOLTAGE / SOFT START STARTERS					



Project Team:

Prime Consultant
GEC ARCHITECTURE

Structural Consultant
ENTUITIVE

Mechanical Consultant
MCW CONSULTANTS LTD.

Electrical Consultant
MCW CONSULTANTS LTD.

Civil Consultant
PLANMAC ENGINEERING

Passive House Consultant
PEEL PASSIVE HOUSE

LEED Consultant
MCW CONSULTANTS LTD.

Client

YORK REGION



Seal & Permit

PRELIMINARY -
NOT FOR
CONSTRUCTION



9	ISSUED FOR ADDENDUM #5	2025/07/31
8	ISSUED FOR ADDENDUM #4	2025/07/18
7	REISSUED FOR TENDER	2025/05/23
6	ISSUED FOR TENDER	2025/04/22
5	ISSUED FOR BUILDING PERMIT	2024/11/27
4	ISSUED FOR PRE-TENDER	2024/10/31
REVIEW		
3	ISSUED FOR 60% CD	2024/05/02
2	ISSUED FOR 100% DD	2024/02/29
1	ISSUED FOR 60% DD	2024/01/25

NO.	ISSUED FOR	DATE
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Drawing History

Scale	Checked By
N.T.S.	NL

Region of York Project Number	Region of York Building Code
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22046 G013-B

Project

YORK REGION NORTH ROADS
OPERATIONS CENTRE

6525 BASELINE RD.SUTTON WEST, ON L0E 1R0

Drawing Title

EQUIPMENT SCHEDULES #3

Project Number	Drawing Number
23137	ME-03

CONTENTS

PART 1 - GENERAL

- 1.01 GENERAL REQUIREMENTS**
- 1.02 SCOPE OF WORK**
- 1.03 QUALITY ASSURANCE**
- 1.04 REFERENCE CODES AND STANDARDS**
- 1.05 SUBMITTALS**
- 1.06 SITE VISIT**

PART 2 - PRODUCTS

- 2.01 ELECTRIC HEATING CABLE**
- 2.02 SYSTEM CONTROL**
- 2.03 ELECTRIC HEAT TRACING FOR FIRE PROTECTION SYSTEMS**
- 2.04 SELF-REGULATING GUTTER DE-ICING HEAT TRACING CABLES**

PART 3 - EXECUTION

- 3.01 GENERAL**
- 3.02 INSTALLATION**
- 3.03 TESTS**
- 3.04 PIPING SYSTEMS WHICH REQUIRE HEAT TRACING AND INSULATION**
- 3.05 INSTALLATION OF SELF-REGULATING GUTTER DE-ICING HEAT TRACING CABLES**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with requirements of the Owner's General Requirements and all documents referred to therein.
- .2 Comply with requirements of Section 20 01 10 Mechanical General Requirements.
- .3 Comply with requirements of Section 20 01 50 Basic Materials and Methods.

1.02 SCOPE OF WORK

- .1 Provision of electric heat tracing systems and equipment heating cables, components and controls to prevent pipelines from freezing as described in this Section.
- .1 Coordinate with the Electrical Trades all systems, equipment and devices.

1.03 QUALITY ASSURANCE

- .1 Electrical heat tracing work shall be performed by a qualified licensed electrician.
- .2 Unless stated otherwise, all electric heat tracing products, materials and equipment shall be ULC listed and ETL approved.

1.04 REFERENCE CODES AND STANDARDS

- .1 Comply with applicable Codes and Standards including the following:
 - .1 Requirements of the Authorities Having Jurisdiction ("AHJs").
 - .2 The Ontario Building Code ("OBC").
 - .3 The Ontario Electrical Safety Code ("OESC")
 - .4 Requirements of the Owner's Insurer.

1.05 SUBMITTALS

- .1 Submit fire protection system shop drawings to the regulatory authority for review and approval prior to submitting to the Design Consultant. Conform to the following requirements:
 - .1 submit shop drawings for all products specified.

1.06 SITE VISIT

- .1 Visit the site prior to tender and verify all conditions. Prior to submitting price, the Mechanical Division Trade Contractor is to review all discrepancies and verify the locations of all existing services that are being extended, and the routing of new services.
- .2 Report all ambiguities, discrepancies, departures from building by-laws and/or from good practice. Failure to do so will result in all additional costs being the responsibility of the Mechanical Division Trade Contractor.
- .3 Include for any alternate routing of new or rerouting of existing services to accommodate all site conditions in the tender price.

PART 2 - PRODUCTS

2.01 ELECTRIC HEATING CABLE

- .1 The specifications are based on Raychem XL-Trace System.
- .2 Provide self-regulating heating cable consisting of two (2) 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field.
- .3 The heating cable shall be covered by a radiation-crosslinked, modified polyolefin dielectric jacket with a braid of tinned-copper and an outer jacket of modified polyolefin (CR) as required by the electrical code.

- .4 Provide heating cable with self-regulating factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 40°F pipe temperature operation to 150°F pipe temperature operation.
- .5 The heating cable shall operate on line voltages of 120 and/or 208 volts without the use of transformers.
- .6 The heating cable shall be sized according to the table below. The required heating cable output rating is in watts per foot at 50°F. Heating cable selection is based on 1" fiberglass insulation on metal piping.

Pipe Size (in.)	Minimum Ambient Conditions (- 10°F)
3 in or less	5 watts
4 in	5 watts
6 in	8 watts
8 in	2 strips – 5 watts
12 in to 14 in	2 strips – 8 watts

- .7 Provide power connection, end seal, splice and feed kit components to be applied in the field.
- .8 Heating cable circuit shall be protected by a ground fault device for equipment protection. Coordinate breaker requirements with Division 26.

2.02 SYSTEM CONTROL

- .1 The system shall be controlled by a line sensing thermostat AMC-1A set at 40°F either directly or through an appropriate contactor.

2.03 ELECTRIC HEAT TRACING FOR FIRE PROTECTION SYSTEMS

- .1 Electric heat tracing used for fire protection system piping shall include supervision at the building fire alarm system for the following:
 - .1 Ground fault
 - .2 Low system temperature
 - .3 High system temperature
 - .4 Temperature sensor failure
 - .5 Primary controller failure
 - .6 Electrical continuity
 - .7 Loss of incoming supply voltage
 - .8 Engagement of secondary controller

2.04 SELF-REGULATING GUTTER DE-ICING HEAT TRACING CABLES

- .1 ***Provide roof and gutter de-icing heat tracing system(s) in accordance with applicable CSA Standards, including, but not limited to, heating cables, electrical wiring and distribution, controls, sensors, roof clips, and downspout hangers as required.***
- .2 ***Provide heating cables equal to Thermal Resources Management (TRM) model SR self-regulating type.***
- .3 ***Cable Construction: dual conductor bus wire cable with an inner conductive core, a protective braid, and polyolefin jacketing for corrosion protection.***
- .4 ***Power output: 5 W/ft, or 8 W/ft standard output rating as required by the application.***
- .5 ***Maximum maintain temperature: 65°C (150°F)***

- .6 **Maximum exposure temperature: 85°C (185°F)**
- .7 **Bus Wires : 16 AWG**
- .8 **Operational voltage of the heating cables shall be 120V or 208-240 V in accordance with electrical service provided.**
- .9 **Provide a CET-GF style thermostat with the capability to provide integral ground fault protection and basic circuit monitoring for loss of power, low ambient temperature, or ground faulting in the heat tracing circuits.**

PART 3 - EXECUTION

3.01 GENERAL

- .1 All wiring and conduit installation shall conform to governing Codes and Standards and shall be inspected, as required, by the Authorities Having Jurisdiction ("AHJ's). Make any corrections to the Work to comply with the requirements of the AHJ's in order to obtain approval for the Work.
- .2 Install all wire and conduit in a neat and secure manner in such a way that it is protected from damage, is not in conflict with mechanical or architectural components and allows for future changes and additions.
- .3 Provide wiring for electrical heat tracing systems to achieve a fully operational system as intended by the design.
- .4 Provide all required interlock connections, relays and control wiring.
- .5 Provide complete wiring diagrams of all circuits.
- .6 Identify all conduits, raceways, and junction boxes using colour bands. Colouring scheme shall be Owner's standard.
- .7 Identify system voltage, phase, neutral and grounding of all junction boxes, conduits and wiring.

3.02 INSTALLATION

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .2 Prior to installation of heating cable system, verify that all piping which will be heat trace has passed all hydrostatic/pressure test and is signed off by the Consultant.
- .3 Secure the heating cable to piping with cable ties or fiberglass tape.
- .4 Prior to installing heating cable on the piping an insulation resistance test shall be performed by the installing contractor to ensure integrity of heating cable as describe in the installation & maintenance manual.
- .5 All heating cable ends shall be protected from moisture ingress until cable is terminated.
- .6 All heat tracing components including power connections, splices, tees, crosses or end seal must be installed above grade and protected from abuse or damage; electrical connections are not permitted to be installed below grade.
- .7 Contractor to furnish & install a 1" plastic conduit to six (6) o'clock position on the below ground water piping as a raceway for the heating cable to the electoral heat traced piping below grade. Conduit sweep shall be clamped to the piping as indicated on the drawings.
- .8 Heating Cable shall be installed in the six (6) o'clock position on all of the below ground, water piping.
- .9 Contractor to furnish & install ¾" plastic conduit from controller to the below ground, hydronic piping as a raceway for the temperature sensor. Conduit shall be strapped to the twelve (12) o'clock position/top of the water piping, extend a distance of 2'-0" on top of the pipe and sealed with a closed end cap as indicated on drawings.
- .10 Temperature sensor shall be installed inside of ¾" plastic conduit and pushed all the way to the closed end. Contractor to wire temperature sensor to C910-485 controller and be responsible for extended temperature sensor wiring as required by the site conditions.

- .11 Install electric heating cable according to the drawings and the manufacturer's instructions. The installer shall be responsible for providing a complete functional system, installed in accordance with applicable national and local requirements.
- .12 Apply "Electric Traced" signs to the outside of the thermal insulation.
- .13 For heat tracing for fire protection piping, all products shall be ULC listed and FM approved meeting the requirements of applicable NFPA Standards.

3.03 TESTS

- .1 After installation and before and after installing the thermal insulation, subject heating cable testing using a 2500 Vdc Megger. Minimum insulation resistance shall be 20 to 1000 megohms regardless of length.

3.04 PIPING SYSTEMS WHICH REQUIRE HEAT TRACING AND INSULATION

- .1 Unless noted otherwise, provide electric heat tracing for piping subject to freezing. Piping located in an unheated or partially heated parking garage is considered as area subject to freezing.
- .2 Refer to the following table for piping systems which require heat tracing.

Piping System	Heat Trace	Insulation
Fire Protection – Sprinkler and Standpipe Systems:		
Drum Drips	Yes ⁽¹⁾	Yes
Drainage Systems:		
Sanitary	No ⁽²⁾	Yes
Notes:		
.1 Heat tracing used for fire protection system to be UL and ULC listed and FM approved meeting the requirements of NFPA 13 and 14 and the Owner's Insurer.		
.2 Sanitary P-traps, and sanitary drainage piping 10 ft (3m) downstream of P-trap, are required to be heat traced and insulated in unheated spaces.		

3.05 INSTALLATION OF SELF-REGULATING GUTTER DE-ICING HEAT TRACING CABLES

- .1 ***Provide a complete roof and gutter de-icing system, including, but not limited to, heating cables, electrical wiring and distribution, controls, sensors, roof clips, and downspout hangers,***
- .2 ***All components of the roof and gutter de-icing system, shall be installed in accordance with local electrical codes, as applicable to each location.***
- .3 ***As per the CEC code, GFI protection MUST be installed in all installations.***
- .4 ***Crossing from the roof edge into the rain water leaders or gutters, slab entry, and junction box installation, shall be completed in accordance with manufacturer's installation instructions.***
- .5 ***For each gutter or rain water leader, two (2) runs of heating cable shall be installed per linear foot of the roof feature to provide 16W/ft of gutter.***
- .6 ***The Contractor shall provide a feed point with a junction box and access hatch in a dry location and in an accessible location to ensure the cable ends are accessible for testing and servicing.***

- .7 ***Heating cable shall be tested with an insulation resistance meter, and an ohm meter. The insulation resistance meter shall be 500 Vdc, with a test result of no less than 20 Mohm. The ohm meter readings shall be within the values as stated on the cable tags.***

END OF SECTION 20 05 33

CONTENTS

PART 1 - GENERAL

- 1.01 GENERAL REQUIREMENTS**
- 1.02 SCOPE OF WORK**
- 1.03 QUALITY ASSURANCE**
- 1.04 SUBMITTALS**

PART 2 - PRODUCTS

- 2.01 TRAP SEAL PRIMERS**
- 2.02 BACKFLOW PREVENTERS**
- 2.03 TRAP SEAL PRIMERS**
- 2.04 WATER HAMMER ARRESTORS**
- 2.05 PRESSURE REDUCING VALVES**
- 2.06 PLUMBING SYSTEM PRESSURE SAFETY RELIEF VALVES**
- 2.07 WATER MAKE-UP PRESSURE REDUCING VALVES**
- 2.08 COMBINATION TEMPERATURE-AND-PRESSURE RELIEF VALVES**
- 2.09 VACUUM RELIEF VALVES**
- 2.10 THERMOSTATIC MIXING VALVES**
- 2.11 ELECTRIC DOMESTIC HOT WATER HEATER (LOW BOY)**
- 2.12 ELECTRIC DOMESTIC HOT WATER HEATER**
- 2.13 ELECTRIC DOMESTIC HOT WATER HEATER WITH BAS INTERFACE**
- 2.14 DOMESTIC HOT WATER TANKLESS (INSTANTANEOUS) HEATER - ELECTRIC**
- 2.15 DRAIN PANS**
- 2.16 DOMESTIC HOT WATER HEATER FLOOR STANDS**
- 2.17 DOMESTIC HOT WATER HEATER MOUNTING BRACKETS**
- 2.18 HYDRO-PNEUMATIC TANKS FOR POTABLE WATER SYSTEMS**
- 2.19 HYDRO-PNEUMATIC TANK FITTINGS**
- 2.20 WATER SOFTENER SYSTEMS**
- 2.21 POTABLE WATER SEDIMENT FILTRATION SYSTEMS**
- 2.22 ULTRAVIOLET (UV) LAMP HIGH INTENSITY DISINFECTION SYSTEM**
- 2.23 ULTRA-VIOLET POTABLE WATER STERILIZER SYSTEMS**
- 2.24 WATER METERS**

PART 3 - EXECUTION

- 3.01 GENERAL INSTALLATION REQUIREMENTS**
- 3.02 PRESSURE REDUCING VALVES**
- 3.03 TRAP SEAL PRIMERS**
- 3.04 WATER HAMMER ARRESTORS**
- 3.05 BACKFLOW PREVENTERS**
- 3.06 INSTALLATION OF THERMOSTATIC MIXING VALVES**
- 3.07 DOMESTIC WATER HEATER INSTALLATION**
- 3.08 INSTALLATION OF WATER SOFTENER**
- 3.09 INSTALLATION OF POTABLE WATER SEDIMENT FILTRATION SYSTEMS**
- 3.10 INSTALLATION OF ULTRAVIOLET (UV) LAMP HIGH INTENSITY DISINFECTION SYSTEM**
- 3.11 INSTALLATION OF WATER METERS**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with requirements of the Owner's General Requirements and all documents referred to therein.
- .2 Comply with requirements of Section 20 01 10 Mechanical General Requirements.
- .3 Comply with requirements of Section 20 01 50 Basic Materials and Methods.
- .4 Comply with requirements of Section 20 10 10 Plumbing Piping and Pumping Systems.

1.02 SCOPE OF WORK

- .1 Provision of plumbing equipment and specialties as described in this Section.

1.03 QUALITY ASSURANCE

- .1 Execute the Work of this Section only by skilled tradesmen regularly employed in the manufacture and installation of plumbing equipment and specialties.

1.04 SUBMITTALS

- .1 Submit the following Shop Drawings:
 - .1 Floor drain trap seal primers;
 - .2 Pressure reducing valves;
 - .3 Water hammer arrestors;
 - .4 Domestic hot water storage tanks;
 - .5 Hydro-pneumatic tanks;
 - .6 Backflow preventers;
 - .7 Water meters;

PART 2 - PRODUCTS

2.01 TRAP SEAL PRIMERS

- .1 Primer Valve Type: Precision Plumbing Products Inc. Model P2-500, or equal, trap primer valve, constructed of brass, adjustable to high or low water pressures and complete with "O" ring seals, 12 mm (½") threaded inlet and outlet connections, and, for priming two traps from the same primer, a DU-2 dual outlet distribution unit.
- .2 Primer Valve Type with Manifold: Precision Plumbing Products Inc. Model P1-500, or equal, trap primer valve constructed as specified above for the Model P2-500 primer valve, complete with a Model DU-3 or DU-4, 3 or 4 outlet distribution unit for priming 3 or 4 traps, and at Model "YS-8" supply tube with combinations of Model DU-3 and DU-4 distribution units for priming from 5 to 6 traps.
- .3 Electronic Type: Precision Plumbing Products #PT Series, or equal, surface wall mounting, CSA certified, 115 volt, 1 phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:
 - .1 a galvanized steel cabinet with door;
 - .2 20 mm (¾") dia. NPT copper pipe inlet with shut-off valve and water hammer arrestor;
 - .3 a solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (½") dia. compression type copper tube connections on 40 mm (1½") centres with quantity to suit the number of items to be primed;
 - .4 a control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

2.02 BACFLOW PREVENTERS

- .1 Reduced pressure zone ("RPZ") style dual check valve design backflow preventers in accordance with CAN/CSA B64 (including supplements), each of bronze or epoxy coated cast iron bronze fitted construction depending on size, and complete with inlet strainer, inlet and outlet shut-off valves, an intermediate relief valve, ball valve type test cocks, and a proper air gap fitting.

2.03 TRAP SEAL PRIMERS

- .1 Equal to Precision Plumbing Products (PPP) model PTS electronic trap seal trap priming assembly shall automatically maintains a constant water seal in floor drain traps configured to accommodate 4 to 30 connections. Electronic trap seal primer assembly shall be as follows:
 - .1 Surface mounted NEMA-1 metal cabinet with cover plate: 12" x 12" x 4" deep (305mm x 305mm x 102mm deep)
 - .2 Domestic water inlet: ¾" (20mm) shut-off valve with female threaded connection to ANSI/ASME B1.20.1.
 - .3 Outlet: ½" (12mm) compression fitting(s) to SAEJ512.
 - .4 Manifold: ¾" (20mm) Type "L" copper tubing to ASTM B88.
 - .5 Soldered joints: 95-5 lead free containing lead not in excess of 0.2%.
 - .6 Electrical components: 2 Amp circuit breaker, manual over-ride switch/test button, timer, solenoid valve marked as UL listed.
 - .7 Backflow prevention: Anti-Siphon atmospheric vacuum breaker meets American Society of Sanitary Engineering (ASSE) Standard 1001 and CSA.
 - .8 Temperature rating: 32°F to 125°F (0°C to 51.7°C)
 - .9 Pressure rating: 20 psi to 150 psi (140 kPa to 1035 kPa).
 - .10 Electrical Specifications: 120V/1ph/60Hz; Watts: 6; Holding: 16 VA; In-rush: 34 VA

2.04 WATER HAMMER ARRESTORS

- .1 Piston type, 304 stainless steel, pressurized water hammer arrestors, each complete with a nesting type bellows and a casing of sufficient displacement volume to dissipate the kinetic energy generated in the piping system, a male treaded nipple connection, suitable for either vertical or horizontal installation, and each sized to suit the connecting potable water pipe and equipment it is provided for.

2.05 PRESSURE REDUCING VALVES

- .1 For piping 65 mm (2-1/2") diameter and larger, non-corrosive pilot operated pressure reducing valve to CAN/CSA B356, factory set at the required pressure, field adjustable, and complete with a bronze body and trim, screwed or flanged connections, and brass body pilot valve with stainless steel seat.

2.06 PLUMBING SYSTEM PRESSURE SAFETY RELIEF VALVES

- .1 Valve: to ASME Section IV.
- .2 Body Construction: brass.
- .3 Adjustable Pressure Setting: 8 to 25 psig (55 to 172 kPa).
- .4 Maximum Operating Differential Pressure From Open To Close:
 - .1 3 psig (20 kPa).
- .5 Acceptable Manufacturers:
 - .1 Bell & Gossett;
 - .2 Watts;
 - .3 Or Approved Equivalent

2.07 WATER MAKE-UP PRESSURE REDUCING VALVES

- .1 Iron body water pressure regulator with:

- .1 Low inlet pressure check valve;
- .2 fast fill /purge lever;
- .3 Removable stainless steel strainer, and;
- .4 Iron body diaphragm operated relief valve
- .2 Adjustable Low Pressure: 0.8 to 25 psig (55 to 172 kPa).
- .3 Acceptable Manufacturers:
 - .1 Bell & Gossett;
 - .2 Watts - No.1450F series
 - .3 A.W. Cash Valve - Type CBL
 - .4 Or Approved Equivalent

2.08 COMBINATION TEMPERATURE-AND-PRESSURE RELIEF VALVES

- .1 ASME rated and stamped. Include relieving capacity at least as great as heat input and include pressure setting less than working-pressure rating of domestic hot water heater. Select relief valves with sensing element that extends into storage tank.

2.09 VACUUM RELIEF VALVES

- .1 ANSI Z21.22/CSA 4.4.

2.10 THERMOSTATIC MIXING VALVES

- .1 Provide Lawler Mfg. Co., Inc., or Consultant approved equal, Master Controller mixing valves in accordance with the following.
- .2 Reference Standards:
 - .1 ASSE 1070 – Performance Requirements for Water Temperature Limiting Devices.
 - .2 ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment.
 - .3 CSA B125.3 - Plumbing Fittings.
 - .4 cUPC - Certification and listed for compliance with both ASSE 1017 and Canadian Standard B125.3.
 - .5 Certified Lead Free to NSF 372.
- .3 Construction:
 - .1 Maximum Inlet Pressure: 125 psi (862 kPa).
 - .2 Maximum Inlet Temperature: 200°F (93°C).
 - .3 stainless steel piston and liner.
 - .4 bronze body with replaceable corrosion-resistant components.
 - .5 liquid-filled thermal motor.
 - .6 one of three adjustable temperature setpoint range (see table below).
 - .7 high temperature limit stop.
 - .8 check valve inlets with stainless steel strainers.
 - .9 vandal-resistant temperature adjustment.
- .4 Performance:
 - .1 Temperature maintained to within ASSE and cUPC guidelines if change in hot or cold water is not more than 30°F (17°C).
 - .2 pressure fluctuations compensated for up to 50 percent drop in inlet supply pressure; water flow reduced if supply fails (Lawler 310).

.3 Capacity shall be in accordance with the following:

Thermostatic Mixing Valve Performance Requirements									
Lawler Model	Inlet Size (in.)	Outlet Size (in.)	Min Flow (usgpm)	Min Flow with Recirc. (usgpm)	Rated Flow at 10 psi WPD (usgpm)	Rated Flow at 45 psi WPD (usgpm)	Temp. Setpoint Range (1) (°F)	Temp. Setpoint Range (2) (°F)	Temp. Setpoint Range (3) (°F)
310-1/2"	1/2"	1/2"	0.5	N/A	2.5	7	100°F – 150°F	50°F – 100°F	85°F – 135°F
310-3/4"	1/2"	3/4"	0.5	N/A	5.5	12	100°F – 150°F	50°F – 100°F	85°F – 135°F
6625	3/4"	3/4"	3.75	0.5	12	25	100°F – 150°F	50°F – 100°F	85°F – 135°F
6650	3/4"	1"	7.5	0.5	25	50	100°F – 150°F	50°F – 100°F	85°F – 135°F
801	3/4"	1"	1	0.5	25	50	110°F – 140°F	70°F – 100°F	90°F – 120°F
802	1"	1-1/4"	2	0.5	39	80	110°F – 140°F	70°F – 100°F	90°F – 120°F
803	1-1/2"	1-1/2"	3	0.5	60	125	110°F – 140°F	70°F – 100°F	90°F – 120°F
804	1-1/2"	2"	4	0.5	72	150	110°F – 140°F	70°F – 100°F	90°F – 120°F
805	2"	2"	5	0.5	96	200	110°F – 140°F	70°F – 100°F	90°F – 120°F

.5 Finish:

.1 Rough bronze unless noted otherwise.

2.11 ELECTRIC DOMESTIC HOT WATER HEATER (LOW BOY)

- .1 The Domestic Hot Water heater(s) shall be Dura-Power Commercial Electric Model DEL as manufactured by A. O. Smith, or approved equal, cUL listed, CSA labeled, and approved to the NSF Standard 5. Tanks shall be ASME rated for 150 psi working pressure.
- .2 Domestic Hot Water heaters(s) shall be in accordance with storage volume, heater capacity and heater electrical service in accordance with the Equipment Schedules.
- .3 Domestic Hot Water heaters(s) shall meet the standby loss requirements of the U.S. Department of energy and current edition of ASHRAE/IES 90.1.
- .4 Domestic Hot Water heaters(s) shall be equipped with extruded high density anode rod.
- .5 All internal surfaces of the heater(s) exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 1400°F to 1600°F.
- .6 Electric heating elements shall be medium watt density with zinc plated copper sheath.
- .7 Each element shall be controlled by an individually mounted thermostat and high temperature cutoff switch.
- .8 Manufacturer shall supply CSA, ASME rated Temperature and Pressure (T&P) relief valve.
- .9 The outer jacket shall be of backed enamel finish and shall enclose the tank with foam insulation.
- .10 Electrical junction box with heavy duty terminal block shall be provided, except on 120V & 277V models, and no junction box provided on models DEL-6 through DEL-20.
- .11 The drain valve shall be located in the front for ease of servicing.
- .12 Heater tank shall have a three year limited warranty.
- .13 Acceptable Manufacturers:

- .1 A.O. Smith;
- .2 Rheem- Ruud;
- .3 PVI Industries;
- .4 Or Consultant approved equal.

2.12 ELECTRIC DOMESTIC HOT WATER HEATER

- .1 The Domestic Hot Water heater(s) shall be Gold Series Commercial Electric Model DRE as manufactured by A. O. Smith, or approved equal, cUL listed, CSA labeled, and approved to the NSF Standard 5. Tanks shall be ASME rated for 160 psi working pressure.
- .2 Heater(s) shall be in accordance with storage volume, heater capacity and heater electrical service in accordance with the Equipment Schedules.
- .3 Tanks shall be equipped with extruded high-density anode. All internal surfaces of the heater(s) exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 1400°F to 1600°F.
- .4 Electric heating elements shall be low watt density. Each heating element shall be controlled by a thermostat and high temperature cut-off switch mounted to the surface of the storage tank directly above the heating elements they control. All internal circuits shall be fused.
- .5 The outer jacket shall be of baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panel. The outer jacket shall enclose the tank with foam insulation that meets standby loss requirements of NRCan and current edition of ASHRAE/IES 90.1.
- .6 Electrical junction box with heavy duty terminal block shall be provided.
- .7 A drain valve shall be located in the front for ease of servicing.
- .8 Manufacturer shall supply CSA, ASME rated Temperature and Pressure (T&P) relief valve.
- .9 Heater tank shall have a three year limited warranty.
- .10 Acceptable Manufacturers:
 - .1 A.O. Smith;
 - .2 Rheem- Ruud;
 - .3 PVI Industries;
 - .4 Or Consultant approved equal.

2.13 ELECTRIC DOMESTIC HOT WATER HEATER WITH BAS INTERFACE

- .1 The heater shall be a glass-lined Custom Xi commercial electric model DSE as manufactured by A. O. Smith, or approved equal.
- .2 Heater(s) shall be in accordance with storage volume, heater capacity and heater electrical service in accordance with the drawing schedules.
- .3 Heater shall be constructed in accordance with ASME Code, shall bear appropriate symbol and be listed with the National Board as required. Heater shall be cUL listed, CSA labeled and classified to The National Sanitation Foundation Standard No. 5.
- .4 All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature of 1600°F. Tank shall be cathodically protected with a combination of sacrificial and powered anodes.
- .5 The entire vessel is to be enclosed in a round steel outer jacket with baked enamel finish. The outer jacket shall enclose the tank with foam insulation that meets standby loss requirements of NRCan and current edition of ASHRAE/IES 90.1.
- .6 Water heater shall have an electronic control with large LCD displaying current water heater status; provide real time element status and sensing, low water cut-off and economy mode operation, and have the capability of connecting to a Building Automation System (BAS) via BACnet or MODBUS

gateway. Heater shall include a 120 volt control circuit transformer, transformer fusing, magnetic contactor(s), element fusing per N.E.C., and commercial grade incoloy elements. Temperature controls include limiting switch which will require resetting manually in the event the temperature reaches 202°F.

- .7 A drain valve shall be located in the front for ease of servicing.
- .8 Heater shall include a CSA Certified and ASME Rated Temperature and Pressure (T&P) relief valve.
- .9 Acceptable Manufacturers:
 - .1 A.O. Smith;
 - .2 Rheem- Ruud;
 - .3 PVI Industries;
 - .4 Or Consultant approved equal.

2.14 DOMESTIC HOT WATER TANKLESS (INSTANTANEOUS) HEATER - ELECTRIC

- .1 Provide Chronomite Laboratories Inc., R Series, or equal, undercounter, tankless, domestic-water heaters with performance as noted on the Equipment Schedules.
- .2 Heaters shall be listed to UL 499 "Electric Heating Appliance", and certified to CAN/CSA C22.2 Canadian Electrical Code, Part II, No. 88 "Industrial Heating Equipment."
- .3 Construction: Plastic heating chamber with direct-insertion heating element, mounted in a No. 4 brushed finish stainless steel housing.
 - .1 Connections: 3/4 NPS ASME B1.20.1 male pipe thread.
 - .2 Operating Pressure: [25 psig (175 kPa)]
 - .3 Pressure Rating: [150 psig (1035 kPa)]
 - .4 Minimum Operating Flow: 0.35 gpm (1.3 L/m).
 - .5 Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - .6 Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - .7 Enclosure: Cast aluminum, NEMA 1.
- .4 Capacity and Characteristics:
 - .1 Flow Rate Range: 0.35 - 5.0 usgpm (1.3 - 18.9 L/m)
 - .2 Minimum Operating Flow to Activate Heater: 0.35 usgpm (1.3 L/m).
 - .3 Temperature Setting, Adjustable: 70 - 125°F (21 - 52°C).
 - .4 Electrical Characteristics: as noted on the Equipment Schedules
 - .5 Ambient Operating Temperature: 140°F (60°C), maximum.
- .5 Accessories:
 - .1 Disconnect Switch: 80A, lockable, in NEMA 4X enclosure.
 - .2 Q-Quite, clickless activation.
 - .3 Digital readout.
 - .4 Support bracket for wall mounting.
- .6 Acceptable Manufacturers;
 - .1 Chronomite Laboratories Inc.
 - .2 A.O. Smith.
 - .3 Bosch Thermotechnology Corp.

- .4 Eemax, Inc.
- .5 Stiebel Eltron, Inc.
- .6 Or Consultant approved equal

2.15 DRAIN PANS

- .1 Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads.

2.16 DOMESTIC HOT WATER HEATER FLOOR STANDS

- .1 Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic hot water heater and water. Include dimension that will support bottom of domestic hot water heater a minimum of 18" (457 mm) above the floor.

2.17 DOMESTIC HOT WATER HEATER MOUNTING BRACKETS

- .1 Manufacturer's factory-fabricated steel bracket for wall mounting, or mounting above a ceiling, capable of supporting domestic-water heater and water.

2.18 HYDRO-PNEUMATIC TANKS FOR POTABLE WATER SYSTEMS

- .1 Bladder type tank for Hydro-pneumatic applications for potable water system. The Domestic Cold Water shall not come into contact with the steel tank.
- .2 Capacity: As indicated on drawings.
- .3 Tanks shall be welded steel construction, ASME Section VIII, Division 1 suitable for a working pressure upto 250 psig (1722.5 kPa) and a temperature of 240°F (115°C).
- .4 Air shall be pre-charged at 40 psig (275.6 kPa). Tank shall be complete with an air charging valve.
- .5 Bladder shall be made of heavy duty Butyl Bladder.
- .6 All internal parts shall comply with the requirements of ANSI/NSF 61, FDA, Canadian Water Quality Association and Health Canada requirements.
- .7 Tanks shall be supported by steel legs or base for floor installations and shall be supported by adequate straps and hangers for ceiling installations.
- .8 Acceptable Manufacturers:
 - .1 Amtrol Well-X-Trol Series;
 - .2 Armstrong WX-L Series;
 - .3 HG Spec Expanflex AFX Series;
 - .4 Or Approved Equivalent.

2.19 HYDRO-PNEUMATIC TANK FITTINGS

- .1 Expansion tank air control fitting.
- .2 Working Pressure: 125 psig (860 kPa).
- .3 Adjustable vent tube and built in manual vent valve.
- .4 Acceptable Manufacturers:
 - .1 Amtrol;
 - .2 Bell and Gossett;
 - .3 Or Approved Equivalent.

2.20 WATER SOFTENER SYSTEMS

- .1 Softener to have performance as noted on the Drawings.
- .2 Provide a complete automatic packaged and matched duplex commercial water softening system comprised of softener tank(s), brine tank and control valve(s) complete with following components:

- .1 Softener Tank(s):
 - .1 Tanks to be sized for 100% of make-up requirements.
 - .2 Electrical welded pressure vessel, low carbon steel construction rated for 689.5 kPa (100 psi) working pressure and a minimum design pressure of 1.2 times working pressure amount. Tanks to be capable of withstanding testing with pressure fluctuations from 0 to 827 kPa (0 to 120 psi) for a minimum of 30,000 cycles.
 - .3 Each tank to be equipped with openings for mineral filling and periodic inspection.
 - .4 Tank finish to be a rust inhibiting primer.
- .2 Poly Brine tank with cover.
- .3 All tanks to be supported on structural steel legs that permit skid mounting. If required, comply with seismic zone 4 loading requirements.
- .4 Control valve shall be Fleck Model 2900, or Consultant approved equal, fully integrated programmable microprocessor driven electronic controller to automatically cycle main operating valve through regeneration cycle, and as follows:
 - .1 Valve Material: Lead-free Brass
 - .2 Regeneration Type: Time Clock or Metered
 - .3 Flow Rate: 2" (65mm) up to 106 usgpm (continuous), up to 140 usgpm (peak)
 - .4 Adjustable backwash rate
 - .5 Operating Pressure: 20 - 125 psi
 - .6 Operating Temperature: 34°F - 110°F (1°C - 43°C)
 - .7 Certifications:
 - .1 NSF/ANSI Standard 61 Certified
 - .2 NSF/ANSI Standard 372 Certified (Lead-free).
- .5 Audible alarm capable of emitting a tone of ~70 dBA and able to be disabled.
- .6 Easily removable flow sensor with accuracy to 1% over full range and repeatability to +/- 0.5% of full range.
- .7 Ion exchange resin capable of removing 30,000 grains of hardness with 6.8 kg (15 lb) of salt.
- .8 Complete set of instructions, installation and operating manuals.
- .9 Field service availability to supervise, inspect and provide operator training.
- .10 Warranty covering workmanship and materials.
- .11 Acceptable manufacturers are:
 - .1 Neotec Water Treatment
 - .2 Culligan Canada;
 - .3 Petwa Ltd;
 - .4 WaterMart;
 - .5 WaterGroup Companies Inc.

2.21 POTABLE WATER SEDIMENT FILTRATION SYSTEMS

- .1 Provide Judo model Profimat-Plus-ATP, or equal, protective potable water sediment filters with automatic backwash (time and differential pressure controlled) with performance and capacity as noted on the Drawings, and as follows:
 - .1 Suitable for installation in horizontally and vertically orientation,

- .2 Complete with silver coated, stainless steel filter screen and high-efficiency point rotation system.
- .3 Suitable for drinking water temperature up to 86°F (30°C)
- .4 Operating pressure range: 20 - 230 psi (1.5 - 16 bar) for systems up to 2" (50mm) line size,
- .5 20 – 145 psi (1.5 - 10 bar) for sizes 2 ½" – 4" (65 – 100mm),
- .6 Plastic filter housing,
- .7 Servomotor,
- .8 Threaded connections (up to 2" [50mm]) line size; flanged connections for sizes 2 ½" (65mm) and larger.
- .9 Automatic time-controlled and differential pressure-dependent backwash cycle,
- .10 Backwashing based on point rotation system with simultaneous cleaning of the inspection bell,
- .11 Adjustable backwash differential pressure up to maximum 1.5 psi (0.1 bar),
- .12 Electronic controller with function and fault display (light diode and buzzer), including:
 - .1 plug-in power supply,
 - .2 timer controlled backwash,
 - .3 settings: hourly, daily, weekly, monthly,
 - .4 manual backwash start-up button.

2.22 WELL-WATER PRE-TREATMENT FILTRATION SYSTEM

- .1 Provide Viqua model AWP42B-V, or Consultant approved equal, heavy-duty three-piece design filter housing as follows:
 - .1 maximum 40 usgpm (2.5 l/s) flow rate per filter housing.
 - .2 accepts 4-½" x 20" nominal filter cartridges (provide additional set of spare filter cartridges at turn over).
 - .3 manufactured from food grade materials.
 - .4 complete with pressure relief valve.
 - .5 complete with mounting bracket and wrench.
 - .6 NSF 42 Certified.

2.23 ULTRAVIOLET (UV) LAMP HIGH INTENSITY DISINFECTION SYSTEM

- .1 Provide UV Pure, Model Hallett 1000P, or equal, high intensity amalgam ultraviolet (UV) pressurized/enclosed treatment disinfection system including all equipment, performance, components, requirements to achieve the desired system output.
- .2 UV equipment shall be designed for continuous and intermittent operation in environments and conditions that are typically found in a water treatment facility.
- .3 UV equipment shall be arranged for easy access to serviceable items such as, but not limited to, UV lamps, UV sensors, and ballasts.
- .4 The UV reactor, including all wetted components shall be certified to the NSF/ANSI 61 standard by third party independent body.
- .5 Water Quality and Operating Range:

Maximum Solids Content (Turbidity)	1 NTU
Maximum Hardness	855 mg/L
Maximum Iron Concentration	3 mg/L

Maximum Manganese Concentration	0.05 mg/L
UV Transmittance (UVT) Range @ 253.7 nm	50-99%*
Water Temperature Range	34-95°F (1-35°C)
Ambient Air Temperature Range	34-104°F (1-40°C)
Relative Humidity	30% to 70%
Flow Range	0-100 USgpm (0-378 Lpm)*
Water Pressure Range	5-100 psi (34-690kPa)

*The UV dosage dependent on the min. UVT and max. water flow

.6 UV Equipment Requirements

Inlet Connection Required	2" Female NPT
Outlet Connection Required	2" Female NPT
Input Power	120Vac, 1phase, 60Hz, 403W (max) (2 wire + ground)
Maximum Headloss (@100gpm, 378 lpm) – see Flow Curve for flow characteristic	4.4 psi (30kPa)
Minimum Lamp aging factor	0.85

.7 UV dosage at end-of-lamp-life (EOLL):

- .1 UV dosage at end-of-lamp-life shall be validated from 16.8 to 200.6 mJ/cm² in flows ranging from 6.2 to 101.5 USgpm and Ultraviolet Transmittance (UVT) ranges of 34.3 to 98.9%.
- .2 The default UV dose alarm setting is 40mJ/cm², at the end-of-lamp-life, and this can be adjusted for application specific requirements.

.8 Flow Characteristics:

- .1 Maximum 1 psi WPD at 32 usgpm,
- .2 Maximum 4 psi WPD at 94 usgpm.

.9 Product Requirements:

- .1 The UV equipment shall operate in an enclosed reactor and use high output amalgam UV lamps.
- .2 Arrange system such that draining of the UV equipment shall not be required to change UV lamps or to perform calibration checks on the UV intensity sensors.
- .3 All wetted materials exposed to UV light shall be 316 stainless steel, quartz equivalent to GE Type 214, FKM, or other suitable UV resistant material.
- .4 The electrical system shall be designed to provide maximum reliability of the UV equipment.
- .5 All heat sensitive components shall be adequately cooled with forced dry air.
- .6 The UV equipment shall be equipped with over temperature safety devices to prevent scalding conditions should any device fail.
- .7 The UV equipment shall be designed to allow operators to perform routine maintenance such as lamp replacement, without the use of special tools.
- .8 The UV equipment shall be equipped with a safety interlock to prevent accidental exposure to UV light in the event the system is not powered down during lamp replacement.

.10 UV Lamps:

- .1 The UV Lamp shall be rated for minimum useful life of 12,000 hours.

- .2 The UV Lamp shall be able to be cycled up to 12 times within a 24 hour period.
- .3 The UV Lamp shall use high purity quartz such as GE type 219 or equivalent with coating to ensure constant UV output over complete lamp lifetime.
- .4 The UV Lamp shall use bases of ceramic construction, resistant to UV light with electrical connection at one end only.
- .5 The UV Lamp filament shall be rugged to withstand shock and vibration.
- .6 The UV Lamp shall have monochromatic spectral output with the emissions peaking at 253.7nm and shall be non-ozone producing.
- .7 The UV Lamps shall maintain a steady output over water temperature range of 34-95°F (1-35°C).
- .8 The UV Lamps shall be removable with the quartz sleeve and automatic quartz cleaning device remaining in place.
- .9 The UV Lamps shall be able to startup and reach full power without water flow for up to 15 minutes in ambient conditions.
- .11 UV Reactor:
 - .1 The 2" male NPT ports of UV reactor shall be connected through a 2-bolt pump flange for convenient installation and disassembly.
 - .2 The UV chamber within the UV reactor shall be easily accessible without tools to allow inspection of quartz sleeve and automatic quartz cleaning device without draining of the reactor.
 - .3 The UV lamps within the UV reactor shall be mounted in air to minimize effect from changes in water temperature.
 - .4 The UV chamber within the UV reactor shall contain reflective panels to ensure 360° coverage of UV radiation to prevent shadowing.
 - .5 The quartz sleeve shall be clear fused quartz GE Type 214 or equivalent with a minimum UV transmissibility of 88 percent.
- .12 Automatic Quartz Cleaning System:
 - .1 Each UV reactor shall be equipped with an electronically powered quartz cleaning system that will automatically function without operator intervention.
 - .2 The automatic quartz cleaning system shall consist of 316 stainless steel wipers for mechanical cleaning.
 - .3 The automatic quartz cleaning system shall not use any chemicals.
 - .4 The wiping cycle shall occur on power up of the lamps and then once every 4 hours by default. The wiping cycle shall be adjustable and also be initiated at any time by an operator.
 - .5 The wiped portion of the quartz sleeve shall consist of the entire length of the exposed quartz within the UV chamber.
 - .6 The automatic quartz cleaning system shall contain a sensor to confirm operation and also return wipers to correct park position.
- .13 UV Intensity Monitoring System:
 - .1 Each individual UV lamp shall be continuously monitored by its own UV intensity sensor.
 - .2 Each UV intensity sensor shall be mounted in air to prevent water fouling from affecting its performance.
 - .3 The UV intensity sensor shall be removable from the UV reactor for reference checking with a factory calibrated spare without interrupting the disinfection process or draining of the UV reactor.

- .4 The UV intensity sensor shall measure the germicidal portion of the light emitted by the UV lamps at 253.7nm.
- .5 The UV intensity sensor shall be factory calibrated. Calibration shall be valid for a minimum of one (1) year from beginning of service.
- .14 Automatic Purging System:
 - .1 Each UV reactor shall be equipped with a purge valve to regulate water temperature within the UV reactor during periods of no flow.
 - .2 The setpoint for purge valve operation shall be adjustable.
 - .3 The purge valve shall discharge water from the UV reactor if low UVT water is detected within the UV chamber.
- .15 Electrical Enclosure:
 - .1 The UV equipment shall be powered and controlled by one electrical enclosure.
 - .2 The electrical enclosure shall be mounted to the UV reactor and contain the microcontroller, electronic ballasts, and power distribution devices.
 - .3 The electrical enclosure shall be powered by a detachable power cord.
- .16 Electronic Ballasts:
 - .1 Each ballast shall drive one UV lamp.
 - .2 Ballasts shall incorporate a filament pre-heat circuit to improve reliability of lamp startup and allow for multiple on/off lamp cycles per day.
 - .3 Ballasts shall be installed with polarized connectors for ease of maintenance.
 - .4 Operating power factor for the ballasts shall be 0.98 or higher.
- .17 Instrumentation and Controls
 - .1 The control system shall continuously monitor and control the UV equipment's functions.
 - .2 Complete control and monitoring of the UV equipment shall be accomplished through the operator interface.
 - .3 The operator interface shall be a color touchscreen and display the following information: UV system status, UV Dose, UV Intensity, UVT prediction, UV lamp lifetime, maximum prescribed flow rate, countdown for warm up and power down, UV Lamp cycles, power cycles, cycle time of automatic quartz cleaning device, unit temperatures including water, pcb, lamp and overall system.
 - .4 The control system shall provide warnings and alarms for all critical devices and functions in both visual and audible format.
 - .5 The control system shall contain a real time clock.
 - .6 The control system shall maintain a log of the last 100 events and record the time of the event and all critical parameters.
 - .7 The control system shall provide discrete outputs in the form of dry contacts for warning and alarm conditions for remote monitoring.
 - .8 The control system shall allow remote operation of the UV lamps with the UV reactor on standby when not in use.
 - .9 The control system shall be able to provide analog outputs for UV Dose, or UV Intensity, or predicted UVT, and Modbus connectivity.
 - .10 The control system shall be able to provide continuous data logging every 30 seconds onto a USB drive.
 - .11 The control system shall be able to connect to and control a solenoid valve for automatic shutdown of untreated water.

- .18 Safety Warnings and Alarms:
 - .1 The control system shall provide the following warnings at a minimum:
 - .1 End of lamp life approaching
 - .2 End of lamp life exceeded
 - .3 Lamps cycling too often
 - .4 Quartz Cleaning device not operating
 - .5 Water temperature approaching high limit
 - .6 System temperature approaching high limit
 - .7 Temperature sensor failure
 - .2 The control system shall provide the following alarms at a minimum:
 - .1 Low UV Dose
 - .2 Low UV Intensity
 - .3 UV Lamp failure
 - .4 Lamps Not Starting
 - .5 UV Door Open
 - .6 PCB temperature too high
 - .7 System temperature too high
 - .8 Water temperature too high
 - .9 UV sensor failure
 - .10 Microprocessor failure

2.24 ~~ULTRA-VIOLET POTABLE WATER STERILIZER SYSTEMS~~

- ~~.1 Provide Pure Aqua Inc. Series UVI, or equal, ultra-violet (UV) potable water sterilizer systems with performance and capacity as noted on the Drawing schedules.~~
- ~~.2 UV potable water sterilizer systems shall employ ultraviolet generator technology. Untreated water shall enter the reaction chamber, circulate around a low-pressure mercury vapor lamp emitting ultraviolet light energy at 235.7nm wavelength to disrupt DNA of any microbiological (bacteria, viruses, ozone, chlorine, total organic carbon, and other micro-organisms) contaminants prior to discharge.~~
- ~~.3 UV potable water sterilizer systems shall be constructed as follows:
 - ~~.1 Electrical supply: 100-240V/50-60Hz,~~
 - ~~.2 Maximum Operating Pressure: 100 psi (6.9 bar),~~
 - ~~.3 Ambient Temperature: 32-104°F (0-40°C),~~
 - ~~.4 Flow meter,~~
 - ~~.5 Dynamic flow restrictor,~~
 - ~~.6 Temperature management valve,~~
 - ~~.7 Solenoid valve,~~
 - ~~.8 Sensor reading output (4-20mA) UV sensor,~~
 - ~~.9 Low-pressure high-output lamps (LPHO),~~
 - ~~.10 Lamp status visual indicator,~~
 - ~~.11 System hours of operation,~~
 - ~~.12 Lamp out audible and visual alert (LOA),~~~~

- .13 — Remote start/stop (HOA),
- .14 — 304 stainless steel control cabinet,
- .15 — 316L stainless steel treatment reaction chamber,
- .16 — Ra 15 internal surface finish,
- .17 — EPDM elastomers,
- .18 — UV monitoring package: UV intensity reading with NIST certified sensor,
- .19 — Cool touch fan,
- .20 — Control panel:
 - .1 — UL type 4X or UL type 12,
 - .2 — sloped top,
 - .3 — 4-20mA sensor reading output signal with UV monitoring option.

2.25 WATER METERS

- .1 Provide Neptune, or equal, municipal type water meter in accordance with sizes shown on the drawings and meeting City of Toronto requirements for accuracy and repeatability.
- .2 Provide dry contact type pulsed output with one pulse every 10 liters, or in units as otherwise noted on the Submittal, suitable for interface with the Building Automation System ("BAS"). Output to BAS shall provide instantaneous and totalized flow.

2.26 INDUSTRIAL HOT WATER PRESSURE WASHER

- .1 ***Provide Easy-Kleen Pressure Systems Ltd. Caribou Series, model EH440E448A, or Consultant approved equal, 4000 psi rated, fully electric heated industrial pressure washer assembly, where indicated on the Drawings, and in accordance with the following requirements:***
- .2 ***Industrial hot water pressure washer assembly and downstream distribution piping system shall be fully ASME B31.1 Power Piping Code compliant for the pressure class.***
- .3 ***Pumps:***
 - .1 ***Industrial Heavy-Duty Triplex Plunger Pumps***
 - .2 ***Oil bath crankcase***
 - .3 ***Stainless valves***
 - .4 ***Brass manifold***
 - .5 ***Thermo pump protector***
 - .6 ***Belt driven or flange and coupling driven***
- .4 ***Electric Motors:***
 - .1 ***1750 RPM, TEFC high efficiency, full frame, continuous duty***
 - .2 ***1.25 service factor with thermal overload protection***
- .5 ***Electric Heating Element(s):***
 - .1 ***Direct-immersion type electric heating elements, 48 kW total capacity,***
 - .2 ***Pin-type calrod heating elements with incoloy sleeves,***
 - .3 ***316 stainless steel heat exchanger coil(s) that do not require de-calcification,***
 - .4 ***Adjustable temperature controller with cut-off switch,***
 - .5 ***designed for continuous use.***
- .6 ***Heater Storage Tanks:***
 - .1 ***70 Gallon capacity (single coil models)***

- .2 **120 Gallon capacity (dual coil models)**
- .7 **Frame:**
 - .1 **All welded steel,**
 - .2 **Powder coated finish,**
 - .3 **All components accessible for servicing.**
- .8 **Options and accessories:**
 - .1 **Adjustable pressure regulator with cut-off switch**
 - .2 **Liquid filled pressure gauge**
 - .3 **Stainless steel covers and heater skins**
 - .4 **Remote control**
- .9 **Pressure washer hose reel and hose:**
 - .1 **Provide Hannay Series 2000, model E2020-17-18, or Consultant approved equal, power rewind hose reel, where indicated on the Drawings, and in accordance with the following requirements:**
 - .1 **Provide a single 3/8" (10mm) internal diameter (I.D.) water supply hose, 100 ft. (30m) length as follows:**
 - .1 **Flextral model UJ4-06YWM, or Consultant approved equal, oil resistant pressure washer hose,**
 - .2 **3/8" (10mm) NPT male threaded inlet and outlet hose ends,**
 - .3 **Threaded hose end Quick Connect adaptor for gun and wand assembly connection,**
 - .4 **Maximum operating pressure: 4000 psi**
 - .5 **Operating temperature range: -40°F to +250°F (-40°C to +121°C)**
 - .6 **Hose construction:**
 - .1 **Tube: seamless black synthetic rubber**
 - .2 **Reinforcement: One braid of high-tensile steel wire**
 - .3 **Cover: Yellow, smooth ultra-abrasion resistant synthetic rubber, ARPM Class A**
 - .2 **Gun and wand assembly:**
 - .1 **36" (915mm) long wand with trigger gun,**
 - .2 **side handle grip,**
 - .3 **Quick-Connect coupler, and**
 - .4 **0°/15°/25°/40° spray nozzles.**
 - .3 **90° inlet ball bearing swivel joint,**
 - .4 **3/8" (10mm) NPT female inlet and outlet threads,**
 - .5 **Rated operating pressure to 4,000 psi,**
 - .6 **Suitable for operating fluid temperatures from -40°F to +250°F (-40°C to +121°C).**
 - .7 **115V/1ph/60Hz electric powered chain and sprocket drive complete with strap brake and disconnect switch.**

2.27 HOSE REEL AND HOSE

- .1 ***Provide Hannay Series 4000, model 4038-17-18, or Consultant approved equal, power rewind hose reel, where indicated on the Drawings, and in accordance with the following requirements:***
 - .1 ***90° inlet ball bearing swivel joint,***
 - .2 ***1" (25mm) NPT female inlet and outlet threads,***
 - .3 ***Standard rated operating pressure to 2,000 psi (138 bar),***
 - .4 ***Suitable for operating fluid temperatures from -40° F to +250 °F (-40° C to +121° C).***
 - .5 ***115V/1ph/60Hz electric powered chain and sprocket drive complete with strap brake and disconnect switch.***
- .2 ***Provide a single 1" (25mm) internal diameter (I.D.) water supply hose, 100 ft. (30m) length as follows:***
 - .1 ***Flextral model AR-30-100, or Consultant approved equal, oil resistant pressure washer hose,***
 - .2 ***1" (25mm) NPT male threaded inlet and outlet hose ends,***
 - .3 ***Non-conductive, minimum electrical resistance greater than (1) megaohm per inch of hose length at 1,000 Volts DC,***
 - .4 ***Maximum operating pressure: 300 psi.***
 - .5 ***Operating temperature range: -20°F to +190°F (-29°C to +88°C)***
 - .6 ***Hose construction:***
 - .1 ***Tube: Black, nitrile, ARPM Class A (high-oil resistance)***
 - .2 ***Reinforcement: Synthetic yarn***
 - .3 ***Cover: Red, NBR blend, ARPM Class B***
 - .4 ***Branding: "FLEXTRAL AR30-100 1" (25mm) ORCT NON CONDUCTIVE OIL RESISTANT 300 PSI MAX WP"***

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- .1 Install plumbing equipment and specialties in accordance with Manufacturer's requirements and the requirements of the Authorities Having Jurisdiction ("AHJs").
- .2 Provide all required labour necessary for the installation of control components and devices supplied by Controls Trades. Include all additional labour necessary for the successful completion of point-to-point verification of devices, and performance verification of devices and systems as part of the project commissioning requirements.

3.02 PRESSURE REDUCING VALVES

- .1 Provide domestic water pressure reducing valves in piping where required. Install so that each valve is readily accessible. Whenever possible, provide pressure reducing valves factory pre-set to required pressures.
- .2 Check and test operation and adjust as required.

3.03 TRAP SEAL PRIMERS

- .1 Prime all traps as required by Code and the Authorities having Jurisdiction (AHJs).
- .2 Prime all traps where called for in the design documents, such as fuel fired appliance flue vent drainage piping connections.
- .3 Install unit plumb and true with suitable access above finished floor.
- .4 Allow 1 ft. (300mm) of elevation for every 20 ft. (6m) of distance ran for floor drain make up line.

- .5 Coordinate with Electrical Trades suitable power source to provide power to electronic trap seal primer.

3.04 WATER HAMMER ARRESTORS

- .1 Provide accessible water hammer arrestors in domestic water piping in locations as follows:
 - .1 in headers at groups of plumbing fixtures;
 - .2 at the top of risers;
 - .3 at ends of long horizontal runs of piping;
 - .4 in piping connecting solenoid valves or equipment with integral solenoid valves;
 - .5 wherever else shown or required by Code.
- .2 Install each unit in a piping tee either horizontally or vertically in the path of potential water shock in accordance with the manufacturer's published instructions and details.

3.05 BACKFLOW PREVENTERS

- .1 Provide a backflow preventer in each direct domestic cold water connection to equipment other than plumbing fixtures and fittings.
- .2 Do not group make-up water connections to hydronic systems on a common backflow preventer. Provide a dedicated backflow preventer in the make-up water line to each system.
- .3 Locate each backflow preventer on a wall and above the floor such that it is easily accessible for maintenance and testing in accordance with Code requirements. Equip each backflow preventer with an air gap fitting and pipe the reduced pressure zone water outlet to drain.
- .4 Test operation of each backflow preventer in accordance with requirements of CAN/CSA B64 by personnel certified for such testing by governing authorities, and submit signed test results and a properly and clearly identified and marked inspection and test record card for each backflow preventer.
- .5 Provide drains to nearest floor drain on all back flow preventers.

3.06 INSTALLATION OF THERMOSTATIC MIXING VALVES

- .1 Install thermostatic mixing valves where indicated in the Documents.
- .2 Thermostatic mixing valves shall be installed in accordance with the Manufacturer's requirements, and the requirements of the Authorities having Jurisdiction (AHJs).
- .3 Install thermostatic mixing valves in accordance with the drawing Detail and as follows:
 - .1 Isolation valves and check valves on the hot and cold-water inlet connection; provide isolation valve on tempered water discharge connection.
 - .2 Provide domestic water balancing valve upstream of hot water inlet connection.
 - .3 Provide thermometers downstream of tempered water discharge connection.
- .4 Select thermostatic mixing valves in accordance with the performance table specified above, or in accordance with sizing noted on the Drawings. Provide multiple thermostatic mixing valves arranged in parallel where design capacity exceeds performance table values indicated or where shown on the Drawings.
- .5 Install thermostatic mixing valve at every emergency eyewash, emergency face wash, and emergency shower fixture set to maintain tempered water supply temperature of 60°F (adjustable).

3.07 DOMESTIC WATER HEATER INSTALLATION

- .1 General:
 - .1 Install equipment and specialties level and plumb in accordance with Manufacturer's requirements and the requirements of the Authorities Having Jurisdiction ("AHJs"). Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions and datasheets.

- .2 Provide all required labour necessary for the installation of control components and devices supplied by Controls Trades. Include all additional labour necessary for the successful completion of point-to-point verification of devices, and performance verification of devices and systems as part of the project commissioning requirements.
- .3 Where integration of domestic water heater integral controls with the Building Automation System (BAS) is required, coordinate with Controls Trades the correct integration gateway protocol and include with shop drawing submission.
- .4 Provide a hydro-pneumatic expansion tank in accordance with Section 22 30 10 for each independent domestic hot water systems, whether shown on the drawings or not. Hydro-pneumatic expansion tank shall be minimum 2 US gallon capacity unless noted otherwise in the Documents.
- .5 Provide Combination Temperature-and-Pressure Relief Valves for installation in piping or where no relief valve is specified with the domestic-water heater.
- .6 Provide Pressure Relief Valves for installation in piping or where no relief valve is specified with the domestic-water heater.
- .7 Provide Vacuum Relief Valves for installation in piping or where no relief valve is specified with the domestic-water heater.
- .2 Mount Domestic Hot Water Heaters, on drain pans set on 4" (100mm) concrete housekeeping pads.
 - .1 Where noted on the Drawings or Details, or Specified elsewhere in this Section, provide additional Domestic Hot Water heaters floor stands.
- .3 Provide structural steel for horizontal mounted tanks and for instantaneous heaters.
- .4 Provide insulation between Domestic Hot Water heater storage tank and supplementary steel supports.
- .5 Provide additional Domestic Hot Water heaters floor stands to ensure high efficiency gas-fired condensing Domestic Hot Water heaters are mounted at a height that allows for acidic condensate to drain by gravity through acid neutralizing tanks.
- .6 Provide two (2) coats of rustoleum paint on all Domestic Hot Water heater supplementary steel support framing.
- .7 Provide 4" (100mm) floor drain, primed and vented, adjacent to individual Domestic Hot Water heaters, or groups of Domestic Hot Water heaters, whether shown on the Drawings or not.
- .8 Provide one acid neutralizing tank for each high efficiency condensing water heater provided. Terminate flue gas vent drain over acid neutralizing tank; terminate acid neutralizing tank drain over 4" (100mm) floor drain.
- .9 For multiple domestic-water heater installation provide domestic-water-heater series, parallel or combination series and parallel piping manifolds as shown on the Drawings.
 - .1 Include shut-off valves in accordance with Section 22 11 13 to isolate each domestic-water heater.
 - .2 Provide domestic water domestic water flow balancing valves in accordance with Section 22 11 13 for parallel or combination series and parallel manifold piping arrangements to provide balanced flow through each domestic-water heater.

3.08 INSTALLATION OF WATER SOFTENER

- .1 Provide a package type water softener assembly and secure in place on a concrete housekeeping pad.
- .2 Install equipment and components supplied loose with softener in accordance with softener manufacturer's instructions. Provide required valved piping, including drain piping terminated at a funnel floor drain combination.

- .3 Provide low voltage control wiring required in accordance with softener manufacturer's certified control wiring schematics. Install control wiring in conduit in accordance with requirements of electrical work specification.
- .4 Install initial charge of softener salt. Hand spare salt and soap test kit to Owner at site and store where directed.
- .5 Refer to General Mechanical requirements for equipment/system start-up requirements.
- .6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements. Submit a copy of the letter prior to Substantial Performance of the Work.
- .7 Include for 4 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.
- .8 Coordinate with electrical trades for the provision of a 110V, 1ph, 60Hz power supply.

3.09 INSTALLATION OF POTABLE WATER SEDIMENT FILTRATION SYSTEMS

- .1 Install potable water sediment filtration system in accordance with manufacturer's requirements, and all requirements of the Authorities Having Jurisdictions (AHJs.)
- .2 Provide isolation valves on the inlet and discharge piping connections to each potable water sediment filtration system.
- .3 Provide bypass valve around each potable water sediment filtration system with locking mechanism to allowing for valve to be locked in the closed position.
- .4 Run backwash flushing drain connection to nearest hub drain using an indirect connection.
- .5 Coordinate with electrical trades for the provision of a 3-prong duplex box outlet with a ground-fault circuit-interrupter (GFCI) receptacle for each filter.

3.10 INSTALLATION OF WELL-WATER PRE-TREATMENT FILTRATION SYSTEMS

- .1 Install well-water pre-treatment filtration system in accordance with manufacturer's requirements, and all requirements of the Authorities Having Jurisdictions (AHJs.)
- .2 Provide isolation valves on the inlet and discharge piping connections to each well-water pre-treatment filtration system.
- .3 Provide bypass valve around each well-water pre-treatment filtration system with locking mechanism to allowing for valve to be locked in the closed position.
- .4 Run backwash flushing drain connection to nearest hub drain using an indirect connection.

3.11 INSTALLATION OF ULTRAVIOLET (UV) LAMP HIGH INTENSITY DISINFECTION SYSTEM

- .1 Install Ultra-violet (UV) water sterilizer system in accordance with manufacturer's requirements, and all requirements of the Authorities Having Jurisdictions (AHJs.)
- .2 The UV equipment shall be installed indoors, in a dry location.
- .3 Provide isolation valves on the inlet and discharge piping connections to each UV water sterilizer system.
- .4 Provide bypass valve around each UV water sterilizer system with locking mechanism to allowing for valve to be locked in the closed position.
- .5 Coordinate with electrical trades for the provision of a power supply of 120V, 1ph, 60 Hz, two wire plus a ground, 60Hz, with a ground-fault circuit-interrupter (GFCI) receptacle in the vicinity of each the UV lamp.

3.12 INSTALLATION OF WATER METERS

- .1 Install water meter in accordance with Municipal requirements, manufacturer's instructions, and with isolation valves on inlet and discharge, and with lockable bypass valve around entire water meter assembly.

- .2 If water meter is not immediately available, provide spool pieces and filler connection. Remove filler pieces and install meter when available. Provide stanchion supports within {150 mm} [6"] of water meter inlet and outlet.

3.13 INSTALLATION OF INDUSTRIAL HOT WATER PRESSURE WASHER

- .1 *Install Industrial Hot Water Pressure Washer assembly where noted on the Drawings in accordance with Manufacturer's instructions.*
- .2 *Provide a line size Reduced Pressure Zone (RPZ) style backflow preventer on the water supply piping for each Industrial Hot Water Pressure Washer assembly.*
- .3 *Provide a flexible connector between the building water supply piping connection and the Industrial Hot Water Pressure Washer.*
- .4 *Pressurized water supply piping downstream of Industrial Hot Water Pressure Washer manifold shall be Schedule 160, 304 stainless steel piping and fittings with all valves and ancillaries rated for minimum 4000 psi service. The entire assembly and distribution network shall be fully compliant to ASME B31.1 Power Piping Code requirements for this pressure class.*
- .5 *Coordinate with electrical trades power connection to the Industrial Hot Water Pressure Washer.*

3.14 INSTALLATION OF PRESSURE WASHER REEL AND HOSE

- .1 *Install Pressure Washer Reel and Hose assembly where noted on the Drawings in accordance with Manufacturer's instructions.*
- .2 *Provide a line size Reduced Pressure Zone (RPZ) style backflow preventer on the water supply piping for each Industrial Hot Water Pressure Washer assembly.*
- .3 *Provide a flexible connector between the building water supply piping connection and the hose reel inlet swivel joint.*
- .4 *Coordinate with electrical trades power connection to power rewind hose reel.*

END OF SECTION

CONTENTS

PART 1 - GENERAL

- 1.01 GENERAL REQUIREMENTS**
- 1.02 DESCRIPTION**
- 1.03 SCOPE OF WORK**
- 1.04 QUALITY ASSURANCE**
- 1.05 SUBMITTALS**
- 1.06 SITE VISIT**

PART 2 - PRODUCTS

- 2.01 GENERAL REQUIREMENTS**
- 2.02 PLUMBING FIXTURE DATA SHEETS**

PART 3 - EXECUTION

- 3.01 GENERAL INSTALLATION REQUIREMENTS**
- 3.02 INSTALLATION OF PLUMBING FIXTURES**
- 3.03 INSTALLATION OF DRAINS AND CLEANOUTS**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with requirements of the Owner's General Requirements and all documents referred to therein.

1.02 DESCRIPTION

- .1 Comply with requirements of Section 20 01 10 Mechanical General Requirements.
- .2 Comply with requirements of Section 20 01 50 Basic Materials and Methods.
- .3 Comply with requirements of Section 20 11 10 Plumbing Piping and Pumping Systems.
- .4 Comply with requirements of Section 22 13 10 Sanitary and Storm Water Piping and Pumping Systems.
- .5 Comply with requirements of 22 30 10 Plumbing Equipment and Specialties.

1.03 SCOPE OF WORK

- .1 Provision of plumbing fixtures, roof drains, floor drains and cleanouts as described in this Section.

1.04 QUALITY ASSURANCE

- .1 Execute the Work of this Section only by skilled tradesmen regularly employed in the manufacture and installation of plumbing fixtures.

1.05 SUBMITTALS

- .1 Submit the following Shop Drawings:
 - .1 All plumbing fixtures specified.
 - .2 All roof drains specified
 - .3 All floor drains specified
 - .4 All cleanouts specified

1.06 SITE VISIT

- .1 Visit the site prior to tender and verify all conditions. Prior to submitting price, the Mechanical Division Trade Contractor is to review all discrepancies and verify the locations of all existing services that are being extended and the routing of new services. Also report all ambiguities, discrepancies, departures from building by-laws and/or from good practice. Failure to do so will result in all additional costs being the responsibility of the Mechanical Division Trade Contractor. Include for any alternate routing of new or rerouting of existing services to accommodate all site conditions in the tender price.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- .1 All plumbing fixtures provided shall comply with applicable Codes and Standards, and the requirements of the Authorities Having Jurisdiction ("AHJs").

2.02 PLUMBING FIXTURE DATA SHEETS

- .1 Reference the following plumbing fixture data sheets appended to this Section:
 - .1 Water closets
 - .2 **Waterless Urinals**
 - .3 Lavatories
 - .4 Showers
 - .5 Service sinks
 - .6 Emergency showers
 - .7 Emergency eyewash

- .8 Floor drains
- .9 Cleanouts
- .2 Each lavatory, shower, and bathtub plumbing fixture shall be provided with a pressure balanced mixing valve to limit the hot water supply temperature to 49°C (120°F) in accordance with Ontario Building Code requirements whether one has been indicated on the plumbing fixture data sheets or not.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- .1 Installation of plumbing fixtures, roof drains, floor drains, and cleanouts shall comply with applicable Codes and Standards, and the requirements of the Authorities Having Jurisdiction ("AHJs").
- .2 Installation of plumbing fixtures, roof drains, floor drains, and cleanouts shall be in accordance with Manufacturer's requirements.

3.02 INSTALLATION OF PLUMBING FIXTURES

- .1 Make all required water piping, drain piping and vent piping connections to plumbing fixtures.
- .2 Each barrier free lavatory fixture that incorporates a horizontal offset drain connection at the base of the bowl shall have the incline angle of drain piping checked to ensure installation provides positive waste flow to drain. Correct drain incline until satisfactory positive waste flow is achieved.
- .3 In residential suites with washroom groups comprised of multiple plumbing fixtures, a common pressure balanced mixing valve may be provided in lieu of individual plumbing fixture mixing valves provided piping distribution from the outlet of the common mixing valve to the hot water connection at each fixture is limited to no more than 2 m (6 ft.).

3.03 INSTALLATION OF DRAINS AND CLEANOUTS

- .1 Make all required drain and vent piping connections to drain and cleanout bodies.
- .2 Prime all drainage traps as required by applicable Code(s) and Standards.
- .3 Provide 6 mil polyethylene under each drainage strainer and cleanout cover to prevent dirt from entering the system during construction. Remove polyethylene prior to Substantial Performance.
- .4 Coordinate all drain and cleanout provisions with affected Trades and the Architect.
- .5 Coordinate installation of roof drains and floor drains with all Trades to ensure location provides positive slope to drain, and to ensure proper integration of drain with any integral membrane layer.

END OF SECTION

CONTENTS

PART 1 - GENERAL

- 1.01 GENERAL REQUIREMENTS**
- 1.02 DESCRIPTION**
- 1.03 WORK PERFORMED BY THIS SECTION**
- 1.04 QUALITY ASSURANCE**
- 1.05 REFERENCE STANDARDS**
- 1.06 VOLATILE ORGANIC COMPOUND ("VOC") REQUIREMENTS**
- 1.07 SITE VISIT**

PART 2 - PRODUCTS

- 2.01 DUCT ACCESS DOORS**
- 2.02 INSTRUMENT TEST PORTS**
- 2.03 ROUND TO RECTANGULAR DUCT CONNECTIONS**
- 2.04 AIR TURNING VANES**
- 2.05 SPLITTER DAMPERS**
- 2.06 SINGLE BLADE BALANCING DAMPERS**
- 2.07 MULTI-BLADED BALANCING DAMPERS**
- 2.08 MULTI-LEAF AUTOMATIC CONTROL DAMPERS**
- 2.09 AIR FLOW STATIONS**
- 2.10 BACKDRAFT DAMPERS**
- 2.11 CASING AND PLENUM ACCESS DOORS**
- 2.12 SILENCERS**
- 2.13 DYNAMIC FIRE DAMPERS**
- 2.14 MULTI-BLADE FIRE DAMPERS**
- 2.15 LOW LEAKAGE MOTORIZED SMOKE DAMPERS**
- 2.16 COMBINATION FIRE/SMOKE DAMPERS**
- 2.17 COMBINATION DUCT MOUNTED SMOKE DAMPER OR COMBINATION FIRE SMOKE DAMPER WITH INTEGRAL SMOKE DETECTOR**
- 2.18 WIRE MESH (BIRDScreen)**
- 2.19 LOUVRES**
- 2.20 LOUVRE BLANK-OFF PANELS**

PART 3 - EXECUTION

- 3.01 GENERAL AIR DUCT ACCESSORIES INSTALLATION REQUIREMENTS**
- 3.02 DUCT ACCESS DOORS**
- 3.03 INSTRUMENT TEST PORTS**
- 3.04 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS**
- 3.05 INSTALLATION OF TURNING VANES**
- 3.06 INSTALLATION OF SPLITTER DAMPERS**
- 3.07 MANUAL BALANCING DAMPERS**
- 3.08 AUTOMATIC CONTROL DAMPERS**
- 3.09 AIR FLOW STATIONS**
- 3.10 INSTALLATION OF FIRE DAMPERS, SMOKE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS**
- 3.11 COMBINATION DUCT MOUNTED SMOKE DAMPER OR COMBINATION FIRE SMOKE DAMPER WITH INTEGRAL SMOKE DETECTOR**
- 3.12 INSTALLATION OF WIRE MESH (BIRDScreen)**
- 3.13 INSTALLATION OF LOUVRES**
- 3.14 INSTALLATION OF LOUVRE BLANK-OFF PANELS**
- 3.15 AIR BALANCING**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with requirements of the Owner's General Requirements and all documents referred to therein.

1.02 DESCRIPTION

- .1 Comply with requirements of Section 20 01 10 Mechanical General Requirements.
- .2 Comply with requirements of Section 20 01 50 Basic Materials and Methods.

1.03 WORK PERFORMED BY THIS SECTION

- .1 Provision of air distribution equipment and related ancillaries.
- .2 Louvers are to be supplied and installed by Trades other than Mechanical Division Trades.

1.04 QUALITY ASSURANCE

- .1 Qualifications: execute work of this section only by skilled tradesmen regularly employed in the construction and installation of air distribution equipment and related ancillaries.
- .2 Submittals: Submit shop drawings for the following Products:

1.05 REFERENCE STANDARDS

- .1 SMACNA HVAC Duct Construction Standards Metal and Flexible - Second Edition
- .2 NFPA 96 – 2008 Ventilation Control and Fire Protection of Commercial Cooking Operations
- .3 NFPA 90A-2009 Installation of Air Conditioning and Ventilating Systems
- .4 NFPA 90B-2009 Installation of Warm Air Conditioning and Air Conditioning Systems
- .5 ASTM A621 & A621M - 1998 Specification for Forming Steel (FS), sheet and Strip, Carbon, Hot Rolled.
- .6 ASTM A653M – 09 Specification for Steel Sheet, Zinc Coated Galvanized or Zinc Alloy Coated (Galvannealed) by the Hot Dip Process
- .7 ASTM A924M – 09 General Requirements for Sheet Steel, Metallic Coated by the Hot Dip Process
- .8 Duct dimensions shown on Drawings are net, inside insulation and acoustic duct lining.

1.06 VOLATILE ORGANIC COMPOUND ("VOC") REQUIREMENTS

- .1 All adhesives, sealants, paints and coatings used on or inside of building weatherproofing layer shall have a VOC content that is less than the content limits defined in LEED® Product Requirements.

1.07 SITE VISIT

- .1 Visit the site prior to tender and verify all conditions. Prior to submitting price, the Mechanical Division Contractor is to review all discrepancies and verify the locations of all existing services that are being extended and the routing of new services. Also report all ambiguities, discrepancies, departures from building by-laws and/or from good practice. Failure to do so will result in all additional costs being the responsibility of the Mechanical Division Contractor. Include for any alternate routing of new or rerouting of existing services to accommodate all site conditions in the tender price.

PART 2 - PRODUCTS

2.01 DUCT ACCESS DOORS

- .1 General.
 - .1 The access doors shall be of ultra-low leakage, premium quality design. Flat oval design optimizes access area and simplifies installation.
 - .2 The access doors shall be complete with insulated double flanged door with pre-punched holes on inner flange for surface mounting.

- .3 Provide camlock for positive seal and easy opening.
- .2 Construction
 - .1 Die-formed 24 gauge galvanized flanged frame for extra strength.
 - .2 Die-formed 24 gauge galvanized door panel for extra strength.
 - .3 1" (25mm) insulation with 24 gauge galvanized backing plate.
 - .4 3/16" (5mm) dia pre-punched attachment holes on inner flange for surface mounting.
 - .5 Plated steel camlock fasteners.
 - .6 Positive bulb door seal.
 - .7 Oval or flat oval shaped opening adaptable to all ducts 5" (125mm) and over.
 - .8 Tested in accordance to DW142 Class C – maximum leakage at 8 in.wg. (2kPa):
 - .1 12"x 6" (300 x 150 mm): 0.06 cfm (1.8 l/min)
 - .2 18"x12" (450 x 300 mm): 0.13 cfm (3.8 l/min)
 - .3 25"x 17" (625 x 425 mm): 0.28 cfm (8.1 l/min)
- .3 Acceptable Manufacturers:
 - .1 Nailor;
 - .2 Or approved equivalent.

2.02 INSTRUMENT TEST PORTS

- .1 0.063" (1.6 mm) thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug.
- .3 1" (25 mm) minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable Manufacturers:
 - .1 Duro Dyne IP1 or IP2 for insulated ducts;
 - .2 Duro Dyne IP4 for non-insulated ducts.

2.03 ROUND TO RECTANGULAR DUCT CONNECTIONS

- .1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.04 AIR TURNING VANES

- .1 For square duct elbows - multiple-radius turning vanes, interconnected with bars, adequately reinforced to suit the pressure and velocity of the system, and constructed of the same material as the duct they are associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 For short branch ducts at grille and diffuser connections - air extractor type, each equipped with a matching bottom operated 90 degree opposed blade volume control damper, constructed of the same material as the duct it is associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.05 SPLITTER DAMPERS

- .1 Minimum #20 gauge damper blade constructed of same material as duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to DynAir Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

2.06 SINGLE BLADE BALANCING DAMPERS

- .1 Of same material as duct. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 12" (300 mm).
- .3 Locking device.
- .4 Inside and outside end bearings for special fume exhaust ducts.

2.07 MULTI-BLADED BALANCING DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration to recommendations of SMACNA.
- .3 Bearings: pin in bronze bushings.
- .4 Linkage: shaft extension with locking quadrant.
- .5 Channel frame complete with angle stop.
- .6 Inside and outside end bearings.

2.08 MULTI-LEAF AUTOMATIC CONTROL DAMPERS

- .1 Automatic Control Dampers are specified in Section 25 30 10 shall be supplied by the BAS Trades for installation in the Air Distribution system. Coordinate all requirements with BAS Trades.

2.09 AIR FLOW STATIONS

- .1 Air flow stations are specified in Section 25 30 10 shall be supplied by the BAS Trades for installation in the Air Distribution system. Coordinate all requirements with BAS Trades.

2.10 BACKDRAFT DAMPERS

- .1 Backdraft dampers shall meet the following minimum construction standards:
 - .1 Frame shall be 0.125" (3.2 mm) wall thickness 6063T5 extruded aluminum.
 - .2 Frame shall have galvanized steel braces at all corners.
 - .3 Blades shall be 0.070" (1.8 mm) wall thickness 6063T5 extruded aluminum.
 - .4 Blades shall begin to open at approximately 0.12 in. wg. and be fully open at approximately 0.20 in.wg. static pressure.
 - .5 Blade edge seals shall be extruded vinyl mechanically locked into blade edge; adhesive type seals are unacceptable.
 - .6 Bearings shall be corrosion resistant long life synthetic for quiet operation.
 - .7 Linkage shall be ½" (13mm) tie bar with stainless steel pivot pins; linkage shall have the capability of being manually locked in the closed position for independent fan isolation from the remained of fans in the array.
 - .8 Damper shall be designed for 3500 fpm maximum spot air velocity.

2.11 CASING AND PLENUM ACCESS DOORS

- .1 Gasketed access doors, factory insulated type in insulated casings or plenums, each constructed of galvanized steel (unless otherwise specified) in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the pressure classification of the casing or plenum.
- .2 Where access doors occur in casings and/or plenums constructed of materials other than galvanized steel, the doors shall be as above but constructed of material to match the casing and plenum material.

2.12 SILENCERS

- .1 Provide silencers to maintain the maximum Noise Criteria (NC) levels as stated in the following Table:

Area	Maximum NC Level
------	------------------

Open office/reception areas	35
Private offices	30
Conference, interview & meeting rooms	30
Circulation and lobbies	40
Washrooms, service and storage areas	40

- .2 Silencers certified to ASTM E477 "Standard Method of Testing Duct Liner Materials and Prefabricated Silencers For Acoustical and Airflow Performance" completely prefabricated and as follows:

.1 Materials:

- .1 No-medial type rectangular type silencers shall be constructed with a 22 gauge (0.78 mm) galvanized steel outer casing and 26 gauge (0.47 mm) galvanized perforated steel;
- .2 Film lined rectangular type silencers shall be constructed with a 22 gauge (0.78 mm) galvanized steel outer casing and 26 gauge (0.47 mm) galvanized perforated steel.
- .3 No-media and film lined elbow silencers shall be constructed with an 18 gauge (1.24 mm) galvanized steel outer casing and 22 gauge (0.78 mm) galvanized perforated steel. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48" (1200 mm) shall have at least two half splitters and one full splitter.
- .4 Circular silencers shall be constructed with a galvanized steel casing as noted below and 22 gauge (0.78 mm) galvanized perforated steel. All casing and seams and joints shall be lock formed and sealed or stitch welded and sealed.

.5	CASING DIAMETER	.6	CASING GAUGE
.7	Less than 30" (750 mm)	.8	20
.9	30" (750 mm) to 54" (1350 mm)	.10	18
.11	Over 54" (1350 mm)	.12	16

.2 Acoustic Media:

- .1 Media for film lined silencers shall be media containing 100% natural cotton fibers treated with an EPA registered, non-toxic borate solution, "flash dried" to provide resistance to mold, mildew and fungi. Media shall comply with UL181 and NFPA 90A. Media shall be packed with a minimum of 15% compression during silencer assembly. Media shall not cause or accelerate corrosion of aluminum or steel.

.3 Acoustic Media Protection:

- .1 Film lined silencers shall be as above with acoustic media completely wrapped with Tedlar film to prevent shedding, erosion and impregnation of glass fibre. The wrapped acoustic media shall be separated from the perforated metal by a factory installed ½" (12 mm) thick acoustically transparent spacer. The spacer shall be flame retardant and erosion resistant. A mesh, screen or corrugated liner will not be acceptable as a substitute for the specified spacer.
- .4 High Transmission Loss ("HTL") Ductwork
 - .1 Silencers shall have a High Transmission Loss ("HTL") walls externally applied and completely sealed to the silencer casing by the silencer manufacturer to assure quality controlled transmission loss. The HTL walls shall consist of media, airspace, mass and outer protective metal skin, as required to obtain the specified room noise criteria. Standard acoustical panels will not be accepted as HTL walls. Provide breakout noise calculations as part of the silencer shop drawing submissions for each air handling and fan system with HTL silencers. Breakout noise shall be based on the sound power levels of the specified equipment.
- .3 Manufacturer shall certify on shop drawings that silencer performance is per ASTM E477.

2.13 DYNAMIC FIRE DAMPERS

- .1 Application:
 - .1 HVAC System operates under fire alarm, smoke control, or smoke evacuation modes.
- .2 Construction:
 - .1 Provide Dynamic rated fire dampers, meeting or exceeding the following criteria:
 - .1 Fire dampers shall all the requirements of UL and NFPA 80, 90A and 101 for fire dampers in dynamic HVAC systems, as well as National Building Code of Canada (NBC) requirements.
 - .2 Manufactured, tested and labeled in accordance with UL 555 and CAN/ULC-S112 Standard for Dynamic Fire Dampers, including Dynamic Closure Test (formerly the Operation Test). Dampers shall be classified for dynamic closure against an airflow velocity of 2000 fpm (10.16 m/s) at 4" w.g. (1 kPa) static pressure differential across closed damper.
 - .2 Each fire damper shall bear a UL 1½ hours or 3 hours fire resistance rating label in addition to label verifying the airflow and closure pressure ratings as established by the Dynamic Closure Test.
 - .3 Each fire damper shall also be marked with the words "For use in dynamic systems"; Dampers marked "For use in static systems only" are not acceptable.
 - .4 Each fire damper shall be complete with a 165°F (74°C) UL Listed fusible link.
 - .5 Fire dampers shall each include a steel sleeve of appropriate length/gauge and retaining angles, supplied by damper manufacturer to ensure proper installation in accordance with damper manufacturer's instructions.
 - .6 Contractor shall provide an access door at each fire damper, of appropriate size to allow for inspection, testing and fusible link replacement.
 - .7 Fusible link dampers shall be Type B or Type C (as required) with curtain blade out of air stream. Type A dampers (with the curtain blade in the air stream) may be installed only where size or location are such that Type B and Type C cannot be installed. Consultant shall review application of Type A use prior to installation.
 - .8 Fusible link dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.
- .3 Acceptable Manufacturers:
 - .1 Nailor Industries D0100 series for 1½ hr rated, and D0500 series for 3 hr rated.

- .2 EH Price, Brisk, Ruskin;
- .3 Or acceptable equivalent

2.14 MULTI-BLADE FIRE DAMPERS

- .1 Application:
 - .1 Provide Multi-Blade Dynamic Fire Dampers as shown on plans and/or schedules,
 - .2 Each fire damper shall also be marked with the words "For use in dynamic systems". Dampers marked "For use in static systems only" are not acceptable.
- .2 Construction:
 - .1 Fire dampers shall meet the requirements of NFPA 80, 90A and 101 and shall be manufactured, tested and labeled in accordance with UL 555.
 - .2 Each damper shall bear a UL fire resistance rating label of 1½ hours or 3 hours, in accordance with the fire rating of the assembly being penetrated, and in addition, a label verifying the airflow and closure pressure ratings of 2000 fpm (10 m/s) at 4 in.wg. (1 kPa) static pressure differential, as established by the Dynamic Closure Test.
 - .3 Frame shall be constructed of 16 ga. (1.6) galvanized steel hat channel with mitered corners reinforced with die-formed corner gussets for strength.
 - .4 Blades shall be 14 ga. (2.0) equivalent galvanized steel formed double skin, airfoil design, on 5 1/2" (140) centers.
 - .5 Dampers shall be of opposed blade configuration with an inter-locking blade design. Blade seals are not acceptable.
 - .6 Blade axles shall be plated steel, double bolted at each end of blade to provide positive locking connection. Hex, square friction-fit or press-fit axles are not acceptable.
 - .7 Bearings shall be self-lubricating oilite bronze type. Blade linkage shall be zero-maintenance, concealed in frame, out of airstream. Each fire damper shall be complete with a 165°F (74°C) UL Listed fusible link that will cause the damper to close and lock in closed position by means of an over center/knee lock linkage for assured closure.
 - .8 Fire dampers shall each include a steel sleeve of appropriate length/gauge as field verified by contractor, with retaining angles supplied by damper manufacturer to ensure proper installation in accordance with damper manufacturer's instructions.
 - .9 Each damper shall be supplied with an internal manual quadrant(s) for setting and locking of blades in desired position. Contractor shall provide and install an access door at each fire damper, of appropriate size to allow for inspection, testing and fusible link replacement.
- .3 Acceptable Manufacturers:
 - .1 Nailor Industries.
 - .2 EH Price, Brisk, Ventex/Lloyd Industries, Ruskin;
 - .3 Or acceptable equivalent

2.15 LOW LEAKAGE MOTORIZED SMOKE DAMPERS

- .1 Application:
 - .1 Provide Class I low leakage motorized smoke dampers as shown on plans and/or schedules.
 - .2 Dampers shall be suitable for use in dynamic or static smoke control systems.
 - .3 Dampers shall be fail safe opposed blade configuration with an interlocking blade design that provides complete smoke seal under elevated temperature conditions when in closed position.
- .2 Construction:

- .1 Dampers shall meet the requirements of NFPA 90A, 92, 101 and 105 and shall be classified as a Class I Leakage Rated (Smoke) Damper under UL 555S at an elevated temperature of 250°F (121°C) and each damper shall bear a ULC label verifying same.
- .2 Dampers must comply with the requirements of AMCA 511 Certified Ratings Program and be qualified to bear the AMCA Seal.
- .3 Dampers shall have been operation tested by ULC to a minimum velocity/pressure rating of 2000 fpm @ 4 in.wg.
- .4 Frame shall be constructed of 16 ga. (1.6mm) galvanized steel hat channel with mitered corners reinforced with die-formed corner gussets for strength.
- .5 Blades shall be type 6063-T5 extruded aluminum airfoil design on maximum 6" (152) centers with integral structural reinforcing tube running full length of each blade
- .6 Blade axles shall be ½" (13mm) dia. plated steel, double bolted at each end of blade to provide positive locking connection; hex, square friction-fit or press-fit axles are not acceptable.
- .7 Bearings shall be self-lubricating bronze type.
- .8 Blade linkage shall be zero-maintenance, concealed in frame, out of airstream.
- .9 Jamb seals shall be compression type stainless steel.
- .10 Blade seals shall be silicone, mechanically locked in extruded blade slots.
- .11 Externally mounted electrical actuators shall be installed by the damper manufacturer in the factory; review with Consultant any smoke damper actuator proposed to be internally mounted prior to installation. Actuators shall incorporate an OEM internal spring-return mechanism. Damper and actuator assembly shall be factory cycled a minimum of three (3) times to ensure correct operation.
- .12 Submitted pressure drop data to be based on tests in accordance with AMCA Standard 500-D and shall demonstrate a maximum pressure drop of 0.02 in.wg. @ 849 fpm (5 Pa @ 4.3 m/s) across a 36" x 36" (914mm x 914mm) damper.
- .13 Damper shall come complete with a position indicator switch where damper is required to be reopened or closed from a remote location for smoke management and control; damper open end switches shall be adjustable in the field.
- .14 Provide manual test switch to demonstrate proper damper operation as part of regular on-going system maintenance and verification.
- .3 Acceptable Manufacturers:
 - .1 Nailor Industries
 - .2 EH Price
 - .3 Ruskin
 - .4 Or acceptable equivalent

2.16 COMBINATION FIRE/SMOKE DAMPERS

- .1 Application:
 - .1 Provide Combination Fire/Smoke Dampers as shown on plans and/or schedules.
- .2 Construction:
 - .1 Combination Fire Smoke Dampers shall meet the requirements of NFPA 80, 90A, 92 101 and 105.
 - .2 Combination Fire Smoke Dampers shall be classified by Underwriter's Laboratories and labeled as a 1½ hour Fire Damper under UL 555, and as a Class I Smoke Damper under UL 555S at an elevated temperature of 250°F (121°C). Each Combination Fire Smoke Damper shall bear a ULC label verifying same for use in dynamic or static Smoke Control Systems.

- .3 Dampers must comply with the requirements of AMCA 511 Certified Ratings Program and be qualified to bear the AMCA Seal.
- .4 Frame shall be constructed of 16 ga. (1.6mm) galvanized steel hat channel with mitered corners reinforced with die-formed corner gussets for strength.
- .5 Blades shall be 14 ga. (2.0mm) equivalent galvanized steel formed double skin, airfoil design.
- .6 Dampers shall be of opposed blade configuration with an interlocking blade design that provides complete flame and smoke seal under fire conditions at an elevated temperature of 2000°F (1093°C) when in closed position.
- .7 Blade axles shall be plated steel, double bolted at each end of blade to provide positive locking connection.
- .8 Bearings shall be self-lubricating bronze type.
- .9 Blade linkage shall be zero-maintenance, concealed in frame, out of airstream.
- .10 Jamb seals shall be compression-type stainless steel.
- .11 Dampers shall have been tested for dynamic closure by UL to a minimum velocity/pressure rating of 2000 fpm @ 4in.wg.
- .12 Dampers shall be supplied with factory installed sleeves of minimum 16" (406mm) length and shall be field verified by contractor, dependent on wall thickness. Factory sleeves shall be caulked to UL requirements and shall be 20 ga. (1.0mm) through 84" (2134mm) wide, and 18 ga (1.2mm) above 84" (2134mm) wide.
- .13 Appropriate electric (115 V/1ph/60Hz) actuator shall be installed by the damper manufacturer in the factory and shall have been tested and classified under UL 555S. Actuators shall incorporate an OEM internal spring return mechanism.
- .14 Each damper shall be equipped with a UL Classified heat responsive device that will cause the damper to close in a controlled manner and lock in a closed position by means of an over center/knee lock linkage, when the duct temperature reaches the maximum degradation temperature of the damper/actuator assembly as required by UL 555S. Closure devices that cause instantaneous closure are not acceptable.
- .15 Submitted pressure drop data to be based on tests in accordance with AMCA Standard 500-D and shall demonstrate a maximum pressure drop of 0.02 in.wg. @ 849 fpm (5 Pa @ 4.3 m/s) across a 36" x 36" (914 x 914) damper.
- .16 Damper shall come complete with a position indicating switch where damper is required to be reopened or closed from a remote location for smoke management and control; damper open end switches shall be adjustable in the field.
- .17 Provide manual test switch to demonstrate proper damper operation as part of regular on-going system maintenance and verification.
- .3 Acceptable Manufacturers:
 - .1 Nailor Industries.
 - .2 EH Price
 - .3 Ruskin
 - .4 Or acceptable equivalent

2.17 COMBINATION DUCT MOUNTED SMOKE DAMPER OR COMBINATION FIRE SMOKE DAMPER WITH INTEGRAL SMOKE DETECTOR

- .1 Application:
 - .1 ~~At the Contractor's Option, provide~~ **Provide** standalone Combination Duct Mounted Smoke Detector and Smoke Damper or Combination Fire Smoke Damper Assembly at penetrations of fire separations noted on the plans and/or schedules where smoke detector is not required to be monitored by the building fire alarm system.

- .2 Duct smoke detector to be utilized to detect the presence of smoke within HVAC ductwork, whether there is airflow or not, and close the smoke damper or combination fire/smoke damper to prevent smoke from spreading to other areas of the building.
- .3 The standalone Combination Duct Mounted Smoke Detector and Smoke Damper or Combination Fire Smoke Damper Assembly may be a packaged assembly constructed by the damper manufacturer or built-up in the field using components noted below.
- .2 Construction:
 - .1 Refer to Low Leakage Motorized Smoke Dampers and/or Combination Fire/Smoke Dampers specifications above for damper component requirements.
 - .2 Provide ULC listed photoelectric duct smoke detector meeting the requirements of NFPA 72, 90A, 92 and 101 and FM Approved.
 - .3 Where Smoke Damper or Combination Fire and Smoke Damper is intended to function as part of a smoke management system, provide requisite controls suitable for remote override of local detector operation, and provide damper end switches to prove damper closed and damper open; damper open end switches shall be adjustable in the field.
 - .4 Smoke detectors shall be mounted in downstream of the smoke damper or combination fire/smoke damper in accordance with CAN/ULC-S524 "Standard for Installation of Fire Alarm Systems" and wired to actuator(s) and heat sensor(s), as applicable.
- .3 Operation:
 - .1 Upon detection of smoke, the smoke detector causes the smoke damper or combination fire/smoke damper to close by cutting off power to the actuator.
 - .2 The actuator return spring forces the smoke damper or combination fire/smoke damper closed.
 - .3 The smoke detector is reset through a momentary power interruption.
 - .4 Provide manual test switch to demonstrate proper damper operation as part of regular on-going system maintenance and verification.
- .4 Acceptable Manufacturers:
 - .1 Nailor Industries.
 - .2 Or acceptable equivalent

2.18 WIRE MESH (BIRDSCREEN)

- .1 Heavy-gauge galvanized steel or aluminum mesh, 12 mm x 12 mm (½" x ½") secured in a rigid galvanized steel or aluminum framework, sized as indicated on drawings, and constructed so as to be removable.

2.19 LOUVRES

- .1 Fixed Blade Horizontal Louvers, 6" (150mm) Deep:
 - .1 Nailor model 1606KD extruded aluminum stationary blade drainable louvers as follows:
 - .1 Frame: 6" (152mm) deep, Type 6063-T6 extruded aluminum, .080" (2.03mm) nominal wall thickness. Integral caulking slot provided;
 - .2 Blades: Type 6063-T6 extruded aluminum, .080" (2.03) nominal wall thickness, with reinforcing bosses; K style.
 - .3 Blade Angel: Fixed at 37 degrees;
 - .4 Blade Spacing: Approx. 6" (152mm) on centers;
 - .5 Free Area: 50%
 - .6 Performance: 0.14 in.wg. APD at 1017 ft/min velocity through free area.
 - .7 Blade Support Brackets: Concealed type, factory installed on rear of louver

- on maximum 60" (1524mm) centers; reinforced with 1 1/2" x 2" (38mm x 51mm) angle; adds approximately 2" (51mm) to overall louver depth;
- .8 Mullions: Concealed type allowing continuous line appearance up to 120" (3048mm) wide; larger assemblies require separate visible frames with downspouts;
 - .9 Birdscreen: 3/4" x .051" (19mm x 1.3mm) expanded, flattened aluminum bird screen in removable frame, inside (rear) mount; adds approximately 3/8" (10mm) to louver depth.
 - .10 Finish: Custom high performance powder coat finish to suit architectural requirements.

- .2 Other acceptable manufacturers: Ruskin, Greenheck, Ventex, Construction Specialties.

2.20 LOUVRE BLANK-OFF PANELS

- .1 Insulated, framed, sandwich construction panels consisting of two staggered layers of (2") 50 mm thick low temperature phenolic board insulation between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

PART 3 - EXECUTION

3.01 GENERAL AIR DUCT ACCESSORIES INSTALLATION REQUIREMENTS

- .1 Install ducts in accordance with SMACNA Standards and as indicated, and all requirements of the Authorities Having Jurisdiction ("AHJs").
- .2 Provide all required labour necessary for the installation of control components and devices supplied by Controls Trades. Include all additional labour necessary for the successful completion of point-to-point verification of devices, and performance verification of devices and systems as part of the project commissioning requirements.
- .3 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 4" (100 mm) beyond insulated duct.
- .4 Support risers in accordance with SMACNA Standards or as indicated.
- .5 Provide a drain at the low point of all exhaust and outside air plenums. Slope plenum back to louver. Pipe drain to funnel floor drain.
- .6 Provide all required labour necessary for the installation of control components and devices supplied by Controls Trades. Include all additional labour necessary for the successful completion of point-to-point verification of devices, and performance verification of devices and systems as part of the project commissioning requirements.

3.02 DUCT ACCESS DOORS

- .1 Size:
 - .1 25" x 17" (650 x 425 mm) for person size entry.
 - .2 21" x 14" or 18" x 10" (525 x 350 mm or 450 x 250 mm) for servicing entry depending on required space.
 - .3 18" x 10" or 12" x 6" (450 x 250 mm or 300 x 150 mm) for viewing depending on site condition.
 - .4 As indicated on the Drawings and in the Specifications.
- .2 Location:
 - .1 At fire and smoke dampers.
 - .2 At control dampers if linkage is located internally.
 - .3 Upstream of all reheat coils.
 - .4 At devices requiring maintenance.

- .5 At locations required by Code.
- .6 As indicated on the Drawings and in the Specifications.

3.03 INSTRUMENT TEST PORTS

- .1 General:
 - .1 For traverse readings, install in accordance with recommendations of SMACNA.
 - .2 Provide adjacent to all control sensors installed by Control Contractors to allow for confirmation and validation of the readings provided by these sensors. This includes but is not limited to temperature sensors, relative humidity sensors, pressure sensors, and flow stations.
 - .3 Install in accordance with manufacturer's instructions.

3.04 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS

- .1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

3.05 INSTALLATION OF TURNING VANES

- .1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.06 INSTALLATION OF SPLITTER DAMPERS

- .1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on the drawings.
- .2 Install splitter dampers so they do not vibrate and rattle and so damper operation mechanisms are in an easily accessible and operable location.
- .3 Ensure operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

3.07 MANUAL BALANCING DAMPERS

- .1 Provide balancing dampers as follows:
 - .1 at each branch duct connection from a main trunk duct (branch ducts serve more than one terminal device, diffuser, grille, or register);
 - .2 at each duct run-out to an individual terminal device, diffuser, grille, or register;
 - .3 where indicated in the Documents.
- .2 Install balancing dampers in accordance with recommendations of SMACNA.
- .3 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers do not move or rattle.
- .4 Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.
- .5 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.
- .6 Confirm exact damper locations with TAB Trades performing air balancing testing work and install dampers to suit. Include for providing an additional eight [8] manual balancing dampers at no additional cost.

3.08 AUTOMATIC CONTROL DAMPERS

- .1 Sheet Metal Trades shall install Automatic Control Dampers supplied by BAS Trades.

- .2 Install in the exhaust air ducts from all air handling units and return fans where the exhaust duct connects to the exhaust air plenum unless otherwise noted on the drawings.
- .3 Outside air and return air dampers shall be factory mounted within the air handling units unless otherwise noted on the drawings.
- .4 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .5 Seal multiple damper modules with UL listed non-transparent silicon sealant.
- .6 Upon system start-up, ensure that dampers operate properly. Refer to BAS Specification Sections for additional requirements.

3.09 AIR FLOW STATIONS

- .1 Sheet Metal Trades shall install Air Flow Stations supplied by BAS Trades.

3.10 INSTALLATION OF FIRE DAMPERS, SMOKE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

- .1 General:
 - .1 Install dampers as per manufacturer's ULC listing.
 - .2 Where a fire damper, smoke damper or combination fire smoke damper exceeds maximum size limitations then a hybrid or Multi-blade dampers must be installed.
 - .3 Maintain integrity of fire wall and/or fire separation.
 - .4 For fire dampers, smoke dampers and combination fire/smoke dampers provide an access door adjacent to the damper to allow for inspection of the damper. Refer to Section 23 33 10 for access door requirements.
 - .5 After completion and prior to concealment, obtain approvals from the Authorities having Jurisdiction (AHJs) of complete installation.
 - .6 Provide fire stop flaps on any grilles penetrating fire-rated ceilings.
 - .7 The Mechanical Contractor shall review the Architectural Drawings. Any discrepancies between fire damper locations and the fire rated walls shall be brought to the attention of the Consultant.
- .2 Fire Dampers and Combination Smoke/Fire Dampers:
 - .1 Install fire dampers in accordance with NFPA 90A, UL555 and suppliers instructions, complete with retaining angles on both sides of wall or floor and fastened to damper collars.
 - .2 Minimum size of the opening for the fire damper shall be larger than the fire damper by 1/8" (3 mm) for each 12" (300 mm) of width or height of the damper to allow for expansion. The maximum allowable size of the opening shall be 1/2" (12 mm) larger in either dimension than the allowable minimum size.
 - .1 Example, a sleeve dimension of 36" x 48" (900 x 1200 mm) shall have an opening of 36-3/8" x 48-1/2" (912 x 1212 mm) The maximum opening size shall be 36-7/8" x 49" (924 x 1224 mm).
 - .3 The damper shall be connected to the sleeve by one (1) of the following methods:
 - .1 Where the sleeve is the same metal gauge as the duct, the duct shall be connected to the sleeve utilizing one (1) of the approved slip joints.
 - .2 Where the sleeve is 16-gauge up to 36" x 24" (900 x 600 mm) and 14-gauge for sizes exceeding 36" x 24" (900 x 600 mm) the duct may be connected with a rigid or fixed joint.
 - .4 The damper shall be centred horizontally in the opening and all of the clearance in the vertical plane shall be at the top.
 - .5 Dampers shall not be cast-in-place. Retaining angles and damper shall not be fastened directly to the wall or floor.

- .6 The damper shall be installed in the plane of the fire separation.
- .3 Smoke Dampers:
 - .1 Smoke dampers shall be installed in accordance with NFPA 92A, UL555S and the supplier's installation listing.
 - .2 All joints between the damper and the sleeve or duct and between dampers in multiple sections shall be sealed with silicone sealant on one (1) side only.
 - .3 Damper shall be installed a maximum of 24" (600 mm) from the smoke barrier.

3.11 COMBINATION DUCT MOUNTED SMOKE DAMPER OR COMBINATION FIRE SMOKE DAMPER WITH INTEGRAL SMOKE DETECTOR

- ~~.1 **Generally, Combination Duct mounted Smoke Detector and Smoke Damper or Combination Fire/ Smoke Damper Assembly, not required to be monitored at the building Fire Alarm system, shall be installed in accordance with Smoke Damper or Combination Fire/ Smoke Damper installation requirements specified in Article above. However, these smoke damper and combination fire and smoke damper assemblies, not required to be monitored and annunciated at the building fire alarm system, may be built up by the Sheet Metal Trade contractor in coordination with the BAS Trade Contractor. Field wiring between the duct mounted smoke detector and the smoke damper or combination fire and smoke damper actuator shall ensure damper closes on activation; additional 110V/1Ø/60Hz power wiring connection from emergency power supply shall be provided by the BAS Trade Contractor from the termination provided by Division 26.**~~
- .1 **Generally, Combination Duct mounted Smoke Detector and Smoke Damper Assemblies, and/or Combination Duct mounted Smoke Detector and Fire/ Smoke Damper Assemblies not required to be monitored at the building Fire Alarm system, shall be installed in accordance with Smoke Damper or Combination Fire/ Smoke Damper installation requirements specified in Article above. However, these smoke damper and combination fire and smoke damper assemblies, not required to be monitored and annunciated at the building fire alarm system, may be built up by the Sheet Metal Trade contractor in coordination with the BAS Trade Contractor without involving the Fire Alarm Trade Contractor. Field wiring between the duct mounted smoke detector and the smoke damper or combination fire and smoke damper actuator may be completed by the BAS Trades to ensure damper closes upon activation of the adjacent duct mounted smoke detector. Additional 110V/1Ø/60Hz power wiring connection from emergency power supply shall be provided by the BAS Trade Contractor from the termination provided by the Electrical Trade Contractor.**
- .2 At the Contractor's option, review with Consultant the use of a consolidated smoke damper and/or combination fire and smoke damper detector packaged assembly equal to Nailor model DSD-NF to satisfy the installation requirements. Prior to ordering and release into fabrication confirm that packaged assembly can be constructed in accordance with the manufacturer's installation listing particularly where smoke damper and/or combination fire and smoke dampers are located at or near branch duct connections or duct elbows.
- .3 Provide power wiring and/or control wiring (as may be required by the damper function) to assembly termination points provided by the assembly manufacturer.
- .4 Verify operation of Combination Duct mounted Smoke Detector and Smoke Damper or Combination Fire/ Smoke Damper Assembly in accordance with ULC-S537 "Standard for the Verification of Fire Alarm Systems"

3.12 INSTALLATION OF WIRE MESH (BIRDSCREEN)

- .1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.
- .2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

3.13 INSTALLATION OF LOUVRES

- .1 Provide louvres for wall openings.
- .2 Install louvre assemblies and secure in place in accordance with manufacturer's instructions and details.
- .3 Confirm exact louvre sizes and finish prior to ordering.
- .4 Provide vertical blade louvers for commercial kitchen exhaust applications subject to NFPA 96 requirements.
- .5 Hurricane rated louvers and sill flashing to be installed in accordance with the manufacturer's recommended procedures to ensure complete water integrity performance of louver system.

3.14 INSTALLATION OF LOUVRE BLANK-OFF PANELS

- .1 Provide blank-off panels for inactive portions of exterior wall louvres.
- .2 Secure panels in place with non-ferrous hardware so they cannot move or rattle, yet are easily removable.
- .3 Confirm exact finish of panels prior to fabrication.

3.15 AIR BALANCING

- .1 Refer to Section 20 05 95.

END OF SECTION

CONTENTS

PART 1 - GENERAL

- 1.01 GENERAL REQUIREMENTS**
- 1.02 DESCRIPTION**
- 1.03 SCOPE OF WORK**
- 1.04 BAS TRADE REQUIREMENTS**
- 1.05 GENERAL BUILDING AUTOMATION SYSTEM ("BAS") DEFINITIONS**
- 1.06 EQUIPMENT SUPPLIED FOR INSTALLATION BY MECHANICAL TRADES**
- 1.07 EQUIPMENT PROVIDED BY MECHANICAL TRADES OTHER THAN BAS TRADES**
- 1.08 APPLICABLE STANDARDS**
- 1.09 MANUFACTURERS AND INSTALLERS**
- 1.10 CONTINUITY OF STAFF AND SUBCONTRACTORS**
- 1.11 LEED SUPPORT REQUIREMENTS**
- 1.12 THE BUILDING AUTOMATION SYSTEM ("BAS")**
- 1.13 CONTROLLED INDOOR ENVIRONMENTAL CONDITIONS**
- 1.14 ENERGY AND RESOURCE METERING**
- 1.15 BAS ACCEPTANCE**
- 1.16 CORRECTION AFTER ACCEPTANCE**
- 1.17 LICENSES AND OWNERSHIP**
- 1.18 WARRANTY**

PART 2 - PRODUCTS

- 2.01 NOT USED**

PART 3 - EXECUTION

- 3.01 COORDINATION**
- 3.02 ENERGY AND RESOURCE METERING**
- 3.03 BAS TESTING, COMMISSIONING AND ACCEPTANCE**
- 3.04 OWNER TRAINING**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with requirements of the Owner's General Requirements and all documents referred to therein.

1.02 DESCRIPTION

- .1 Comply with the requirements of Section 20 01 10 Mechanical General Requirements
- .2 Comply with the requirements of Section 20 10 50 Basic Materials and Methods
- .3 Comply with the requirements of Section 20 05 70 Motors, Motor Starters, and Wiring
- .4 Comply with the requirements of Section 20 05 95 Testing Adjusting and Balancing
- .5 Comply with the requirements of Section 20 08 10 Mechanical Commissioning
- .6 Comply with the requirements of Section 25 10 10 BAS Control Network
- .7 Comply with the requirements of Section 25 30 10 BAS Instrumentation and Devices
- .8 Comply with the requirements of Section 25 56 26 Integrated Lighting System Controls

1.03 SCOPE OF WORK

- .1 Provide all detailed design, labour, materials, products and service to supply Building Automation System (BAS) with Direct Digital Control (DDC), and Energy Management (EMS) for building mechanical and electrical systems.
- .2 The entire BAS shall be peer-to-peer networked, stand-alone, distributed control in accordance with American National Standards Institute/American Society of Heating, Refrigerating and Air Conditioning Engineers (ANSI/ASHRAE) Standard 135-2004, BACnet – A Data Communication Protocol for Building Automation and Control Networks.
- .3 Be responsible for the complete installation of the Building Automation System (BAS) for this project and guarantee its proper function.
- .4 Include software and hardware, wiring, and computing equipment. The BAS shall be compatible with future control Products for ten (10) years or more.
- .5 Power wiring for all electric motors shall be by the Mechanical Trade Contractor unless indicated otherwise by the Construction Manager.
- .6 Provide sufficient resources to complete the Work within the Agreement time. Any required overtime and similar costs to complete the project by the agreed completion date is included in the Bid price.
- .7 Mechanical Trades will provide electromagnetic starters with required number of ancillary contactors unless supplied as an integral part of the Equipment. Where integral starters are supplied with Equipment, provide all additional wiring and ancillary devices to achieve specified equipment performance and control sequences.
- .8 Electrical Trades will provide lighting fixtures to be controlled by the Integrated Lighting Systems Control specified in Section 25 56 26.
- .9 Provide instruction on the revised system's operation to the Owner's maintenance personnel; allow for eight (8) days of on site and classroom instruction.
- .10 Arrange for all the necessary inspections and approvals of built-up control systems and relay panels by the Authorities Having Jurisdiction ("AHJ's"). All electrical equipment, material and its installation shall conform to the current requirements of the AHJ's including:
 - .1 Ontario Electrical Safety Code ("OESC")
 - .2 Ontario Building Code ("OBC")
 - .3 Ontario Fire Code ("OFC")
 - .4 Canadian Standards Association ("CSA")

- .11 Generally control systems, algorithms and sequence programming shall follow requirements outlined in ASHRAE Guideline 35 - High-Performance Sequences of Operation for HVAC Systems. Any proposed deviations from the Standard shall be reviewed with the Consultant prior to implementation on site.

1.04 BAS TRADE REQUIREMENTS

- .1 The BAS Trades shall co-ordinate and take the lead role in the onsite testing, supervision of assembly and Commissioning of the installation and verification of the performance of the BAS.
- .2 The BAS Trades shall ensure that all equipment meets all design and Code requirements prior to shipment from the BAS Trades shop.
- .3 The BAS Trades shall provide specialized expertise during the installation, Start-up and Commissioning of the BAS as follows:
 - .1 On-site technical supervision of the BAS Trades during installation and assembly of the equipment as per BAS component manufacturer's instructions.
 - .2 On-site technical supervision of the BAS Trades for calibration of equipment and systems prior to commencement of any system testing.
 - .3 Review of the electrical and communication wiring.
 - .4 Technical supervision of Start-up and Commissioning of the BAS.
 - .5 Completion of all forms necessary for Acceptance of the equipment by Owner and Consultant.
 - .6 Submission of BAS shop drawings and preparation of Operating and Maintenance ("O&M") Manuals.
 - .7 Owner's training for operation and maintenance of BAS equipment and ancillary components.

1.05 GENERAL BUILDING AUTOMATION SYSTEM ("BAS") DEFINITIONS

- .1 The following terms and references appear throughout the Division 25 Specifications, and the Control Sequences issued with the Documents and provide additional background information as to the intent of the functionality of the Building Automation System (BAS).
 - .1 **Actuator:** A mechanical device that is used to operate a final control element in a control system (e.g., Control Valve, or Damper) based on an electric, electronic, or pneumatic signal from a Controller.

Actuators may attach to the valve stem or damper shaft through a linkage or be direct coupled connecting directly to the stem or shaft, and can be two separate devices or together they can be one device.

The direction of shaft rotation on loss of control signal varies for spring-return Actuators. The direction can be clockwise (CW) or counterclockwise (CCW) as viewed from the drive end of the Actuator. Actuator controlled Control Valves and Dampers also vary as to whether they open or close on a loss of control signal. This depends on the specific Actuator, linkage arrangement, and Control Valve or Damper selected.

Actuators are available with various timings to drive through full stroke such as 15, 30, 60, 120, or 240 sec. In general, the timing is selected to meet the application requirements (e.g., an Actuator with 240 sec timing might be used to control the Variable Frequency Drive (VFD) for a fan in a floating control system).
 - .1 **Electric Actuator:** Electric actuators consist of an electric motor coupled to a gear train and output shaft. Typically, the shaft drives through 90 degrees or 160 degrees of rotation depending on the application. For example, 90-degree stroke Actuators are used with Dampers, and 160-degree stroke actuators are used with Control Valves. Limit switches, in the Actuator, stop the motor at either end of the stroke, or current limiters sense when the motor is stalled at the end of the stroke. Actuator gear trains are factory lubricated for life requiring no additional lubrication.

The Electric Actuator's motor may be electrically reversible by the controller for some applications. Electric Actuators with a return spring enables the output shaft to return to the normal position on loss or interruption of power; a solenoid brake may be used on spring-return actuators to hold the Actuator in the control position.

- .2 **Air Handling Unit (AHU):** Equipment that conditions air either through filtration, heating, humidifying, cooling, de-humidifying, or any combination thereof, and delivers it to an air distribution system.
- .3 **Algorithm:** A calculation method that produces a control output by operating on an Error signal or a time series of Error signals. Also see Control Algorithms.
- .4 **Analog:** Continuously variable (e.g., the outdoor air temperature is an Analog value).
- .5 **Analog Input (AI):** continuously variable input value, usually from a Sensor, referenced to a Controller.
- .6 **Analog Output (AO):** continuously variable output value, usually a control signal sent to an Actuator, referenced to a Controller.
- .7 **Analog-to-Digital (A/D) Converter:** The part of a microprocessor based controller that changes an analog input signal to a digital value for use by the microprocessor in executing software programs. Analog input values typically come from temperature, pressure, humidity, or other types of sensors or transducers.
- .8 **Application Software:** Programs that provide functions such as direct digital control, energy management, lighting control, event initiated operations, and other alarm and monitoring routines.
- .9 **Authority (Reset Authority or Compensation Authority):** A setting that indicates the relative effect a compensation sensor input has on the main Setpoint (expressed in percent).
- .10 **Authority Having Jurisdiction (AHJ):** An organization, office, or individual responsible for enforcing the requirements of a Code or Standard, or for approving equipment, materials, an installation, or a procedure. There may be more than one AHJ.
- .11 **Automatic Control System:** A system that reacts to a change or imbalance in the Controlled Variable it controls by adjusting other variables to restore the system to the desired balance.
- .12 **Binary:** A term applied to a signal or device that has only two discrete positions or states. When used in its simplest form, as in a "binary signal" (as opposed to "analog signal"), the term denotes an "on-off" or "high-low" state, i.e., one which does not represent continuously varying quantities. A Digital signal (value of 1 or 0) is an example of a Binary signal.
- .13 **Building Automation System (BAS):** A system that controls the comfort and safety of a buildings assets and environment, and which centralizes the monitoring, operations; management of a building to achieve a more efficient operation overall.
- .14 **Building Automation and Control Network (BACnet) Protocol:** A BAS communications protocol developed by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
- .15 **Building Control Unit (BCU):** A PC or other device used primarily by building operation personnel for everyday building operations. This processor can access points or data in all the lower level controllers and other BCUs on the network. The processor at this level typically incorporates colour operator terminal displays and plug-in function boards to accommodate additional operator terminals, printers, memory expansion, and communications links.
- .16 **Building Operator:** Building operations staff familiar with the operating and maintenance requirements of the building equipment and/or systems infrastructure.
- .17 **Commissioning:** The process of designing, achieving, verifying, and documenting the performance of a building, or building system(s), or other building infrastructure element to meet the operational needs of the building, and to confirm building system or element's performance capabilities align with the design documentation within the of the design and

the Owner's functional criteria. Commissioning also includes training of operating personnel. Also see Integrated System Testing (IST) requirements.

- .1 **Mechanical System Commissioning:** The process of documenting and verifying the performance of mechanical systems so that systems operate in conformity with the design intent. Refer to Specification 20 08 10 Mechanical Commissioning for additional requirements.
- .18 **Communications Protocol:** A set of conventions used to govern the format and content of data transmitted between Processors.
- .19 **Configurable Controller:** A controller with a set of selectable programs with adjustable parameters but without the ability to modify the programs.
- .20 **Contact Arrangement:** The electric switch configuration of a controller, relay, contactor, motor starter, limit switch, or other control device. Contacts which complete circuits when a relay is energized (pulled in) are called normally open (NO) or "in" contacts. Contacts which complete electric circuits when a relay is de-energized (dropped out) are called normally closed (NC) or "out" contacts. Many contact arrangements are available depending on the control device.
- .21 **Control Algorithms:**
 - .1 **Compensation Control:** A process of automatically adjusting the control Setpoint of a given Controller to compensate for changes in a second measured variable (e.g., outdoor air temperature). For example, the hot water temperature in a perimeter radiation system is normally reset upward as the outdoor air temperature decreases. Also called "Reset Control".
 - .2 **Derivative Control:** A control Algorithm that changes the output of a Controller in proportion to the rate of change of the Error.
 - .3 **Enhanced Proportional-Integral-Derivative (EPID) Control:** A control Algorithm that enhances the standard PID algorithm by allowing the designer to enter a startup output value and error ramp duration in addition to the gains and Setpoints. These additional parameters are configured so that at startup the PID output varies smoothly to the control point with negligible overshoot or undershoot.
 - .4 **Integral Control:** A method of changing the output of a controller by an amount proportional to the Error and the duration of that Error.
 - .5 **Proportional Control:** A control Algorithm or method in which the final control element moves to a position proportional to the Error.
 - .6 **Proportional-Integral (PI) Control:** A control Algorithm that combines the proportional (proportional response) and integral (reset response) control Algorithms. Reset response tends to correct the offset resulting from proportional control. Also called "proportional-plus- reset" or "two-mode" control.
 - .7 **Proportional-Integral-Derivative (PID) control:** A control algorithm that enhances the PI control algorithm by adding a component that is proportional to the rate of change (derivative) of the Error. Compensates for system dynamics and allows faster control response. Also called "three- mode" or "rate-reset" control.
- .22 **Control Modes:**
 - .1 **Modulating Control:** When an actuator is energized, it moves the damper or valve a distance proportional to the sensed change in the controlled variable. For example, a thermostat with a 10-degree throttling range moves the actuator 1/10 of the total travel for each degree change in temperature.
 - .2 **On/Off Control:** See Two-Position Control.
 - .3 **Two-Position Control:** When an actuator is energized it moves the valve or damper to one of the extreme positions either full ON or full OFF with no intermediate

- operating positions available. The valve or damper position remains unchanged until conditions at the controller have moved through the entire range of the differential.
- .4 **Floating Control:** When an actuator is energized, it moves the damper or valve until the controller is satisfied. The actuator maintains that position until the controller senses a need to adjust the output of the valve or damper.
- .23 **Control Point:** See Process Variable.
- .24 **Control Valve:** A device used to control the flow of fluids such as steam, water or aqueous glycol solution.
- .25 **Controlled Variable:** The quantity or condition of a medium measured by a Sensor and controlled by the BAS through a Controller. For example, temperature, relative humidity, pressure.
- .26 **Controller:** Controllers receive inputs from sensors. A Controller compares the input signal with the desired condition (Setpoint), determines the proper Corrective Action, and generates an output signal to operate a controlled device. A sensing device (eg. temperature, humidity, pressure sensor) inputs, at regular intervals, changes in the controlled, or process variable, to the Controller.
- .1 **Electronic Controller:** A solid-state device usually consisting of a power supply, a sensor amplification circuit, a process/comparing circuit, an output driver section, and various components that sense changes in the controlled variable and derive a control output which provides a specific control function. In general, adjustments such as setpoint and throttling range necessary for the process can be done at the controller via potentiometers and/or switches.
- .2 **Microprocessor Controller:** A microprocessor controller uses digital logic to compare input signals with the desired result and computes an output signal using
- .27 **Corrective Action:** Control action taken by the BAS resulting from a change in the Controlled Variable; initiated when the Controlled Variable deviates from Setpoint beyond the Deadband value.
- .28 **Damper:** A device used to control the flow of air in a duct or through a wall louver.
- .29 **Dashboard:** A high-level visualization tool(s) that displays a building's operating data, performance analytics and other useful information, at a Workstation, and intended to make it easy for operators to quickly visualize and prioritize their work. Information presented will allow operators to respond to changing operational parameters with a focus on building occupant comfort, energy usage, costs, Key Performance Indicators (KPIs), trends, and alarm management, and comparisons with similar buildings or building uses. Multiple dashboards may be provided for each building stakeholder or stakeholder group. Each stakeholder group must determine what information to present for each dashboard, and how it is to be presented.
- .30 **Deadband:** A range of measurement in which no corrective action is taken by the Controller. See also "Zero Energy Band".
- .31 **Demand:** the highest amount of power use (average KW over an interval) recorded for a building or service in a selected time frame.
- .32 **Detector:** See Sensor
- .33 **Deviation:** See Error.
- .34 **Digital:** A term used to describe a series of on and off, or Binary, pulses arranged to represent continuous values or discrete states. Processors operate using digital language.
- .35 **Digital-to-Analog (D/A) Converter:** The part of a microprocessor based controller that changes digital values from a software program to analog output signals for use in the control system. The analog signals are typically used to position actuators or actuate transducers and relays.

- .36 **Direct Digital Control (DDC):** A control loop in which a digital controller periodically updates a process as a function of a set of measured control variables and a given set of control algorithms.
- .37 **Digital Control:** A control loop in which a microprocessor- based controller directly controls equipment based on sensor inputs and setpoint parameters. The programmed control sequence determines the output to the equipment.
- .38 **Digital (Binary) Input (DI):** a two-state (On-Off) value, usually associated with a switch or state, referenced to a controller.
- .39 **Digital (Binary) Output (DO):** a two-state (On-Off) value, usually associated with starting or stopping equipment or generating an alarm, referenced to a controller.
- .40 **Dynamic Display Data:** Data displayed on a Workstation which periodically updates, such as temperature or ON/OFF status. The data updates automatically at a rate appropriate for the point or it may be updated manually.
- .41 **Electric Control:** A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature-sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer. The controller signal usually operates or positions an electric actuator or may switch an electrical load directly or through a relay included in the circuit.
- .42 **Electronic Control:** A control circuit that operates on low voltage and uses solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator. Electronic devices are primarily used as sensors. The controller usually furnishes fixed control routines based on the logic of the solid-state components.
- .43 **Energy Management System (EMS):** The portion of the BAS that performs Energy Management System functions used for energy metering data acquisition, data storage, analysis, display and reporting of energy use.
- .44 **Error:** Deviation of the measured value of the Controlled Variable from the Setpoint. Also called Deviation or Offset.
- .45 **Ethernet:** a communications network that facilitates transmission of data between nodes across multiple networks in different contexts.
- .46 **Field Equipment Controller (FEC):** A microprocessor-based controller that controls centrally located HVAC equipment such as variable air volume (VAV) supply units, built-up air handlers, and central chiller and boiler plants. Field Equipment Controllers interface with controlled equipment directly through sensors and actuators, or indirectly through communications links with Zone Level Controllers (ZLCs). Field Equipment Controllers typically have an input/output (I/O) device capability, a library of control programs, and may control more than one mechanical system from a single controller, and may contain an integral Operating Terminal. In a BAS, these controllers provide processing of point data for higher-level processors such as Building Control Units (BCUs) and Management Level Processors (MLPs). FECs typically include energy management programs. FECs shall have local connectivity capability to a Laptop PC or Mobile User Interface.
- .47 **Final Control Element:** A device such as a Control Valve or Damper that acts to change the value of the Manipulated Variable. An Actuator positions the Final Control Element.
- .48 **Fire Alarm Control Unit or Fire Alarm Control Panel:** A system component that receives inputs from automatic and manual fire alarm devices. Fire Alarm Control Unit might also supply power to detection devices, transponders, or off-premises transmitter(s). The Fire Alarm Control Unit also operates releasing circuits or solenoids, to provide transfer of power to the notification appliances, or transfer of condition to relays or devices connected to the Fire Alarm Control Unit. A Fire Alarm Control Unit can be a local fire alarm data-gathering panel or a master control unit.

- .49 **Fire Alarm System (FAS):** Components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.
- .50 **Gateway(s):** Software used to translate one application's protocol data (i.e., BACnet) to another (e.g., Modbus or LonTalk). Gateway software can be installed as a "driver" in a BAS controller (i.e., for Modbus), or provided by a separate Gateway device (i.e., for LonTalk) allowing the BAS to effectively Integrate with Third Party Devices.
- .51 **Input/ Output (I/O):** the communication signal between an information processing systems; Inputs are the signals or data received by the system and Outputs are the signals or data sent from it.
- .52 **Instrumentation:** A collection of Sensors, or their application, for the purpose of observation, measurement, control, or any combination of these.
- .53 **Integral Action:** An action in which there is a continuous linear relationship between the amount of increase (or decrease) on the output to the final control element and the deviation of the controlled variable to reduce or eliminate the deviation or offset.
- .54 **Integrate or Integration:** The process of ensuring information from Third Party Devices properly communicates with the BAS. Also see Gateway(s).
- .55 **Integrated Systems Testing (IST):** Integrated testing of fire protection and life safety systems completed in accordance with the requirements of CAN/ULC-S1001.
- .56 **Lag:** A delay in the effect of a changed condition at one point in the system, or some other condition to which it is related. Lag is also, the delay in response of the sensing element of a control due to the time required for the sensing element to sense a change in the sensed variable.
- .57 **Limit Sensor:** A device that senses a variable that may be other than the controlled variable and over rides the Main Sensor at a preset high or low limit.
- .58 **Linkage:** A device that connects an Actuator to a Damper or Control Valve. To open and close a Damper, the typical linkage consists of an actuator crank-arm, ball-joints, pushrod, and damper crank-arm. In a Control Valve application, the linkage connects the Actuator to the Control Valve and translates the rotary output of the Actuator to the linear action of the Control Valve stem.
- .59 **Load:** In a heating or cooling system, the heat transfer that the system called upon to provide. Also, the work that the system must perform.
- .60 **Local Area Network (LAN):** a communication network that transmits data between Processors, Sensors and other devices that are relatively close geographically.
- .61 **LonMark Standard:** A communications standard for control networks developed by the Echelon Corporation and the LonMark Interoperability Association.
- .62 **Loop:** A combination of two or more Instruments or control functions arranged so that signals pass from one to another for the purpose of measurement and/or control of a Process Variable.
- .63 **Main Sensor:** The primary Sensor measuring the medium to be controlled.
- .64 **Management Level Processor (MLP):** Management Level Processors (MLPs) reside at the top of the BAS system hierarchy, exercising control and management over the connected sub-systems. An MLP is typically a server with a desktop workstation used by management personnel to collect, store, and process data for reports on energy use, operating costs, and alarm activity. The MLP can access points or data in all the lower level processors and controllers. Many of the functions of the MLP may be incorporated into a Building Control Unit (BCU). MLPs shall have local connectivity capability to a Laptop PC or Mobile User Interface
- .65 **Manipulated Variable:** The quantity or condition of media or energy controlled and/or regulated by the BAS to achieve a desired change in the Controlled Variable's condition.

- .66 **Measured Variable:** A variable that is measured and may be Controlled (e.g., discharge air is measured and controlled, outdoor air is only measured).
- .67 **Microprocessor Based Control:** A control circuit that operates on low voltage and uses a microprocessor unit, digital input and output connections, A/D and D/A converters, a power supply, and software to perform logic and control functions, such as operating a Relay or providing an output signal to position an Actuator. Electronic devices are used primarily as Sensors. The Controller may also provide flexible DDC and energy management Algorithms.
- .68 **Mobile User Interface:** BAS network access for operator using Smart Phone Device or Tablet.
- .69 **Modulating:** Varying or adjusting by small increments and decrements.
- .70 **Negative Compensation:** A compensating action where a decrease in the compensation variable has the same effect as an increase in the controlled variable. For example, in a heating application as the outdoor air temperature decreases, the control point of the controlled variable increases. Also called Reverse Compensation, Winter Reset or Winter Compensation.
- .71 **Normally Closed (NC):** position of device in a de-energized state.
- .72 **Normally Open (NO):** position of device in a de-energized state.
- .73 **Occupied Zone:** The area in a room or building in which most human activity takes place, considered by ASHRAE to be between 3 and 72 inches from the floor and 2 feet from walls or fixed equipment.
- .74 **Operating Software:** The main operating system and programs that schedule and control the execution of all other programs in a microprocessor-based controller. This includes routines for input/output (I/O) scanning, A/D and D/A conversion, scheduling of application programs, and access and display of control program variables.
- .75 **Operator Workstation (OWS):** a computer terminal that used to access the BAS network. Operator Workstations are for use by a single Building Operator and are password protected.
- .76 **Peer-to-peer:** Control devices exist and communicate equally on same network. Devices on a LAN use peer-to-peer communication.
- .77 **Positive Compensation:** A compensating action where an increase in the compensation variable has the same effect as an increase in the controlled variable. For example, in a cooling application, as the outdoor air temperature increases, the control point of the controlled variable increases. Also called Direct Compensation, Summer Reset or Summer Compensation.
- .78 **Process Variable:** The actual value of the Controlled Variable (Setpoint plus or minus Error) received from a Sensor.
- .79 **Processor:** A communications device that receives a data from multiple Controllers and/or Sensors, performs logic and Control Algorithms with the data received, and creates an output data signal for use by multiple Controllers, and by Building Operators. All Processors shall have local connectivity capability to a Laptop PC or Mobile User Interface. Management Level Processors (MLPs), Building Control Units (BCUs), Field Equipment Controllers (FECs), and Zone Level Controllers (ZLCs) are examples of Processors.
- .80 **Proportional Band:** In a proportional controller, the control point range through which the Controlled Variable must pass to drive, or move, the final Control Element through its full operating range. Proportional Band is expressed in percent of primary Sensor span, usually expressed in a quantity of engineering units ((e.g., degrees Fahrenheit, percent relative humidity, pounds per square inch). As called Throttling Range and Modulating Range.
- .81 **Relay:** A relay uses an electric, pneumatic, or hydraulic signal to operate a Switch, allowing it to control a high-powered circuit with a low-powered signal. Relays are used to control circuits in applications where the control signal (low voltage) needs to be isolated from the circuit it controls (higher voltage). For example a motor starter.

- .82 **Remote Setpoint Adjustment:** A means for adjusting a Setpoint from a remote location, in lieu of adjusting it at the Controller itself. The means of adjustment may be manual with a panel or space mounted potentiometer, or automatic when a separate device provides a signal (voltage or resistive) to the Controller.
- .83 **Repeatability:** The closeness of agreement between the results of successive measurements of the same medium, carried out under by the same measurement procedure; with the same measuring instruments used under the same conditions; at relatively short intervals of time.
 - .1 **Non-Repeatability:** Deviation from Repeatability.
- .84 **Repeater:** Connects two communications network segments together to amplify the signals extending the length of the communication network. A Repeater provides a degree of electrical isolation and protection from electrical disturbances on the opposing side of the unit. A short or communications disruption created on one side of a Repeater will not affect the communications on the other side of the Repeater.
- .85 **Reset:** A control function that attempts to return a system or device to its normal state.
- .86 **Response Time:** The time it takes an element to respond to a change in the value of the measured variable or to produce a change in the output signal.
- .87 **Router:** Provides the electrical isolation and amplification functions of a Repeater, but also filters the transmission of data packets based on domain and sub-net addressing. This logically separates the two communication networks and filters the traffic between them. The filter function of the Router isolates data communication traffic and enhances the bandwidth utilization on the primary communications network. A Router separates the communications network into two different "channels", one on either side of the Router.
- .88 **Sensing Element:** A device or component that detects and measures the value of the Controlled Variable.
- .89 **Sensor:** A device, that includes a Sensing Element, placed in the medium to be measured or controlled. A Sensor will change the output signal in relation to a physical change in the sensed medium (e.g., temperature, humidity). Also known as a Detector.
- .90 **Setpoint:** An input variable on the Controller scale at which the Controller is set to the desired value (e.g., the desired room temperature set on a Temperature Sensor or Thermostat). The Setpoint may be manually set, or a value reset by a programmed Algorithm. The Setpoint value is expressed in the same units as the Controlled Variable.
- .91 **Step Control:** Control method in which a multiple-switch assembly sequentially switches equipment (e.g., electric heat, multiple chillers) as the controller input varies through the proportional band. Step controllers may be actuator driven, electronic, or directly activated by the sensed medium (e.g., pressure, temperature).
- .92 **Switch(es):** A device that opens or closes a circuit, allowing or preventing the flow of electricity.
 - .1 **Double Pole Double Throw (DPDT) Switch:** Two separate switches that operate simultaneously, each with a normally open and a normally closed contact and a common connection.
 - .2 **Single-Pole Single Throw (SPST) Switch:** A switch that only has one of either a normally open or a normally closed contact.
 - .3 **Single-Pole Double-Throw (SPDT) Switch:** A switch combining both normally open and normally closed switch contacts.
- .93 **Testing Adjusting and Balancing (TAB):** also see Section 20 05 95
 - .1 **Air Side:** adjusting air flow rates through air distribution system devices, such as fans and diffusers, by manually adjusting the position of dampers, splitters vanes, extractors, etc., or by using automatic control devices, such as constant air volume or variable air volume boxes.

- .2 **Hydronic Side:** adjusting water flow rates through hydronic distribution system devices, such as pumps and coils, by manually adjusting the position valves, or by using automatic control devices, such as automatic flow control valves.
- .94 **Third Party Devices:** Equipment or systems having their own integral control that are required to Integrate with the BAS. Third Party Devices shall use an open protocol to communicate relevant input and output data, or a Gateway shall be provided to ensure an equivalent data communication pathway. Examples of Third Party Devices are Variable Frequency Drives (VFDs), Chillers, Boilers, Computer Room Air Conditioning (CRAC) Units, Lighting Control Systems, Security Systems, and systems of similar complexity.
- .95 **Time Constant:** The time required for a dynamic component, such as a sensor, or a control system to reach 63.2 percent of the total response to an instantaneous (or “step”) change to its input. Typically used to judge the responsiveness of the component or system.
- .96 **Transducer:** A general term for a device that receives information in the form of one or more physical quantities from a Sensor, modifies the information and/or its form, and produces a resultant output signal.
- .97 **Transformer:** A device used to change voltage from one level to another. For control circuits this is usually line voltage to low voltage. Transformers can be used only on ac power.
- .98 **Transmitter:** A device that senses the low-level output of a Sensor or Transducer and generates a higher-level output signal for use by a Controller, Actuator or display device. A Sensor may or may not be integral with the Transmitter.
- .99 **Turndown:** Expressed as the ratio of maximum flow to minimum controllable flow. For example, in an air system with a maximum airflow of 2000 cfm and minimum controllable airflow of 400 cfm, the turndown is 5:1; for example, in a hydronic system, if the system requires a 66 usgpm maximum flow through the valve and since the minimum accurately controllable flow is 3 usgpm, the turndown is 22:1.
- .100 **Uninterruptible Power Supply (UPS):** A UPS power source is a type of continual power system that provides automated backup electric power to a load when the input power source or mains power fails. A UPS differs from a traditional emergency power supply system, or standby generator, in that a UPS will provide near-instantaneous protection from input power interruptions by switching to energy stored in battery packs, super-capacitors or flywheels.
- .101 **Variable Frequency Drive (VFD):** A specialized motor controller that varies the frequency and/or voltage of the electrical service to the motor varying the speed of the motor as part of a Control Algorithm. See Specification Section 20 05 75 Variable Frequency Drives for additional requirements.
- .102 **Variable Speed Drive (VSD):** See Variable Frequency Drive (VFD).
- .103 **Voltage:**
- .1 **Line Voltage:** A term which refers to the normal electric supply voltage. Line voltage can be used directly in some control circuits or can be connected to the primary side of a step down transformer to provide power for a low-voltage control circuit. Most line-voltage devices function at their rated voltage +10%/–15%. Line-voltage devices should be tested and listed by an appropriate approval agency.
- .2 **Low Voltage:** A term which applies to wiring or other electrical devices using 30 volts or less. Low-voltage control devices usually function on 24V ac +10%/–15%.
- .104 **Zone Level Controller (ZLC):** A microprocessor-based controller that controls distributed or unitary HVAC equipment such as VAV terminal units, fan coil units, and heat pumps. At the Zone Level, sensors and actuators interface directly with the controlled equipment. These controllers typically have relatively few connected I/O devices, standard control sequences, and are dedicated to specific applications. In a BAS, Zone Level Controllers (ZLCs) provide processing of point data for higher level processors. ZLCs shall have local connectivity capability to a Laptop PC or Mobile User Interface

- .105 **Zone (Zoning):** A defined area in a building from which a signal can be received, an area to which a signal can be sent, an area in which a form of control can be executed. The practice of dividing a building into sections, or zones, for heating and cooling comfort control, or an area protected by a life safety system. The term is used to create a relationship between monitored inputs to actuation outputs and peripherals.
- .2 **Instrumentation Definitions:** the following terms are used in addition to the General Building Automation System Definitions, and are used to describe common Input and Output signals to the BAS; however, terms may also be used to describe other control system components and functions.
 - .1 **Aquastat:** see Liquid Immersion Temperature Sensor.
 - .2 **Dewpoint Temperature Sensor:** A virtual point that measures and responds to changes in actual moisture content of the ambient air generated from an Algorithm using analog inputs from dry-bulb temperature and humidity Sensors, a Dewpoint temperature value input signal is sent to a Controller.
 - .3 **Dry-bulb Temperature Sensor:** A device that measures and responds to changes in dry-bulb temperature of the ambient air surrounding the Sensor and inputs a signal to a Controller. Also called a Thermostat.
 - .4 **Enthalpy Sensor:** A virtual point that measures and responds to changes in the energy content of the ambient air generated from an Algorithm using analog inputs from dry-bulb temperature and humidity Sensors, an Enthalpy value input signal is sent to a Controller.
 - .5 **Flow Measuring Station (FMS):** A device containing multiple static pressure sensors and multiple total pressure sensors manifolded separately for instantaneously measuring average pressures across the face of a duct.
 - .6 **Flow Meter:** A device that measures and responds to changes in the volumetric flow.
 - .1 **Flow Meter (Wet):** A device that measures and responds to changes in the volumetric flow of the liquid surrounding the Sensor and inputs a signal to a Controller.
 - .2 **Flow Meter (Dry):** A device that measures and responds to changes in the volumetric flow of the air, gas or steam surrounding the Sensor and inputs a signal to a Controller.
 - .7 **Humidity Sensor:** A device that measures and responds to changes in relative humidity of the ambient air surrounding the Sensor and inputs a signal to a Controller. Also called a Humidistat.
 - .8 **Liquid Immersion Temperature Sensor:** A device that measures and responds to changes in the temperature of the liquid surrounding the Sensor and inputs a signal to a Controller. Also called an Aquastat.
 - .9 **Liquid Level Sensor:** A device that detects the presence of, and/or measures the height of a liquid.
 - .10 **Pressure Sensor:**
 - .1 **Differential Pressure Sensor:** a device that measures the pressure difference between a gas or a fluid's condition relative to a different condition. Examples include a differential pressure measured between the supply and return chilled water piping mains serving a mechanical room, or the difference between an infectious patient hospital bedroom and the adjacent corridor.
 - .2 **Static Pressure Sensor or Tube:** A sensing device with holes perpendicular to the fluid flow stream that measures the fluid static pressure relative to the ambient surroundings.
 - .3 **Total Pressure Sensor or Tube:** A sensing device with holes facing the fluid flow stream that measures the fluid total pressure relative to the ambient surroundings.

- .4 **Velocity Pressure Sensor:** a device that measures the velocity pressure of a flowing fluid. A Velocity Pressure Sensor can also be a virtual point sensor that subtracts the Static Pressure of a flowing fluid from the Total Pressure.
- .11 **Thermostat:** see Dry-bulb Temperature Sensor.
- .12 **Wet-bulb Temperature Sensor:** A virtual point that measures and responds to changes in the moisture content of the ambient air generated from an Algorithm using analog inputs from dry-bulb temperature and humidity Sensors, a wet-bulb temperature value input signal is sent to a Controller.
- .3 **Air Side System Definitions:** the following terms are used in addition to the General Building Automation System Definitions, and used primarily for control in air conditioning, air handling, and air distribution systems, however, terms may also be used to describe other control system components and functions.
- .1 **Airflow:** The rate at which a volume of air moves through a duct. In this section, airflow is denoted Q and is measured in cubic feet per minute (cfm). Airflow is derived as follows:

$$Q = A \times V_{AVG}$$
Where:
Q = Airflow in cfm
A = Cross-sectional area of duct in square feet (sq.ft)
 V_{AVG} = Average velocity
- .2 **Constant Air Volume (CAV) Box:** The terminal device in a central supply fan system that maintains a fixed air volume delivered in the downstream ductwork regardless of varying discharge static pressure in the main upstream distribution ductwork.
- .3 **Constant Air Volume (CAV) System:** A central fan system arrangement in which air volume delivered in the duct does not vary or change.
- .4 **Dewpoint Temperature:** The temperature at which the air is fully saturated with water, or is at a 100% Relative Humidity condition. Measured virtually using an Algorithm that uses the Dry-bulb Temperature and the Relative Humidity.
- .5 **Dry-bulb Temperature:** The ambient air temperature measured by a temperature sensor that is freely exposed to the ambient air, but shielded from other heating or cooling effects.
- .6 **Duct Cross Sectional Area:** For round ducts, the duct cross-sectional area ($A = \pi \times [R^2]$), where R is the Radius (ft., or [in./12]), and the duct cross-sectional area is measured in square feet (sq.ft).
Note: If duct dimensions are in inches (in.) and the result of the duct area is in square inches (sq.in.), divide the result by 144 sq.in/sq.ft to obtain square feet (sq.ft).
- .7 **Duct Diameter:** For round ducts, the diameter is twice the radius ($D = 2 \times R$).

For rectangular ducts, an equivalent diameter is derived from ASHRAE as follows:

$$D_{eq} = \frac{1.30 (ab)^{0.625}}{(a + b)^{0.250}}$$

Where:

D_{eq} = Equivalent Rectangular Duct Diameter (in.)

a = duct side length (in.)

b = duct opposite side length (in.)

- .8 **Electrostatic Air Cleaner:** A device that has an electrical charge to trap particles traveling in the airstream.
- .9 **Energy Recovery Ventilator (ERV):** a type of air-to-air heat exchanger combined with a ventilation system for bringing in fresh outside air, and preheated it at the same time with exhaust air. Also called a Heat Recovery Ventilator (HRV).
- .10 **Exhaust Air (EA):** Air from a space that is discharged to Outdoors and is not to re-enter the building.
- .11 **Fan Surge:** A condition that occurs when air passing over the fan blades causes a stall. A fan surge causes a fluctuation in duct static pressure and an increase noise level.
- .12 **Flow Differential:** The difference between supply and return airflows necessary to maintain a positive or a negative pressure in an area. For example, if supply airflow is 1800 cfm and return airflow is 1500 cfm, the differential (positive) is 300 cfm. The 300 cfm surplus leaves the building through exhaust fans or vents and exfiltration.
- .13 **Impact Tube:** A sensing device with a single opening that points directly into the airstream for measuring Total Pressure.
- .14 **Mixed Air (MA):** Typically a mixture of Outdoor Air (OA) and Return Air (RA) from the space.
- .15 **Outdoor Air (OA):** Unconditioned air brought in to the building from outdoors.
- .16 **Relative Humidity (RH):** The ratio of the quantity of water vapor in the air to the quantity of water vapor required for saturation at the same temperature. Measure with a Relative Humidity sensor.
- .17 **Return Air (RA):** Air entering an air handling system that has been returned from the occupied space.
- .18 **Return Air Volume (RAV) Box:** The terminal device in a central return fan system that modulates the air volume returned from a space. The RAV Box control may be arranged to maintain a constant airflow Setpoint, a varying air volume that tracks a VAV Box supply air Controller Setpoint, a Differential Pressure Setpoint, or other control Algorithm.
- .19 **Static Pressure (SP):** The pressure created by air (whether in motion or not) confined in an enclosed area such as a duct or building due to its potential energy. Static pressure is exerted perpendicularly on all interior walls of the enclosure (duct or building) with respect to a reference pressure outside the enclosure. When static pressure is above atmospheric pressure it is positive and when below atmospheric pressure it is negative.
- .20 **Supply Air (SA):** Conditioned air that has passed through a coil in an Air Handling Unit; Supply Air is typically Mixed Air that has been conditioned in an Air Handling Unit. Supply Air may also refer to air discharged from a supply duct outlet (register or diffuser) into a space. Also referred to as Discharge Air.
- .21 **Total Pressure (TP):** The algebraic sum of Velocity Pressure (VP) plus Static Pressure. Total pressure is derived:
$$TP = VP + SP$$
- .22 **Variable Air Volume (VAV) Box:** The terminal device in a central supply fan system that modulates the air volume delivered in the downstream ductwork, regardless of varying discharge static pressure in the main upstream distribution ductwork, to maintain a Setpoint.
- .23 **Variable Air Volume (VAV) System:** A central fan system in which airflow in the duct varies depending on the instantaneous load requirements of the connected VAV Boxes.
- .24 **Velocity:** The speed or rate of flow of the air stream in a duct. In this section, velocity is denoted V and is measured in feet per minute (fpm).
- .1 **Average Velocity:** The sum of the air velocities from equal area increments of a duct cross-section divided by the number of increments. Average velocity, denoted V_{AVG} , is derived:

$$V_{AVG} = \sum (V_1 + V_2 + V_3 + \dots + V_N) / N$$

Where:

N = Number of duct increments

- .2 **Peak Velocity:** The greatest air velocity occurring in an increment of a duct cross-section. Peak velocity is denoted V_{PK}
- .25 **Velocity Pressure (VP):** The pressure created by air moving at a velocity due to its kinetic energy. Velocity pressure, denoted VP, is always exerted in the direction of airflow and is always a positive value. Velocity pressure can be measured by the difference between total and static pressure. Also called Dynamic Pressure:

Velocity Pressure and Velocity are related by the equation:

$$V = \left(\sqrt{2G \times \frac{VP}{Da} \times \frac{1 \text{ ft}}{12 \text{ in}}} \right) \frac{60 \text{ sec}}{1 \text{ min}}$$

Where:

V = Velocity (ft./min)

G = Gravitational acceleration in feet per second squared (ft./sec²)

VP = Velocity pressure in inches of water gauge (in.wg.)

Dw = Density of water at a specified temperature measured in pounds per cubic foot (lb/cu.ft.)

Da = Density of the air flowing in the duct measured in pounds per cubic foot (lb/cu.ft.)

1ft./12 in. = Conversion factor to convert inches to feet

60 sec/1 min = Conversion factor to convert seconds to minutes

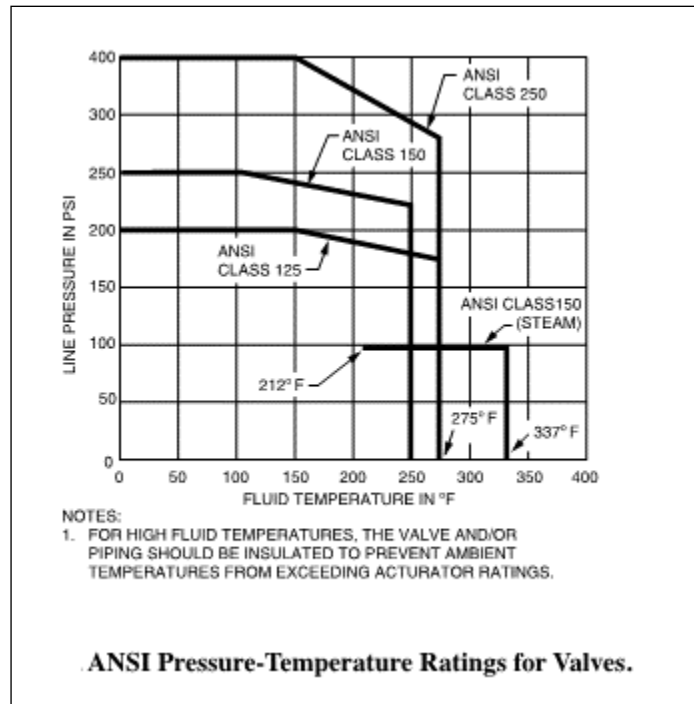
- .26 **Ventilation Air:** Conditioned Outdoor Air (OA) brought into the building with the primary intention that it be delivered to an occupied space.
- .27 **Wet-bulb Temperature:** The temperature at which air can no longer evaporate water, measured with a temperature sensor whose bulb is covered with a wet cloth, or virtually using an Algorithm that uses the Dry-bulb Temperature and the Relative Humidity.
- .4 **Control Damper Definitions:** the following terms are used in addition to the General Building Automation System Definitions, and Air Side System Definitions, and used primarily for control dampers used in air conditioning, air handling, and air distribution systems, however, terms may also be used to describe other control system components and functions.
- .1 **Blank-off Panel:** A sheet metal baffle or orifice placed inside the duct to reduce the duct size to the damper size.
- .2 **Damper:** A device used to regulate the flow of air in an HVAC system by modulating or two-position control.
- .3 **Opposed Blade Damper:** A damper constructed so adjacent blades rotate in the direction opposite to each other.
- .4 **Parallel Blade Damper:** A damper constructed so each blade rotates in the same direction as the blade next to it.
- .5 **Damper Leakage:** The amount of air passing through a damper with a given pressure drop and a given torque holding the damper closed.
- .6 **Damper Seals:** Construction features used to minimize the leakage through a damper.

- .7 **Damper System:** The damper plus the series resistance that relates to it (e.g., duct work, mixing boxes, diffusers, and coils).
- .8 **Drive Blade:** A damper blade that is positioned by an actuator connected by a linkage, axle, or jackshaft connected to the drive blade.
- .9 **Ideal Damper System:** A system with a linear relationship between the percent open damper position and the percent of full airflow.
- .10 **Opposed Blade Damper:** see Damper
- .11 **Parallel Blade Damper:** see Damper
- .5 **Hydronic Side System Definitions:** the following terms are used in addition to the General Building Automation System Definitions, and used primarily for control in hot water, chilled water, glycol, and potable (domestic) water systems, however, terms may also be used to describe other control system components and functions.
 - .1 **Approach:**
 - .1 **Air-cooled Condensing Unit Approach:** The difference between the liquid refrigerant temperature leaving the condenser and the entering air dry bulb temperature.
 - .2 **Heat Exchanger Approach:** The temperature difference between the entering Primary Side fluid and the leaving Secondary Side fluid.
 - .2 **Compressor:** A mechanical device for increasing a gas pressure.
 - .1 **Centrifugal Compressor:** A non-positive displacement compressor that uses centrifugal force to compress refrigerant vapors in a vapor-compression cycle chiller.
 - .2 **Positive Displacement Compressor:** A compressor that reduces the volume of a compression chamber to compress a gas; Reciprocating, Screw and Scroll Compressors are examples of Positive Displacement Compressors
 - .3 **Reciprocating Compressor:** A positive displacement compressor that uses the reciprocating motion of one or more pistons to compress a gas.
 - .4 **Screw Compressor:** A positive displacement compressor that uses the rotary motion of two meshed helical rotors to compress a gas.
 - .5 **Scroll Compressor:** A positive displacement compressor that uses the rotary motion of a spiral scroll to compress a gas.
 - .3 **Constant Speed Pumping:** A pumping system where the system pressure is maintained by a constant speed pump.
 - .4 **Differential Pressure Controller:** In a pumping network with varying demand (eg. heating of chilled water) a Differential Pressure Controller maintains a differential pressure Setpoint between the common supply and return legs of a piping network by varying the speed of the pump set.
 - .5 **Domestic Hot Water (DHW):** Potable water controlled at a constant supply temperature suitable for use in applications such as showers and hand washing stations.
 - .6 **Double Bundle Condenser:** A chiller condenser having two coils in the shell to allow the chiller to dissipate heat either to the cooling tower or to a heating load.
 - .7 **Head:** Pressure of a fluid
 - .1 **Head Pressure:** The pressure measured at the discharge of an operating pump or compressor.
 - .2 **Refrigerant Head:** The pressure difference between compressor suction and discharge pressures or the temperature difference between condensing and evaporating temperatures.
 - .3 **Static Head:** The pressure of a static fluid expressed as the height of the fluid or the height of another fluid it would support.

- .8 **Heat Exchanger:** Transfers hydronic energy from the Primary Side to a Secondary Side.
- .9 **Heat Transfer Station:** Arrangement of heat exchanger(s), pump(s) and controls for a secondary piping distribution network in a building.
- .10 **Hydrostatic Pressure:** The pressure due to the Head of a liquid column.
- .11 **Primary:** Thermal production of hydronic thermal energy such as heat pumps, chillers and boilers in a Central Plant.
- .12 **Primary Side:** Supply and return piping and pumping for hydronic medium (eg. chilled water, or heating water) from the Central Plant to remote heat transfer devices such as Heat Exchangers and AHU coils.
- .13 **Secondary:** Thermal consumption of hydronic thermal energy at remote heat transfer devices such as Heat Exchangers and AHU coils.
- .14 **Secondary Side:** Supply and return piping and pumping for hydronic heat transfer medium served from a Heat Transfer Substation to remote heat transfer devices and terminal units such as fan coil units and perimeter radiation elements.
- .15 **Variable Speed Pumping (VSP):** A pumping system where the flow/pressure is varied by changing the pump speed.
- .6 **Control Valve Definitions:** the following terms are used in addition to the General Building Automation System Definitions, and Hydronic Side System Definitions, and used primarily for control valves used in in hot water, chilled water, glycol, and potable (domestic) water systems, however, terms may also be used to describe other control system components and functions.
 - .1 **Ball Valve:** A ball valve has a precision ball between two seats within a body. Ball valves have several port sizes for a given body size and go from closed to open with a 90 degree turn of the stem. They are available in both two-way and three-way configurations. For HVAC applications, ball valve construction includes brass and cast iron bodies; stainless steel, chrome plated brass, and cast iron balls; resilient seats with larger port area for a given pipe size. Ball valves provide tight shut-off, while full port models have low flow resistance, and reduced port models can be selected for modulating applications.
 - .2 **Body:** The valve casting through which the controlled fluid flows.
 - .3 **Body Rating:**
 - .1 **Nominal:** The theoretical pressure rating, nominal body rating often has characteristics such as pressure-temperature ratings, wall thickness, and end connections that are determined by a society such as ANSI (American National Standards Institute). The figure below shows ANSI pressure-temperature ratings for valves. Note that the nominal body rating is not the same as the actual body rating.
 - .2 **Actual:** The correlation between safe, permissible flowing fluid pressure and flowing fluid temperature of the valve body (exclusive of the packing, disc, and other valve components). The nominal valve body rating is the permissible pressure at a specific temperature.

Example: A valve with an ANSI rating of 150 psi (ANSI Class 150) has an actual rating of 225 psi at 250°F.
 - .3 **Maximum Pressure and Temperature:** The maximum pressure and temperature limitations of fluid flow that a valve can withstand. These ratings may be due to valve packing, body, or disc material or actuator limitations. The actual valve body ratings are exclusively for the valve body and the maximum pressure and temperature ratings are for the complete valve (body and trim). Note that the maximum pressure and temperature ratings may be less than the actual valve body ratings.

Example: The body of a valve, exclusive of packing, disc, and other Trim, has a pressure and temperature rating of 125 psi at 335°F. If the valve contains a composition disc that can withstand a temperature of only 240°F, then the temperature limit of the disc becomes the maximum temperature rating for the valve.



- .4 **Butterfly Valve:** A valve with a cylindrical body, a shaft, and a rotating disc. The disc rotates 90 degrees from open to closed. The disc seats against a resilient body liner and may be manufactured for tight shut-off or made smaller for reduced operating torque but without tight close-off. For three-way applications, two butterfly valves are assembled to a pipe tee with linkage for simultaneous operation.
- .5 **Close Off Rating:** The maximum pressure drop that a valve can withstand without leakage while in the full closed position. The close-off rating is a function of actuator power to hold the valve closed against pressure drop, but structural parts such as the stem can be the limiting factor. The valve close-off rating is independent of the actual valve body rating. See Body Rating (Actual). For example, a valve with a close-off rating of 10 psi could have 40 psi upstream pressure and 30 psi downstream pressure. Note that in applications where failure of the valve to close is hazardous, the maximum upstream pressure must not exceed the valve close- off rating, regardless of the downstream pressure.
- .6 **Close Off Rating of Three-Way Valve:** The maximum pressure difference between either of the two inlet ports and the outlet port for mixing valves, or the pressure difference between the inlet port and either of the two outlet ports for diverting valves.
- .7 **Direction of Flow:** The correct flow of the controlled fluid through the valve is usually indicated on the valve body. If the fluid flow through the valve is incorrect, the disc can slam into the seat as it approaches the closed position. The result is poor control, excessive valve wear, and noisy operation. In addition, the actuator must work harder to reopen the closed valve since it must overcome the pressure exerted by the fluid on top of the disc rather than have the fluid assist in opening the valve by exerting pressure under the disc.
- .8 **Disc:** The part of the valve assembly that contacts the valve seat to close off flow of the controlled fluid. Some valve assemblies are built so the disc is replaceable. Replaceable discs are usually made of a composition material softer than metal.
- .9 **Double Seated Valve:** A valve with two seats, plugs, and discs. Double-seated valves are suitable for applications where fluid pressure is too high to permit a single- seated valve to close. The discs in a double-seated valve are arranged so that in the closed position there is minimal fluid pressure forcing the stem toward the open or closed position; the pressure on the discs is essentially balanced. For a valve of given size and port area, the double-seated valve requires less force to operate than the single-seated valve so the double- seated valve

can use a smaller actuator than a single-seated valve. Also, double-seated valves often have a large valves only. A limitation of double-seated valves is that they do not provide tight shut-off. Since both discs rigidly connect together and changes in fluid temperature can cause either the disc or the valve body to expand or contract, one disc may seat before the other and prevent the other disc from seating tightly.

- .10 **Equal Percentage:** A valve which changes flow by an equal percentage (regardless of flow rate) for similar movements in stem travel (at any point in the flow range).
- .11 **Flanged End Connections:** A valve that connects to a pipe by bolting a flange on the valve to a flange screwed onto the pipe. Flanged connections are typically used on various temperature ratings.
- .12 **Flow Coefficient (Capacity Index):** Used to state the flow capacity of a control valve for specified conditions; a control valve's flow coefficient, or C_v value, is determined based on the following formula:

$$C_v = Q \sqrt{\frac{1}{\Delta p} \cdot \frac{\rho}{\rho_w}}$$

Where:

Q = volumetric flow in US gallons per minute (usgpm).

ρ = fluid density in pounds per cubic foot (lb/cu.ft.).

ρ_w = density of water in pounds per cubic foot (lb/cu.ft.) within the temperature range of 40 to 100°F

Δp = static pressure loss across the valve in pounds per square inch (psi).

- .13 **Globe Valve:** A valve which controls flow by moving a circular disk against or away from a seat. When used in throttling control a contoured plug (throttling plug) extends from the center of circular disk through the center of the seat for precise control.
- .14 **Linear:** A valve which provides a flow-to-lift relationship that is directly proportional. It provides equal flow changes for equal lift changes, regardless of percentage of valve opening.
- .15 **Plug:** The part that varies the opening for the fluid to flow through the valve body.
- .16 **Port:** The opening in the valve seat.
- .17 **Pressure Drop:** The difference in upstream and downstream pressures of the fluid flowing through the valve.
- .18 **Pressure Drop (Critical):** The flow of a gaseous controlled fluid through the valve increases as the pressure drop increases until reaching a critical point. This is the critical pressure drop. Any increase in pressure drop beyond the critical pressure drop is dissipated as noise and cavitation rather than increasing flow. The noise and cavitation can destroy the valve and adjacent piping components.
- .19 **Quick Opening:** A valve that provides maximum possible flow as soon as the stem lifts the disc from the valve seat.
- .20 **Reduced Port Valve:** A valve with a capacity less than the maximum for the valve body. Ball, butterfly, and smaller globe valves are available with reduced ports to allow correct sizing for good control.
- .21 **Screwed End Connection:** A valve with threaded pipe connections. Valve threads are usually female, but male connections are available for special applications. Some valves have an integral union for easier installation.
- .22 **Seat:** The stationary part of the valve body that has a raised lip to contact the valve disc when closing off flow of the controlled fluid.

- .23 **Single Seated Valve:** A valve with one seat, plug, and disc. Single-seated valves are suitable for applications requiring tight shut-off. Since a single-seated valve has nothing to balance the force of the fluid pressure exerted on the plug, it requires more closing force than a double-seated valve of the same size and therefore requires more actuator force than a double-seated valve.
- .24 **Stem:** The shaft that runs through the valve bonnet and connects an actuator to the valve plug.
- .25 **Three Way Valve:** A valve with three ports. The internal design of a three-way valve classifies it as a mixing or diverting valve. Three-way valves control liquid in modulating or two-position applications and do not provide tight shut-off.
- .26 **Tight Shut Off/Close Off:** A valve condition in which no leakage of the controlled fluid occurs in the closed position. Generally, only single-seated valves provide tight shut-off. Double-seated valves typically have a one to three percent leakage in the closed position.
- .27 **Trim:** All parts of the valve that contact the controlled fluid. Trim includes the stem, packing, plug, disc, and seat; it does not include the valve body.
- .28 **Two Way Valve:** A valve with one inlet port and one outlet port. Two-way valves control water or steam in two- position or modulating applications and provide tight shut-off in both straight through and angle patterns.
- .29 **Valve Flow Characteristic:** The relationship between the stem travel of a valve, expressed in percent of travel, and the fluid flow through the valve, expressed in percent of full flow.

1.06 EQUIPMENT SUPPLIED FOR INSTALLATION BY MECHANICAL TRADES

- .1 BAS Trades shall install the following devices for equipment provided by Mechanical Trades:
 - .1 automatic control valve actuators,
 - .2 motorized damper actuators including associated damper end switches and relays.,
 - .3 liquid temperature sensors in hydronic system piping,
 - .4 liquid flow measuring devices in hydronic system piping,
 - .5 steam humidifier automatic control valve actuators,
 - .6 unit heater and cabinet unit heater line voltage thermostats
 - .7 Controllers for Variable Air Volume (VAV) Boxes, Constant Air Volume (CAV) Boxes Fan Powered (FP) Boxes, Fan Coil Units (FCU), and other terminal equipment. Arrange and pay for shipping to terminal unit manufacturer's facility for factory installation.

1.07 EQUIPMENT PROVIDED BY MECHANICAL TRADES OTHER THAN BAS TRADES

- .1 Mechanical Trades shall install the following devices supplied by the BAS Trades:
 - .1 temperature wells for controllers and sensors,
 - .2 automatic control valves,
 - .3 motorized control dampers,
 - .4 steam humidifiers and associated automatic control valves.

1.08 APPLICABLE STANDARDS

- .1 The following Standards are in addition to Codes, Standards and Regulations Specified on other Sections of the Specifications, and the requirements of the Authorities Having Jurisdiction (AHJs).
 - .1 ANSI/ASHRAE Standard 135 BACnet; A Data Communication Protocol For Building Automation And Control Network
 - .2 ANSI/CEA 709.1-D Control Network Protocol Specification
 - .3 Interfacing Standard:

- .1 Input/output devices to use ASCII (American Standard for Communication and Information Interchange) code and standard EI (Electronic Industry Association) interfaces.
- .2 CSA T530: Building Facilities, Design Guidelines for Telecommunications (same as EIA/TIA 569).
- .3 IEEE 802.3 Ethernet 10Base-T LAN.

1.09 MANUFACTURERS AND INSTALLERS

- .1 Provide BAS with DDC and Energy Management capabilities for mechanical and electrical systems by a Control Vendor that:
 - .1 specializes in design, installation, commissioning and service of open protocol BAS systems,
 - .2 has completed five (5) projects of similar size and complexity within the preceding five (5) years,
 - .3 employs certified journeymen experienced in this type of work.
- .2 Acceptable Manufacturers:
 - .1 Delta Controls
 - .1 ***viridian Automation Inc.***
455 North Service Rd. E.,
Oakville, Ontario, L6H 1A5
 - .2 ***Regulvar Canada***
3510 Pharmacy Avenue,
Toronto, Ontario, M1W 2T7
 - .3 ***Ainsworth Inc.***
131 Bermondsey Road,
Toronto, Ontario, M4A1X4
 - .2 Reliable Controls
 - .1 ***Setpoint Building Automation Inc.***
400 Spinnaker Way, Unit #1-3
Concord, Ontario, L4K 5Y9
 - .3 or Owner Approved Vendor

1.10 CONTINUITY OF STAFF AND SUBCONTRACTORS

- .1 Project Manager is to be nominated at time of shop drawing submission and is to remain involved with project, from shop drawing preparation through to Acceptance, unless request for change is submitted and approved by the Owner.
- .2 Subcontractors listed in Bid Form submission are to execute the scope of work defined unless request for change is submitted and approved by the Owner.

1.11 LEED SUPPORT REQUIREMENTS

- .1 Provide services of LEED Accredited Professional to support and provide input to Owner's LEED team, for aspects related to the design, implementation and operation of the BAS. LEED professional to implement a project management process specifically for this project.

- .2 Incorporate LEED related monitoring and verification elements, including:
 - .1 general monitoring,
 - .2 specific energy meter monitoring in accordance with the project M&V plan;
 - .3 temperature and humidity monitoring
 - .4 flow monitoring,
 - .5 air quality and CO2 monitoring
 - .6 Assist the Owner by providing input and associated supporting documentation on BAS related LEED Points, to attain the target LEED Green Building Rating, including services for:
 - .1 Optimum energy performance
 - .2 Optimize energy performance
 - .3 Water efficient landscaping and storm water management
 - .4 Thermal comfort
 - .5 Measurement and verification
 - .6 Carbon Dioxide monitoring
 - .7 HCFC and Halons monitoring
- .3 Throughout the duration of the Project, provide the following submittals;
 - .1 LEED format scorecard qualifying the BAS related LEED points
 - .2 credit Summary Sheet for each LEED point
 - .3 written back-up documentation for each Summary Sheet
 - .4 any other LEED related submittal documentation required for the LEED application submission.
- .4 Coordinate with the owner's Commissioning Authority (CxA) for commissioning requirements related to LEED certification.

1.12 THE BUILDING AUTOMATION SYSTEM ("BAS")

- .1 General:
 - .1 The BAS shall be an integrated package developed and using control components from one controls manufacturer.
 - .2 Generally, and unless specified otherwise, HVAC equipment, shall be provided as "Thermostat-Ready" meaning that the Building Automation System (BAS) shall have direct control over terminal equipment, and custom fabricated air handling units (AHUs) and other similar built-up equipment that include dampers, control valves, heating and cooling stages without the requirement of BACnet, Lonworks or other type of communication interface. Factory installed interlocks, safeties and anti-cycle timers shall be provided as required.
 - .3 Owner approved equipment that incorporate third party controls provided as part of the Original Equipment Manufacturer (OEM) package, such as those provided with Variable Frequency Drives (VFDs), chillers, heat pumps, boilers, Computer Room Air Conditioning (CRAC) units, and similarly complex equipment, shall be provided with a BACnet interface gateway for communication with the BAS.
 - .4 The BAS shall be a graphic based system with operator access by department and floor.
 - .5 The BAS shall be capable of expanding in scope and size to accommodate all of other areas and/or systems of the development not included as part of this BAS project.
 - .6 The BAS shall have internet access and capability for remote dial-out.
 - .1 The BAS shall have Dashboard flexibility for systems monitoring capability from multiple remote locations.

- .2 The BAS shall have the ability to monitor and produce reports from remote locations.
- .7 Internet access to the system shall be provided for individual Building Operators.
- .8 A representative of the controls Contractor shall, for a period of one (1) month after Substantial Performance, be on site to assist and train the building maintenance staff in the operations of the various control systems.
- .9 Provide engineering design, installation, configuration and programming, testing and commissioning of BAS controllers, instrumentation, actuators, power and communication wiring and conduit.
- .10 Provide training of owner's operations staff.
- .11 All temperature units for BAS and controlled equipment shall be in °C (degrees Celcius).
- .12 The new BAS is intended to provide monitoring, control and alarms for mechanical equipment including, but not limited to, the following:
 - .1 Boilers;
 - .2 Chillers including Heat Pump Chillers;
 - .3 Central supply air handling units ("AHU") and related components including:
 - Supply air fans with integral variable frequency drives (VFDs);
 - Return air fans with integral variable frequency drives (VFDs);
 - Air flow sensors;
 - Control dampers;
 - Heating Coils and related control valves;
 - Humidifiers and related control valves;
 - Cooling Coils and related control valves;
 - Duct Monitoring Stations ("DMS");
 - Integral temperature, humidity, dewpoint, enthalpy and pressure sensors associated with AHU control;
 - .4 Central exhaust fan and/or ventilation fan systems including:
 - Exhaust and/or ventilation fan(s) with integral variable frequency drives (VFDs);
 - Air flow sensors;
 - Control damper(s);
 - Duct Monitoring Stations ("DMS");
 - Integral temperature and pressure sensors associated with fan system control;
 - .5 Hydronic heating and cooling systems including:
 - Pump(s) with integral variable frequency drives (VFDs);
 - Heat exchanger(s) and related control valves;
 - Integral temperature and pressure sensors associated with hydronic system control;
 - .6 Plumbing service water heating, circulation and drainage pumping systems including:
 - Pump(s) with integral variable frequency drives (VFDs);
 - Heat exchanger(s) and related control valves;
 - Integral temperature and pressure sensors associated with plumbing system control;
 - Level controllers;

- Packaged control panels.
- .7 All major fire protection equipment and systems
- .8 Fuel oil levels and system status
- .9 A Facilities Maintenance ("FM") program for scheduled Preventative Maintenance ("PM") work based upon run time
- .13 The BAS shall include control of the following terminal devices, equipment, and systems:
 - .1 Terminal re-heat coils;
 - .2 Terminal Fan Coil Units (FCUs) with integral ECM motors;
 - .3 Terminal VAV and/or CAV boxes;
 - .4 Terminal Fan Powered (FP) boxes;
 - .5 Unit heaters;
 - .6 Cabinet heaters;
 - .7 Perimeter wallfin radiation elements;
 - .8 Radiant heating panels;
 - .9 AV/IT Systems;
- .2 Network Architecture:
 - .1 The BAS shall be a web-enabled, direct digital control ("DDC") distributed open protocol, non-proprietary system. Acceptable open protocols are:
 - .1 BACNet/IP, BACNet MS/TP
 - .2 The BAS shall integrate existing equipment in accordance with the following protocols:
 - .1 BACNet/IP for monitoring and control of Central Plant equipment such as chillers, and boilers;
 - .2 BACNet MS/TP for monitoring and control of Field Equipment Controllers (FECs) and Zone Level Controller (ZLCs) for mechanical equipment such as Air Handling Units (AHU's), standalone terminal units, and Variable Frequency Drives (VFDs);
 - .3 BACNet MS/TP, or Modbus RTU for integration of metering devices, specialty HVAC equipment or process equipment;
 - .4 Other industrial protocols with the use of appropriate integration Gateways, for process equipment and electrical load management systems shall be allowed only following review and acceptance by the Owner.
 - .3 The use of battery powered (meaning without external power) and/or wireless-communication controllers is prohibited unless agreed to by the Owner in writing.
 - .4 Each Management Level Processor (MLP), Building Control Unit (BCU), and Field Equipment Controller (FEC) shall have integral battery backup power supply for a minimum of two (2) hours.
 - .5 Each Building Control Unit (BCU) and Field Equipment Controller (FEC), and the overall Building Automation System (BAS) shall have 20% spare points for future use.
- .3 Equipment and System Integration:
 - .1 The BAS shall be integrated with other Third Party Systems and Devices including:
 - .1 Fire alarm (common first stage alarm, common second stage alarm and other alarms as noted in the Documents),
 - .2 Security,
 - .3 Lighting,
 - .4 AV/IT Systems,

- .5 Electrical Power Transformation,
- .6 Automatic Transfer Switch(es) ("ATS"),
- .7 Emergency Generator Control,
- .8 Fuel Oil Storage and Distribution Systems,
- .9 Elevator Control Panel(s).
- .2 The BAS shall be capable to integrate with other systems such that all monitoring information from the BAS is available to and usable (send and receive commands) by the Owner.
- .3 The intent of the integration is to display information at the workstation in the same format for both the BAS and the existing stand-alone control systems, and to allow a building operator the same method of access to view information for the BAS and the existing stand-alone control system.
- .4 Regardless of the method used, integration of the existing BAS includes at a minimum replication of the existing graphical displays including all setpoints, current values and alarm conditions.
- .4 Operator Workstation (OWS) Locations:
 - .1 Provide hierarchy password protected Operator Workstations (OWS) to access the BAS, including graphical displays, trend log information, tabular data, and alarm management in the following locations:
 - .1 Main Maintenance/Facilities office;
 - .2 One additional location as directed by the Owner;
 - .3 Colour touchscreen devices with minimum 7-inch diagonal display in the existing main penthouse mechanical room; and
 - .4 By Mobile User Interface in the form of three (3) iPad mini tablets, or approved equal, shall supplied by the successful BAS Trade Contractor.
 - .2 Proved high-level graphic visualization tool(s), or Dashboards, that displays a building's operating data, performance analytics and other useful information, at each Operator Workstation (OWS) as follows:
 - .1 easy for operators to quickly visualize and prioritize their work;
 - .2 Information presented to allow operators to respond to changing operational parameters with a focus on building occupant comfort, energy usage, costs, Key Performance Indicators (KPIs), trends, and alarm management, and comparisons with similar buildings or building uses;
 - .3 minimum three (3) Dashboards to be provided for each building stakeholder or stakeholder group with specific information for each dashboard to be decided by each stakeholder group.
- .5 WAN Access:
 - .1 Provide necessary interface and cabling to connect the BAS to the the Owner's WAN. Obtain the particular WAN system details from the Project Supervisor.
 - .2 The Owner shall supply the WAN IP address, Gateway and Subnet mask for the BBMD router in the network. The controls contractor will facilitate integration into the Owner's existing BAS BACNET network.
 - .3 On the network a BACnet IP device that is capable of BBMD will route information from other sites and the operator work station. In addition there shall be a CAT5 wire that is run to the Owner's IT switch with a 4' pigtail and connector.
- .6 Alarms:
 - .1 The BAS will be configured to provide for remote alarm capabilities.

- .2 Alarms shall be capable of being routed to The Owner's IT server so that they can be sent to Operator's email addresses.
- .3 The operator workstation shall provide audible, visual and printed means of alarm indication. The Alarm Dialog box shall always become the Top Dialog box regardless of the application(s) being run at the time (such as a word processor). A printout of all alarms shall be sent to the assigned terminal and port.
- .4 Provide a log of alarm messages. The alarm log shall be archived to the hard drive of the operator workstation. Each entry shall include a point descriptor and address, time and date of alarm occurrence, point value at the time of alarm, time and date of point return to normal condition and time and date of alarm acknowledge.
- .5 The BAS Trade Contractor shall work with the Owner to determine the alarms unless specified otherwise.
- .6 Alarm messages shall be in plain English and shall be user definable on site or via remote communication.
- .7 DDC Controls for mechanical equipment and systems:
 - .1 Provide instrumentation and control devices as required to achieve full automatic control of all mechanical building services defined in the project Scope of Work.
 - .2 Sequences of operation shall be in accordance with the Mechanical Contract Documents.
 - .3 Alarms and monitoring points shall provide the building operators with full knowledge of system operation including setpoint values, current measured values, equipment status, and equipment fault status.
 - .4 Local adjustment of room temperature (where specified) shall be proved within a limited range (+/- 2.5°C);
 - .5 CO2 monitoring shall be provided in all lobbies, open public areas, high occupant density areas, loading dock areas, and other areas specified to meet Demand Control Ventilation energy conservation strategies.
 - .6 For Variable Frequency Drives (where specified), the following control functions shall be hard-wired in addition to any network integration provided:
 - .1 Remote start/stop;
 - .2 Summary alarm;
 - .3 Remote fault reset.
- .8 Instrumentation and Controlled Devices:
 - .1 The use of battery-powered (meaning without external power) and/or wireless-communication instruments, including but not limited to room temperature and humidity sensors/controllers, is prohibited except under the following conditions:
 - .1 In feature architectural finished areas such as main entrances where, due to the architectural and structural design, it is not possible to run conduit and wiring in a concealed location; or
 - .2 In other areas which are expressly approved in writing by the Owner for each instance of requested use.
 - .2 Provide the following metering which shall be monitored on the BAS:
 - .1 Air flow stations for each AHU and associated return/exhaust air fans;
 - .2 Domestic water flow meters;
 - .3 Natural gas flow meters;
 - .4 Bulk thermal energy meter;
 - .5 Thermal energy meters for secondary pumping systems for heating;

- .6 Bulk thermal energy meters for primary chilled water system;
- .7 Thermal energy meters for 24/7 cooling system.
- .9 BAS monitoring of equipment operating status:
 - .1 The BAS shall monitor the status of the following equipment types:
 - .1 Control valve position by end-switch or positioners for major equipment located in the Service Spaces and Service Rooms as follows:
 - AHU heating control valves;
 - AHU cooling control valves;
 - AHU humidification control valves;
 - AHU control dampers;
 - Exhaust fan control dampers;
 - Make-up air dampers;
 - Ventilation fan control dampers;
 - Relief dampers;
 - Energy Recovery Ventilator (ERV) dampers
 - .2 Motorized air damper position by end-switch or positioner, as applicable to the type of damper control function. For fans with two-position dampers, the damper power shall be provided or controlled by the fan starter or VFD, and a damper proved-open end-switch shall be hard-wire interlocked to prevent the fan from operating unless the damper is proven open.
 - .3 For two-position valves and dampers, provide end-switches to prove the valve or damper is open and closed.
 - .4 For modulating valves and dampers, provide a feedback positioner to indicate the current position of the valve or damper.
 - .5 Combination smoke and fire dampers, in both open and closed position;
 - .6 Motor run status through current switches or transmitters on constant speed or two speed motors, or by VFD operating status;
 - .7 Chillers and boilers by network communications status;
 - .8 Air filters, by differential pressure switch or transmitter across each bank of filters (where specified).
 - .2 Control valves on terminal equipment such as unit heaters, cabinet heaters, room reheat coils, or perimeter heating room control valves are not required to have position feedback.
- .10 Energy Management System ("EMS"):
 - .1 An Integrated Energy Management System to monitor, record, analyze and report on Energy Consumption from metered sources.
 - .2 Provide purpose developed, web-based database software suite of analytical and reporting tools to develop mathematical models of building system energy consuming equipment. Energy Management System software functionalities shall include:
 - .1 Database for dashboard display with dashboard editing software;
 - .2 Multi-building dashboard displays;
 - .3 Collects metered data from building system meters
 - .3 Web-based graphical displays of conventional trend-logs, Key Performance Indicators, multiple energy source consumption and cost comparison, period-to-period energy

consumption comparison, graphical drill-down for data detail, web-integrated weather data and forecasting functions.

- .4 Energy reporting including standard and custom graphic outputs, narrative fields, year-to-year comparisons, and greenhouse emission estimates.
- .5 Graphical touchscreen displays for configuration of display information.
- .6 MS Word, Excel or similar programs do not meet these requirements and shall not be used for analysis, display or reporting of energy performance.

1.13 CONTROLLED INDOOR ENVIRONMENTAL CONDITIONS

- .1 Unless noted otherwise, the BAS shall be arranged to maintain the following indoor environmental conditions:

	Occupied Mode				Un-occupied Mode			
	Winter		Summer		Winter		Summer	
Area	DB ¹ (°C)	RH ² (%)	DB ¹ (°C)	RH ² (%)	DB ¹ (°C)	RH ² (%)	DB ¹ (°C)	RH ² (%)
General Office	22	>30	23.5	<60	15	---	29.5	---
Corridors	22	>30	23.5	<60	15	---	29.5	---
Lobbies	22	>30	23.5	<60	15	---	29.5	---
Toilets	22	>30	23.5	<60	15	---	29.5	---
Locker Room	22	>30	25	<60	15	---	29.5	---
Conference/ Meeting Room	22	>30	23.5	<60	15	---	29.5	---
Computer Room	22	>30	23.5	<60	22	---	23.5	---
Print Room	22	>30	23.5	<60	22	>30	23.5	<60
Auditorium	22	>30	23.5	<60	15	---	29.5	---
Cafeteria	22	>30	23.5	<60	15	---	29.5	---
Courtroom	22	>30	23.5	<60	15	---	29.5	---
Kitchen	22	---	23.5	---	15	---	29.5	---
Exit Stairwells	18	---	None	---	15	---	None	---
Elevator Machine Rm.	18	---	25	---	18	---	25	---
Electrical closets	15	---	25	---	15	---	25	---
Mechanical Rooms	15	---	35 ³	---	15	---	35 ³	---
Electrical Switchgear	15	---	35 ^{3,4}	---	15	---	35 ^{3,4}	---
Emergency Power Generation Room	18	---	35 ³	---	18	---	35 ³	---
Storage Room	18	---	30	---	15	---	30	---
Bus Storage Garage	12	---	30	---	12	---	30	---
EMS Ambulance Bay	18	---	30	---	18	---	30	---
Vehicle Maintenance/ Repair	18	---	30	---	15	---	30	---

	Occupied Mode				Un-occupied Mode			
	Winter		Summer		Winter		Summer	
Area	DB ¹ (°C)	RH ² (%)	DB ¹ (°C)	RH ² (%)	DB ¹ (°C)	RH ² (%)	DB ¹ (°C)	RH ² (%)
Notes: 1. Temperatures are degrees Celsius, to be maintained at +/- 1 °C. 2. Relative humidity to be maintained at +/- 5% RH. Maximum permissible humidity is 60% RH in conditioned areas. 3. Maximum temperature. 4. Electrical cables to be de-rated if required by Code.								

- .2 Building heating shall be enabled when the outside air temperature is less than 10°C and shall be adjustable.
- .3 Overhead roll up doors (open/closed) shall be monitored by the BAS and interlocked with radiant tube or unit heaters so that heaters do not run when overhead doors are open. Space heating shall be disabled when the outdoor air temperature is above 10°C.

1.14 ENERGY AND RESOURCE METERING

- .1 Provide separate end-use metering for the following energy and/or resource services consumed:
 - .1 Natural Gas:
 - .1 Facility incoming bulk gas
 - .2 Space heating
 - .3 Domestic water heating
 - .4 Process gas
 - .5 Commercial kitchen equipment
 - .2 Potable (Domestic) Water:
 - .1 Facility incoming municipal water service
 - .2 Domestic hot water make-up
 - .3 Plumbing fixtures
 - .4 Heating plant water make-up
 - .5 Cooling plant water make-up
 - .6 Cooling tower and/or fluid cooler make-up
 - .7 Process water make-up (e.g. vehicle wash, humidification)
 - .8 Commercial kitchen water usage
 - .9 Landscape irrigation
 - .3 Non-potable water:
 - .1 Greywater
 - .2 Harvested rainwater
 - .3 Landscape irrigation
 - .4 Electrical metering for each separate end use type:
 - .1 Facility incoming electricity
 - .2 Interior Lighting

- .3 Exterior Lighting
 - .4 Ventilation Fans
 - .5 Pumps
 - .6 Space Cooling
 - .7 Process electricity (e.g. compressors)
 - .8 Elevators
 - .9 Data Centres
 - .10 Plug loads
 - .11 Electric heating where it is the primary source of building heating
 - .12 Any other load 40 kW (50 HP for motors) or greater (submeter individually except where multiple similar pieces of equipment serve a similar load)
 - .13 Generation used as part of demand response systems
- .2 Metering shall include both instantaneous and cumulative consumption of energy and/or resource services.
 - .3 Materials shall be compatible with the systems in which they are installed at all potential operating temperatures and pressures.
 - .4 Meter accuracy shall be +/- 1.5% in expected operating range.

1.15 BAS ACCEPTANCE

- .1 Following satisfactory completion of testing and Commissioning of the BAS as described in the Specifications, and checklists and reports are submitted and reviewed, provide Certification in writing operation of the BAS including:
 - .1 Control system checkout and testing
 - .2 Control system demonstration
 - .3 Owner Training
 - .4 As-built documentation, and Operating and Maintenance (O&M) manuals and instructions submitted and reviewed.
- .2 Certification document shall identify any testing that cannot be performed due to extenuating circumstances such as weather conditions. Append program to certification document for rectification and completing of these tests later during warranty period.
- .3 Submittals for Acceptance:
 - .1 Provide system documentation at time of acceptance.
 - .2 As-Built Documentation:
 - .1 Within two weeks following Substantial Completion of the project, update the original submittal documents to reflect the "As Built" conditions of the project and submit four (4) copies to the Project Manager.
 - .2 Provide a separate laminated copy of the control drawings for mounting in the mechanical room or in the controls panels.
 - .3 Provide final point lists, shop drawings and all installed equipment data and operations sheets.
 - .4 Submit USB memory thumb drives containing up to date copies of the programs in each controller. Provide original program documentation proving registration for all software programs provided as a part of this contract including: the BAS operator interface software, and the BAS graphics (bitmap files). Provide one set of original

- thumb drives for every computer supplied under this contract or that the software has been loaded onto.
- .5 Submit (4) printed copies of the final programs that include all point definitions, weekly and annual schedule setting, controller setpoints and tuning parameters, and documented programmed sequences of operation.
- .3 Operation and Maintenance (O&M) Manuals:
- .1 Provide two (2) paper copies of material and two (2) copies on USB memory storage stick in Adobe PDF format.
- .2 O&M shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire BAS and associated equipment. This documentation shall include specific part numbers and software versions and dates. A complete recommended spare part inventory list, and the lead time and expected frequency of use of each part clearly identified.
- .3 Provide following information in separate sections, each with an index.
- .1 Service and parts;
- .1 Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
- .2 List of recommended spare parts with part numbers and suppliers.
- .2 System description;
- .1 English language outline of BAS system and system architecture
- .2 As-built versions of shop drawing product data.
- .3 Reduced size (11 in x 17 in) copies of record drawings
- .4 Graphic files, programs, and database on magnetic or optical media.
- .5 Licenses, guarantees, and warranty documents for equipment and systems.
- .3 Technical literature for equipment, including;
- .1 catalogue sheets,
- .2 calibration, adjustments and operation instructions,
- .3 installation instructions,
- .4 hardware and software manuals, with information supplied by original product developer, on application programs and on computers and controllers supplied
- .5 Operator's manual with procedures for operating control systems; logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set-points and variables.
- .6 Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
- .7 Original-issue documentation with installation and maintenance information for third-party hardware including computer equipment and sensors.
- .8 Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

- .9 Programming manual or set of manuals with description of programming language and syntax, explanation of statements for algorithms and calculations used, procedures for point database creation and modification, documentation of techniques for program creation and modification, and instructions for use of editor.
 - .10 Documentation of programs created using custom programming language including set-points, tuning parameters, and object database. Electronic copies of programs to modify and create control logic, set-points, tuning parameters, and objects that can be viewed using programming tools.
- .4 Original Software:
- .1 Furnish one original set of application and system software on original media. Disks to bear manufacturer's label. Field copies are not acceptable.
 - .2 Original-issue copies of software to include operating systems, custom programming language, application generation, graphic support, maintenance support, operator workstation or web server software, and other utilities provided in support of installed system.
- .5 On-line record documentation:
- .1 After completion of testing and adjustment, install the following additional information on the server OWS.
 - .1 As-built record drawing files,
 - .2 detailed catalog data on all installed system components, with supplier contact information for purchasing and factory authorized repair service.
- .4 After start-up, testing, and BAS Commissioning has been completed demonstrating satisfactory and reliable operation of equipment and systems, and Owner Training has been complete, Preliminary Acceptance shall be certified by the Consultant should the documented deficiencies remaining to be corrected have no adverse effect on the day-to-day operation of the building operation.
- .5 Final Acceptance of the BAS by the Consultant shall be certified when all of the above items have been satisfactorily completed and all identified deficiencies resolved.

1.16 CORRECTION AFTER ACCEPTANCE

- .1 Provide updates and patches to resolve software deficiencies in operator workstation or web server software, project-specific software, graphic software, database software, and firmware during warranty period.
- .2 Provide upgrades that improve routines and procedures of operator workstation software, web server software, project-specific software, graphic software, or database software, free of charge, during the warranty period .
- .3 Provide details of proposed changes and obtain written authorization before installation of updates, patches, or upgrades.
- .4 Include preventative maintenance, with allowance for spare parts, labour, and emergency (24 hour) service for system and equipment during the warranty period.
- .5 Equipment manufacturers to submit written undertakings to make circuit board repairs and provide spare parts, software support and patches, and technical assistance for at least five (5) years after Acceptance is certified.

1.17 LICENSES AND OWNERSHIP

- .1 Ownership of, and licenses for, hardware and software supplied or used for this project or for ongoing system operation, maintenance and modification to be registered, without restrictions, in Owner's name.
- .2 This is applicable to System Software, Workstation Application Editors, and Controller Software.

- .1 Licensing to permit an unlimited number of users to access system without additional fees.
- .2 As of last day of warranty period, software is to be upgraded to current version or release.
- .3 Project-developed software and resulting documentation to be treated as part of system and subject to these same requirements for ownership and licensing. This material includes;
 - .1 Project graphic images
 - .2 CAD generated record drawings
 - .3 Project database
 - .4 Project-specific application programming code and documentation.
- .3 Software Licenses:
 - .1 Supply licenses for all software required to monitor, configure system, edit graphics, trend storage, (data exchange including ODBC (if applicable)) without limitations to points.
 - .2 Reliable Controls shall include licensing for the following: RC Studio, RC Webview, RC Archive.
 - .3 Delta Controls shall include licensing for the following: ORCAweb-Large, Illustrator, ORCAweb, OWS, ODBC, DDE, Historian Large.
 - .4 Automated Logic shall include licensing for the following: WEB CTRL, Advanced reports.
 - .5 The operator workstation interface software shall be designed to operate on the Windows 7 Professional platform or later.

1.18 WARRANTY

- .1 At completion of Work, submit written guarantee undertaking to remedy defects in work for period of two (2) years from date of Acceptance, which includes:
 - .1 Rectification of control system failures attributable to defects in workmanship, materials, hardware, and software; controllers excepted.
 - .2 Service Technician to arrive on site within 24 hours of warranty service request, to install and de-bug software patches, to replace defective parts, materials or equipment, and to provide incidental supplies, and labour for remedial work during this period without cost to the Owner.
 - .3 Technician to remain in attendance until system is returned to proper operating condition in accordance with system operation expectations.
- .2 All Controllers shall have a minimum five (5) year manufacturer's warranty.
- .3 Submit similar warranty for any part of Work accepted by Owner, prior to certification of Substantial Performance.

PART 2 - PRODUCTS

2.01 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.01 COORDINATION

- .1 Owner Coordination:
 - .1 The work shall occur while the control system remains on-line in order to maintain a minimum level of comfort within the building. The Owner shall be notified about situations in which equipment will be off-line for extended periods of time during the project. The Contractor shall conduct all on-site work in conjunction with building operating staff to streamline the new system startup.
- .2 Mechanical and Electrical Trade Coordination:
 - .1 Control Trades shall turn over control devices for installation in Work performed by Mechanical and Electrical Trades.

- .2 Mechanical and Electrical Trades shall coordinate installation details and operational requirements with Control Trades.
- .3 Mechanical and Electrical Trades shall provide sufficient labour, materials and equipment to complete point-to-point verification, system performance verification, and other activities as part of the project commissioning requirements.

3.02 ENERGY AND RESOURCE METERING

- .1 Provide meters complete with bypass piping arrangement, or other suitable means, to remove or isolate service without interruption to flow.
- .2 Provide meter manufacturer's calibration certificate(s), installation, operations and maintenance manuals (for meter(s) and data logger) and recommended meter recalibration interval(s).

3.03 BAS TESTING, COMMISSIONING AND ACCEPTANCE

- .1 Comply with the requirements of Section 20 08 10 Mechanical Commissioning and the additional requirements outlined in this Article.
- .2 The BAS Trades shall conduct full end-to-end testing and commissioning of the BAS installations and the overall monitoring and control of the building systems, including test documentation and requirements for testing and demonstration.
- .3 BAS Trade testing shall include the monitoring and supervisory control and data communications with all systems operational and integration with Third Party Devices complete.
- .4 Perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning.
- .5 The BAS Subcontractor shall undertake joint testing of the BAS integration with the Project Stakeholder Group including:
 - .1 the Commissioning Authority,
 - .2 the Owner,
 - .3 the Owner's Project Manager,
 - .4 the Consultant,
 - .5 the Construction Manager/General Contractor, and
 - .6 all affected Trades.
- .6 The BAS Contractor shall perform a complete and detailed operational check of each BAS component. Testing shall be documented on start-up forms.
- .7 Upon completion of the operational checks, repeat these tests, point-by-point in the presence of the Owner's representative, as required. Properly schedule these tests so that testing is completed by the time directed by the Owner's representative. The Project Stakeholder Group shall undertake such random testing as the Project Stakeholder Group considers necessary to verify the acceptability of the components.
- .8 Verify BACnet communications as specified and submit all point naming and identification values accordingly.
- .9 Provide a field checks for all controllers and front-end equipment (computers, printers, modems, and similar devices). The BAS Trades shall verify proper operation of both hardware and software of all system components. A checkout sheet shall be provided itemizing each device and a description of the associated tests shall be prepared and submitted to the Owner's Commissioning Authority at the completion of the project.
- .10 Point-to-Point (End-to-End) Testing:
 - .1 Provide schedule for point-to-point (end-to-end) checks and testing.

- .2 Perform point-to-point (end-to-end) checks from an operator terminal to all sensors and actuators to the controller/outstation and from the controller to the presentation of the point on the graphic via LAN.
- .3 Each analogue inputs (i.e. temperatures, pressure, etc.) shall be verified with an approved calibration device. All actual temperature readings should be with +/- 1°C of the readings observed at the workstation.
- .4 Each analogue output shall be verified by manually commanding the output channel from the operator workstation to two or more positions within the 0-100% range and verifying the actual position of the actuator or device. All devices shall operate over their entire 0- 100% range from a minimum control range of 10-90%.
- .5 Digital outputs shall be verified by witnessing the actual start/stop operation of the equipment under control.
- .6 Digital inputs shall be verified by observing the status of the input point as the equipment is manually cycled on and off.
- .7 Point-to-point (end-to-end) checks shall verify (at minimum) the following:
 - .1 Correct location of the field device for the application.
 - .2 Correct installation of the control device/interface with reference to the manufacturer's literature and check that sufficient access has been provided for maintenance.
 - .3 Verify and record in as built OEM drawings that control wiring is connected and free of shorts and ground faults. Verify that terminations are tight.
 - .4 That the control device has the correct range for the application, that the range is correctly entered in the controller and is correctly engineered on the operator's terminal.
 - .5 Correct operation of the controls device/interface, including any associated alarm and alarm text.
 - .6 Verify and record that binary output devices operate and that normal positions are correct.
 - .7 Verify and record that analog output devices are functional, that start and span are correct, and that direction and normal positions are correct.
 - .8 Correct installation of each valve and damper actuator, and ensure that each valve and damper actuator is stroked correctly when checked against the BAS output; adjust valve stem and damper blade travel.
 - .9 Calibration of the control device.
 - .10 Labels provided on the control devices and mechanical equipment are correct.
- .8 Start-up testing shall commence once all component point-to-point (end-to-end) testing has been successfully completed and reviewed by the Consultant.
- .11 BAS Start-up Testing:
 - .1 Start-up testing to verify completion of control system before system demonstrations begins.
 - .1 Verify and record that system operates according to Sequences of Operation. Simulate changes in variables by overriding and varying inputs and schedules, and observe and record each operational mode response.
 - .2 Tune Control Mode loops and control routines.
 - .3 Check each alarm with an appropriate signal at value that will trip alarm.
 - .4 Trip interlocks using field contacts to check logic and to ensure that actuators fail in proper direction.

- .5 Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.
- .2 Prepare and submit log documenting Start-up testing of each input and output device and each control routine, with technician's initials certifying each device and each routine is functioning correctly and sensors have been calibrated. Include list of deficiencies, if any, and schedule setting out rectification program with time lines.
- .3 Manually operate each output for every system with a Mobile User Interface supplied by the BAS Trades as part of the Commissioning activities.
- .4 Submit site-specific trends that contain all I/O points recorded at an analog or digital time frequency that confirms the correct system operation.
- .12 BAS Trade System Testing:
 - .1 Document the following:
 - .1 each point on the BAS including calibration checks and the stroking of actuators.
 - .2 all dynamic graphics comply with the mechanical and control specifications.
 - .3 all system programs comply with the specification under the normal modes of operation, emergency power, building fire detected and firefighter's override operating modes.
 - .4 all system alarms comply with the operating sequences and the specifications.
 - .5 System stability.
 - .6 Dynamic tests to prove control stability and that environmental comfort conditions are maintained.
- .13 Confirm and demonstrate to the Consultant and the Owner's agent that all systems are programmed and operating correctly.
- .14 System Performance Verification Testing:
 - .1 Prior to acceptance, perform System Performance Verification Testing to demonstrate system operation and compliance with specification after, and in addition to, tests specified above. Show field operation of:
 - .1 each Sequence of Operation,
 - .2 Operator Interface,
 - .3 DDC loop response with graphical trend data output showing:
 - .1 Each DDC loop response to set point change producing an actuator position change of at least 25% of full range,
 - .2 Trend sampling rate to be from 10 seconds to 3 minutes, depending on loop speed,
 - .3 Loop trend data to show set point, actuator position, and controlled variable values,
 - .4 Documentation of further tuning of any loop that displays significantly under- or over-damped control,
 - .4 Demand limiting routine with trend data documenting action sampled with output showing demand-limiting algorithm action for each minute over a minimum 30-minute period indicating building kW, demand-limiting set point, and status of set-points and other affected equipment parameters,
 - .5 Building fire alarm system interface,
 - .6 Trend logs for each system point with:
 - .1 trend data to indicate set-points, operating points, valve positions, and other data as specified in points list provided with each Sequence of Operation,

- .2 each log to cover three 48-hour periods and to have sample frequency not less than 10 minutes,
- .3 occupancy sensor trend logs shall show the occupancy patterns of the space,
- .4 confirmation that setpoints are being maintained and excessive cycling of equipment is not occurring.
- .5 show that Logs are accessible through operator interface and can be retrieved for use in other software programs.
- .7 Control loop tuning parameters shall be verified by applying a change to the current setpoint and observing the resulting trend log with setpoint being reached within a "reasonable" period of time without excessive cycling or hunting of the controlled device,
- .8 Substantiate calibration and response of any input and output points requested,
- .9 Provide at least two technicians equipped with two-way communication,
- .10 Provide and operate test equipment to establish calibration and prove system operation.
- .2 Obtain approval of Start-up Testing and Trade System Testing documentation, including any rectifications made, prior to scheduling System Performance Verification Testing.
- .3 Provide notification not less than ten (10) business days before System Performance Verification Testing begins.
- .4 The System Performance Verification Testing shall be performed by the BAS Trades and shall be witnessed by the Consultant who shall complete the Consultant's portion of the system performance verification test sheets as each test is successfully completed.
- .5 The BAS Trade Contractor shall remedy any deficiencies that are observed during the system performance verification tests and shall be re-tested as required to demonstrate satisfactory performance.
- .6 System Performance Verification Testing to follow previously submitted and approved procedures;
 - .1 submit checklists and report forms for each system as part of demonstration,
 - .2 lists and forms to have initials of technicians conducting demonstrations,
 - .3 date of each demonstration and signatures of Owner's representatives witnessing each demonstration section.
- .15 Third Party Device Integrated Systems Testing:
 - .1 Third Party Device Integrated System Testing shall include the following minimum requirements:
 - .1 Test all Third Party monitored and controlled field devices, Third Party data points and all Third Party input and output points. Monitored data point values shall be verified against actual field device values to ensure both Third Party and BAS reported values are the same.
 - .2 Third Party controller device status and data communications status are accurately monitored at the BAS. Alarms for failed controllers and failed data communications are annunciated.
 - .3 BAS override control via the Operator Workstation of all Third Party output points and control data points shall be verified.
 - .4 Third Party data values displayed on the BAS dynamic system graphics, or in tabular data format, are functional and accurate.

- .5 BAS facilities for operator adjustment of Third Party alarm definition parameters and thresholds, setpoint adjustment, control parameter adjustments, point trend initiation and modification to trends, and similar control functions, are fully operational.
- .16 Security System Monitoring to BAS:
 - .1 Provide digital input from security system.
 - .2 When building security armed all outside lighting control shuts off 20 minutes after alarm system armed.
 - .3 When building security armed all AHU's, Exhaust Fans and heating systems shall be changed to unoccupied mode immediately when armed regardless of scheduled times.
 - .4 All critical alarms as determined by the Owner.
- .17 When project is complete the BAS Trade Contract shall allow sufficient programming time in order to customize the sequences to meet operational needs, fine tuning of the system and other duties as required. The Owner will determine the schedule.
- .18 Commissioning Record Documentation.
 - .1 Test results shall be documented using test sheets. The test sheets shall be prepared in an appropriate format for the various categories of component and system to be tested. It is the responsibility of the BAS Trades to provide test verification sheets for each component and system that accurately reflect the sequences of operation and appropriate data for the components and systems
 - .2 All test documentation shall be maintained in electronic format and in hard copy.
 - .3 Submit a four (4) copies of the system Commissioning Report to the Consultant for review and approval.
 - .4 Record all out-of-season or unverified points in the commissioning report as "uncommissioned".
 - .5 Submit inspection certificates.
 - .6 Certificate of Acceptance to be withheld until Submittals are reviewed.
- .19 Ensure the BAS has met requirements outlined in the Article entitled 'Completion' found in Section 20 01 10.

3.04 OWNER TRAINING

- .1 Owner Training sessions shall include classroom type instruction and "hands on" instruction and shall be delivered by the BAS Trades on site using the completed installations. Arrange for additional meeting room space with the Owner.
- .2 Provide training tailored to the various Owner operations personnel requirements.
- .3 Materials:
 - .1 Provide course outline and materials for each class at least six weeks before first class.
 - .2 Provide training through instructor-led sessions, with computer-based, or web-based techniques.
 - .3 Instructors to be factory-trained and experienced in presenting this material.
 - .4 Perform classroom training using network of working controllers representative of installed hardware
- .4 Once five (5) consecutive Days of alarm-free operation are complete and documented, operator training may begin.
- .5 Provide one (1) day of instruction to the Owner's designated personnel on the operation of the BAS and describe its intended use with respect to the programmed functions.
- .6 Operator orientation of the BAS shall include, but not be limited to:
 - .1 the overall operation program,

- .2 equipment functions (both individually and as part of the total integrated system),
- .3 commands,
- .4 systems generation,
- .5 advisories, and
- .6 appropriate operator intervention required in responding to the system's operation.

END OF SECTION

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Date: July 31, 2025

Project Name: York Region North Roads Operations Centre

Client: York Region

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Project #: 23137

ADD #: TE-002

Page #: 1 of 1

+ Attachment

In accordance with the drawings and specifications, provide in the tender all costs required to complete the work including items as listed below.

Title: Electrical & ICAT Tender Addendum TE-002
Reason for Change: Electrical & ICAT Design Clarifications

Electrical Drawings:

Drawing #	Revisions
E0-11	<ul style="list-style-type: none"> Revise diamond note 2 on drawing.
E0-21	<ul style="list-style-type: none"> Revise note 1. Revise diamond note 17 on drawing.
E2-01	<ul style="list-style-type: none"> Clarify demolition of existing electrical distribution equipment. Clarify location of existing electrical room. Add note 4.
E3-12	<ul style="list-style-type: none"> Relocate Exhaust Fans.

End of ADD # TE-002



10. *Journal of the American Medical Association*, 2000; 283: 2686-2692.

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10. *Journal of the American Medical Association*, 2000; 283: 2686-2692.

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E0-11 1 : 500



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|-----|---------------------------------|------------|
| 12 | ISSUED FOR ADDENDUM #5 | 2025/07/31 |
| 11 | ISSUED FOR ADDENDUM #4 | 2025/07/18 |
| 10 | REISSUED FOR TENDER | 2025/05/23 |
| 9 | ISSUED FOR TENDER | 2025/04/22 |
| 8 | ISSUED FOR SITE PLAN AGREEMENT | 2025/01/09 |
| 7 | ISSUED FOR BUILDING PERMIT | 2024/11/27 |
| 6 | ISSUED FOR SPA AND RESUBMISSION | 2024/11/22 |
| 5 | ISSUED FOR PRE-TENDER REVIEW | 2024/10/31 |
| 4 | ISSUED FOR SPA 1ST RESUBMISSION | 2024/09/23 |
| 3 | ISSUED FOR 60% CD | 2024/05/02 |
| 2 | ISSUED FOR SPA SUBMISSION | 2024/04/12 |
| 1 | ISSUED FOR 100% DD | 2024/02/29 |
| NO. | ISSUED FOR | DATE |

Drawing History	
Scale	Checked By
As indicated	S.B.

Region of York Project Number	Region of York Building Code
22046	G013-B
Project	

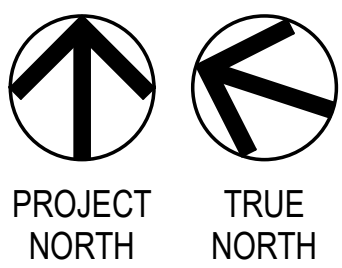
YORK REGION NORTH ROADS
OPERATIONS CENTRE

3525 BASELINE RD.SUTTON WEST, ON L0E 1R0

SITE PLAN - ELECTRICAL & ICAT - DEMOLITION

Project Number	Drawing Number
23137	E0-11

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E0-21

E0-21 N.T.S.



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|----|---------------------------------|------------|
| 13 | ISSUED FOR ADDENDUM #5 | 2025/07/01 |
| 12 | ISSUED FOR ADDENDUM #4 | 2025/07/01 |
| 11 | REISSUED FOR TENDER | 2025/06/25 |
| 10 | ISSUED FOR TENDER | 2025/04/23 |
| 9 | ISSUED FOR SITE PLAN AGREEMENT | 2025/01/08 |
| 8 | ISSUED FOR BUILDING PERMIT | 2024/11/21 |
| 7 | ISSUED FOR SPA 2ND RESUBMISSION | 2024/11/21 |
| 6 | ISSUED FOR PRE-TENDER REVIEW | 2024/10/03 |
| 5 | ISSUED FOR SPA 1ST RESUBMISSION | 2024/09/28 |
| 4 | ISSUED FOR 60% CD | 2024/05/01 |
| 3 | ISSUED FOR SPA SUBMISSION | 2024/04/14 |
| 2 | ISSUED FOR 100% DD | 2024/02/22 |
| 1 | ISSUED FOR 60% DD | 2024/01/21 |
| NO | ISSUED FOR | DATE |

Region of York Project Number	Region of York Building Code
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3525 BASELINE RD.SUTTON WEST, ON L0E 1R0

SITE PLAN - ELECTRICAL & ICAT NEW WORKS

Project Number **23137** Drawing Number **E0-21**



Prime Consultant
GEC ARCHITECTURE

Structural Consultant
ENTUITIVE

Mechanical Consultant
MCW CONSULTANTS LTD.

Electrical Consultant
MCW CONSULTANTS LTD.

Civil Consultant
PLANMAC ENGINEERING

Passive House Consultant
PEEL PASSIVE HOUSE

LEED Consultant
MCW CONSULTANTS LTD

YORK REGION



Seal & Permit

**PRELIMINARY -
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CONSTRUCTION**



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8	ISSUED FOR ADDENDUM #4	2025/07/18
7	REISSUED FOR TENDER	2025/05/23
6	ISSUED FOR TENDER	2025/04/22
5	ISSUED FOR BUILDING PERMIT	2024/11/27
4	ISSUED FOR PRE-TENDER REVIEW	2024/10/31
3	ISSUED FOR 60% CD	2024/05/02
2	ISSUED FOR 100% DD	2024/02/29
1	ISSUED FOR 60% DD	2024/01/25
NO.	ISSUED FOR	DATE

Scale	Checked By
1 : 100	S.B.

Region of York Project Number Region of York Building Code

22046	G013-B
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Project

YORK REGION NORTH ROADS
OPERATIONS CENTRE

3525 BASELINE RD.SUTTON WEST, ON L0E 1R0

Drawing Title

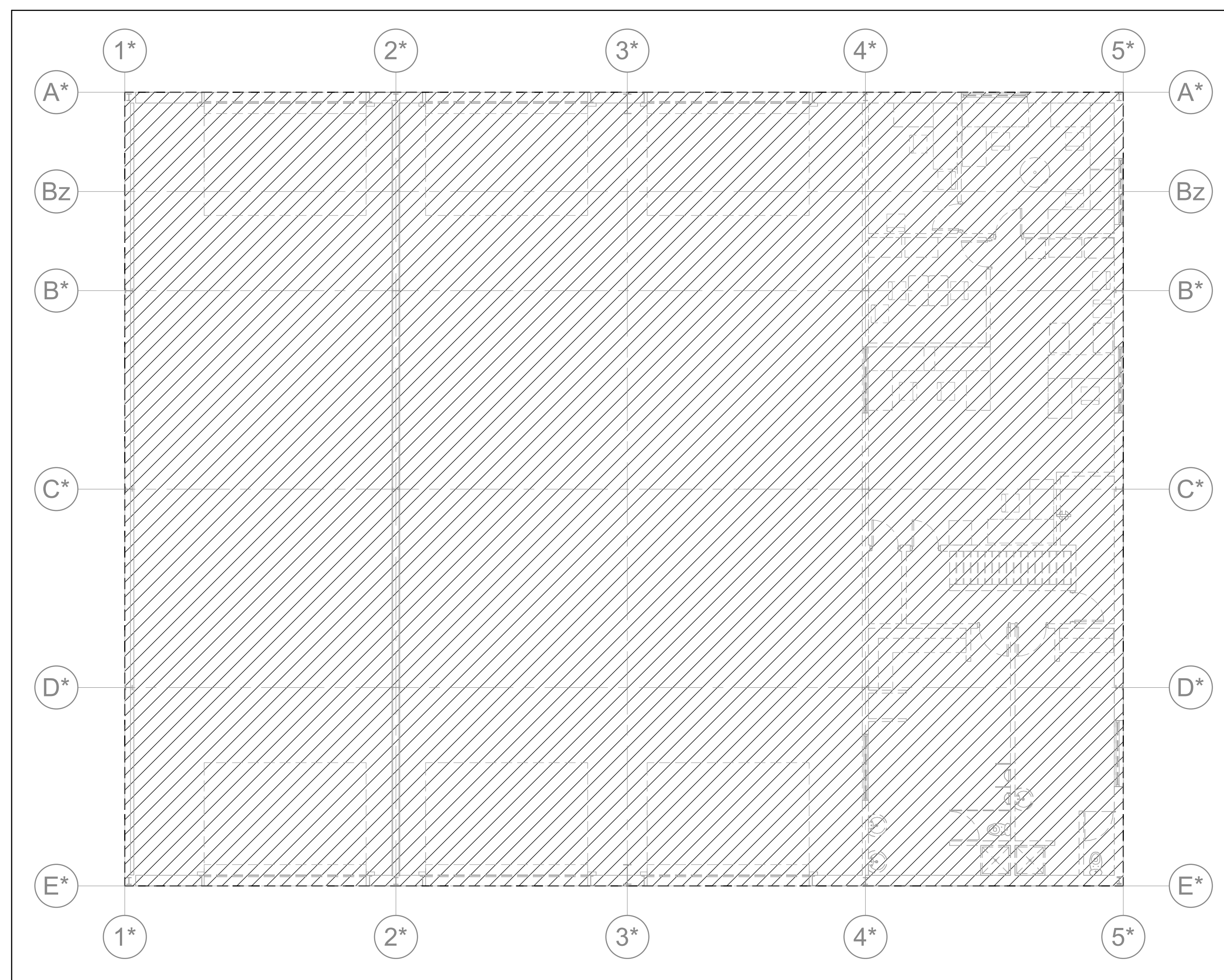
GROUND FLOOR PLAN -
ELECTRICAL & ICAT - DEMOLITION

Project Number

Drawing Number

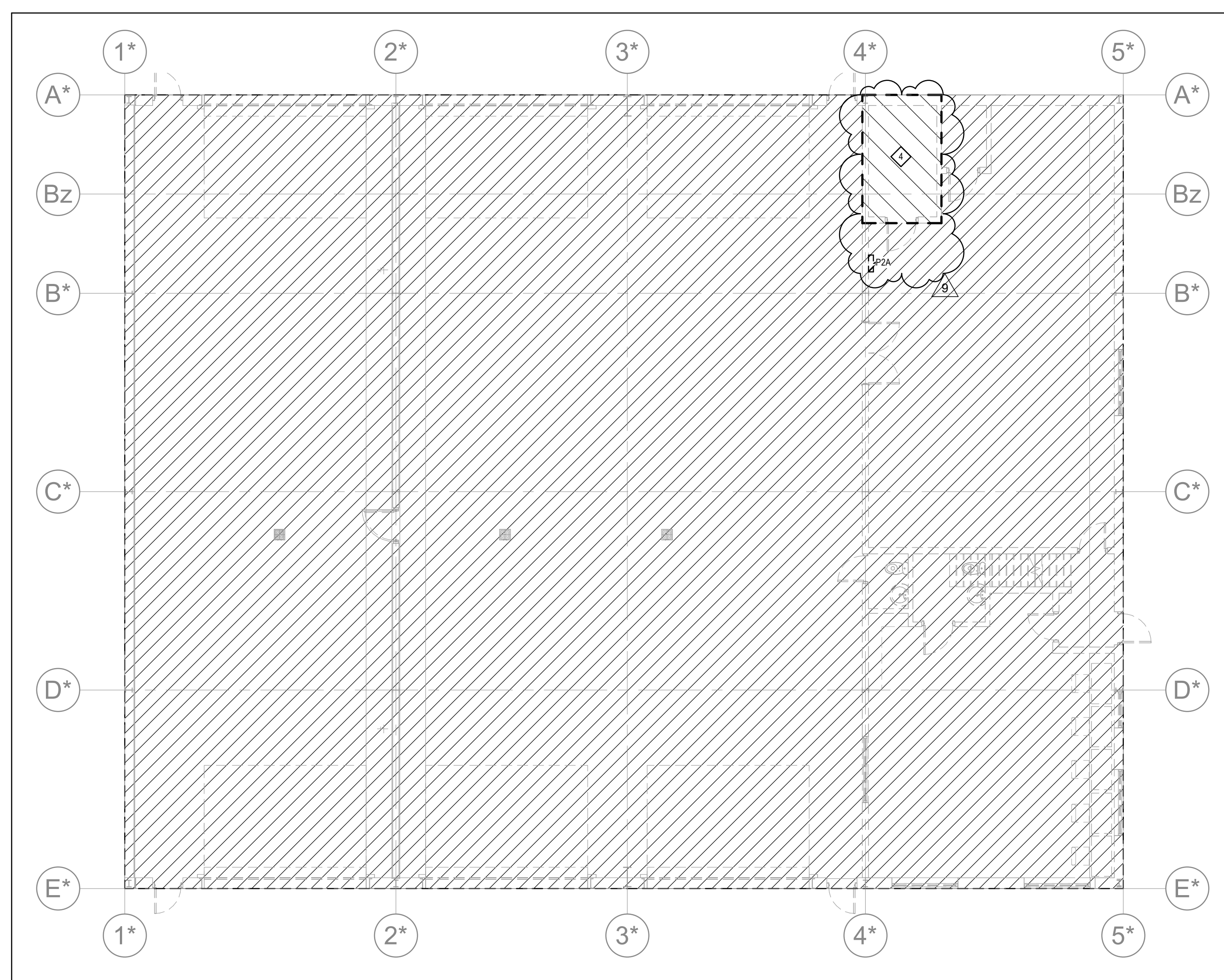
E2-01

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2 LEVEL 2 - ELECTRICAL & ICAT - DEMOLITION

E2-01 1 : 100



① LEVEL 1 - ELECTRICAL & ICAT - DEMOLITION

E2-01 1 : 100

NOTES:

2. ALL DRAWING E-011 FOR GENERAL DEMOLITION NOTES.
3. SEE ELECTRICAL & I&T SERVICES, SYSTEM COMPONENTS
4. ALL ELECTRICAL SHALL BE DEMOLISHED WITHIN THE HATCHED REGION TO ACCOMMODATE NEW WORKS SCOPE.
5. SHALL BE DEMOLISHED WITHIN THE HATCHED REGION TO ACCOMMODATE THE FOLLOWING:
 - ELECTRICAL WIRING DEVICES, WIRES, CONDUITS,
 - GROUNDING AND BONDING WIRES AND CONNECTIONS
 - LIGHTING LIGHTING CONTROL DEVICES
 - TELECOM DEVICES
 - SECURITY DEVICES
 - CEILING FAN ELECTRICAL CONNECTIONS.
 - MECHANICAL EQUIPMENT ELECTRICAL CONNECTIONS
 - INSTRUMENT EQUIPMENT ELECTRICAL CONNECTIONS
 - ELECTRICAL DISTRIBUTION EQUIPMENT
 - TELECOMMUNICATIONS EQUIPMENT
 - STRUCTURE AND EQUIPMENT RACKS, PANELS
 - SECURITY PANELS
6. SOME MECHANICAL EQUIPMENT WITHIN THE WASHBAY AND GARAGE AREA MAY BE EXISTING TO REMAIN, THE POWER CONNECTIONS TO THE EXISTING EQUIPMENT SHALL BE DISCONNECTED FROM THE ELECTRICAL INFRASTRUCTURE BE DEMOLISHED AND PROVIDED WITH THE NEW ELECTRICAL INFRASTRUCTURE. PROVIDE DEMOLITION OF POWER CONNECTIONS SUPPLYING MECHANICAL EQUIPMENT WITH MECHANICAL DRAWINGS PRIOR TO DEMOLITION. FOR MORE INFORMATION SEE MECHANICAL DRAWINGS FOR EXISTING EQUIPMENT.

EXISTING MAIN ELECTRICAL ROOM TO BE DEMOLISHED. ALL DISTRIBUTION EQUIPMENT AND CONNECTIONS WITHIN THIS SPACE SHALL BE DISCONNECTED, MADE SAFE AND DEMOLISHED. SEE DRAWING E1-01 FOR DEMOLITION SCOPE AND DETAILS.



LEED Consultant
MCW CONSULTANTS LTD.



York Region

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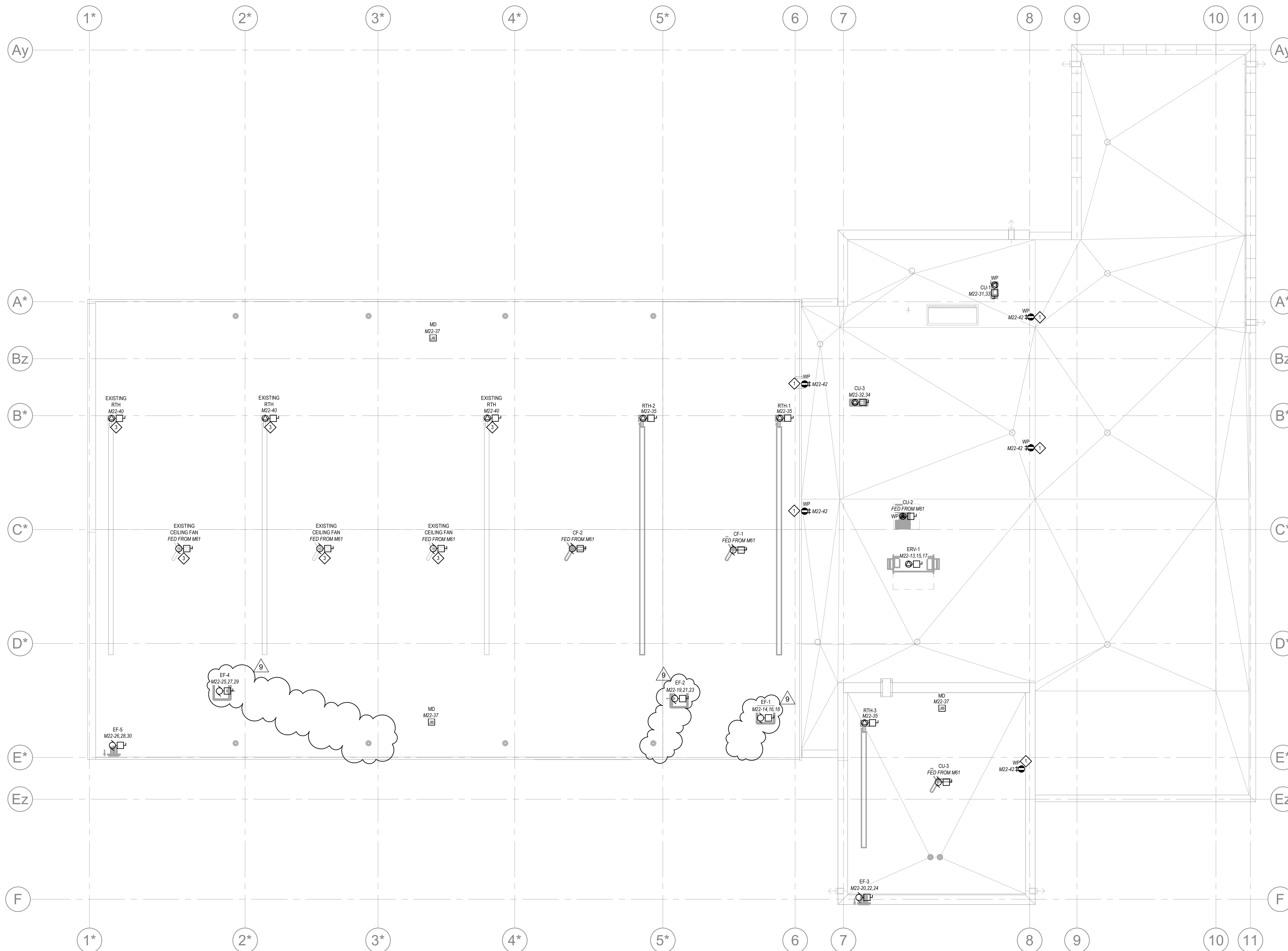
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9	ISSUED FOR ADDENDUM #5	2025/07/31
8	ISSUED FOR ADDENDUM #4	2025/07/18
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2	ISSUED FOR 100% DD	2024/02/29
1	ISSUED FOR 60% DD	2024/01/25
NO.	ISSUED FOR	DATE

23137 **E3-12**

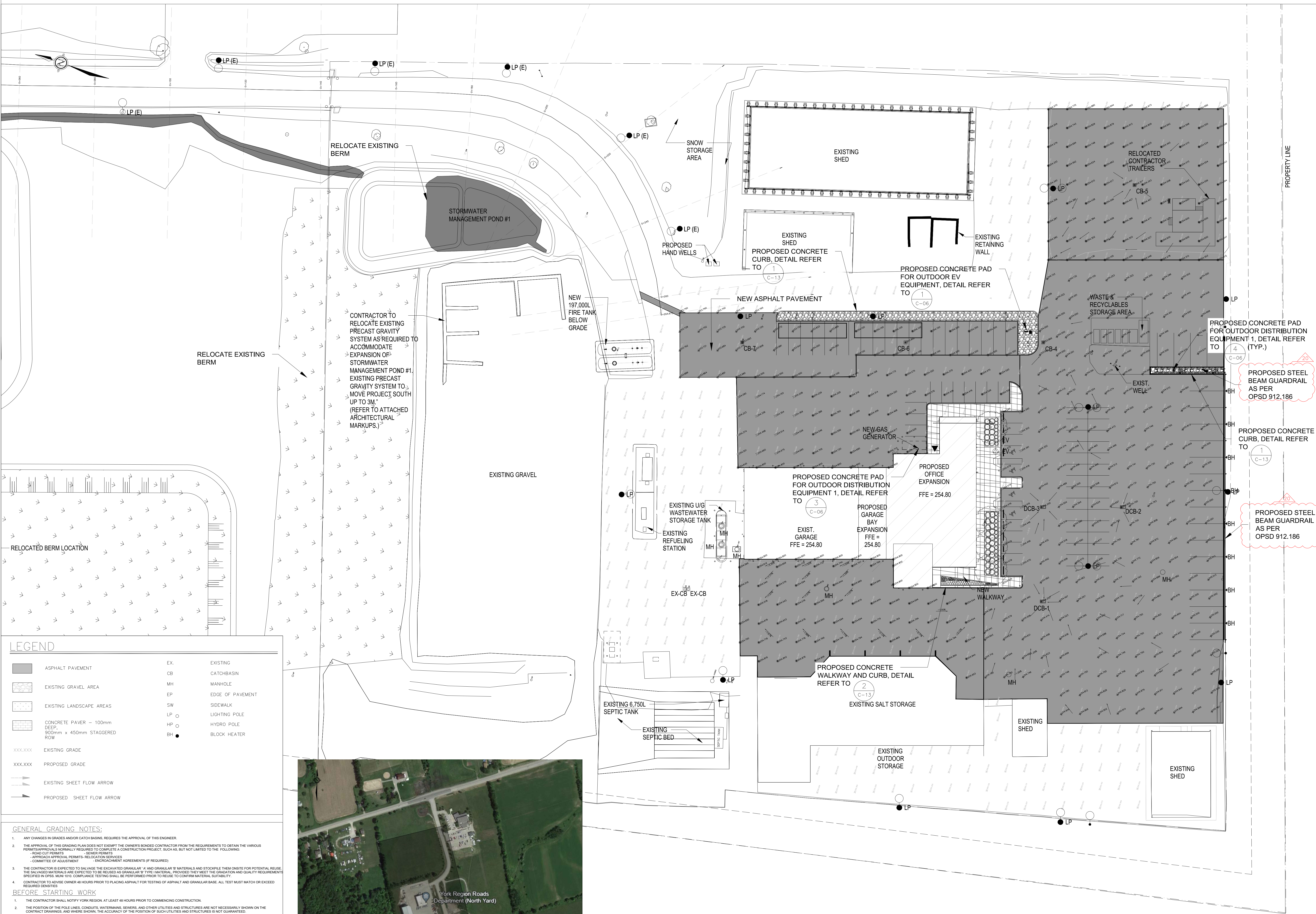
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- NOTES:**
1. RECEPTACLES FOR SERVICING OF ROOF MOUNTED MECHANICAL EQUIPMENT. RECEPTACLES SHALL BE INSTALLED WITHIN 7.5m OF MECHANICAL EQUIPMENT AND AT 750mm ABOVE FINISHED ROOF. COORDINATE EXACT LOCATIONS ON SITE.
 2. ALL ELECTRICAL CONNECTIONS FOR RADIANT TUBE HEATING, CEILING FANS, EXHAUST FANS, AND MOTORIZED DAMPERS WILL BE LOCATED ON INSIDE OF THE BUILDING ON THE CEILING. ELECTRICAL CONTRACTOR SHALL COORDINATE EXACT LOCATIONS AND INSTALLATIONS WITH MECHANICAL CONTRACTOR ON SITE.
 3. ELECTRICAL CONTRACTOR SHALL PROVIDE NEW ELECTRICAL CONNECTIONS TO EXISTING CEILING MOUNTED MECHANICAL EQUIPMENT TO REMAIN. COORDINATE EXACT LOCATIONS AND INSTALLATIONS ON SITE.

23137 **E3-12**

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LEGEND

ASPHALT PAVEMENT	EX. EXISTING
EXISTING GRAVEL AREA	CB CATCH-BASIN
EXISTING LANDSCAPE AREAS	MH MANHOLE
CONCRETE PAVEMENT - 100mm DEEP, 900mm x 450mm STAGGERED ROW	EP EDGE OF PAVEMENT
EXISTING GRADE	SW SIDEWALK
PROPOSED GRADE	LP LIGHTING POLE
EXISTING SHEET FLOW ARROW	HP HYDRO POLE
PROPOSED SHEET FLOW ARROW	BH BLOCK HEATER

GENERAL GRADING NOTES:

- ANY CHANGES IN GRADES AND/OR CATCH-BASINS, REQUIRES THE APPROVAL OF THIS ENGINEER.
- THE APPROVAL OF THIS GRADING PLAN DOES NOT EXEMPT THE OWNERS BONDED CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/NOTICES NORMALLY REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS, BUT NOT LIMITED TO, THE FOLLOWING:
 - ROAD CUT PERMITS
 - SEWER PERMITS
 - APPROACH APPROVAL PERMITS - RELATIONSHIP SERVICES
 - COMMITTEE OF ADJUSTMENT - ENCLOSURE AGREEMENTS (IF REQUIRED)
- THE CONTRACTOR IS DIRECTED TO SALVAGE THE EXCAVATED GRANULAR A-1 AND GRANULAR B-1 MATERIALS AND STOCKPILE THEM ON-SITE FOR POTENTIAL REUSE. THE SALVAGED MATERIALS ARE EXPECTED TO BE REUSED AS GRANULAR B-1 TYPE MATERIAL PROVIDED THEY MEET THE GRADATION AND QUALITY REQUIREMENTS SPECIFIED IN OPS. MATERIAL COMPLIANCE TESTING SHALL BE PERFORMED PRIOR TO REUSE TO CONFIRM MATERIAL SUITABILITY.
- CONTRACTOR TO ADVISE OWNER 48 HOURS PRIOR TO PLACING ASPHALT FOR TESTING OF ASPHALT AND GRANULAR BASE. ALL TEST MATCH OR EXCEED REQUIRED DENSITIES.

BEFORE STARTING WORK

- THE CONTRACTOR SHALL NOTIFY YORK REGION, AT LEAST 48 HOURS PRIOR TO COMMENCING CONSTRUCTION.
- THE POSITION OF THE POLE LINES, CONDUITS, WATERMANS, SEWERS, AND OTHER UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED.
- PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL BENCHMARKS, ELEVATIONS, DIMENSIONS, AND GRADES MUST BE CHECKED BY THE CONTRACTOR AND ANY DISCREPANCIES REPORTED TO THE ENGINEER.
- ALL EXISTING UNDERGROUND UTILITIES WITHIN THE LIMITS OF CONSTRUCTION SHALL BE LOCATED, MARKED AND PROTECTED. ANY UTILITIES DAMAGED OR DISTURBED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE ENGINEER, AT THE CONTRACTOR'S EXPENSE.
- AT LEAST TWO DIFFERENT BENCHMARKS MUST BE REFERRED TO AT ALL TIMES.
- 72 HOURS PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE AND VERIFY INVERTS OF EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.

SILTATION AND EROSION CONTROL

- SILTATION CONTROL BARRIERS SHALL BE PLACED AS REQUIRED.
- ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL AS DIRECTED AND TO THE SATISFACTION OF THE CITY.
- ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED AS DETERMINED BY THE CITY.
- SILTATION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO WORKS COMMENCING ON THE SITE AND SHALL BE MAINTAINED FOR THE DURATION OF CONSTRUCTION, TO THE SATISFACTION OF THE CITY.



POINT NAME	EASTING	NORTHING	ELEVATION	DESCRIPTION
100 CC	426184.8100	4505045.7629	254.875	
101 CC	426045.2390	4504998.8198	255.388	
102 CC	426071.2807	4505037.0840	254.606	
103 CC	426159.7004	4505058.0516	252.246	
268 N	426023.8544	4505040.2967	253.787	

NOTE:
SURVEY COMPLETED BY PLANMAC ENGINEERING INC. ON NOV 14, 2023.
VERTICAL AND HORIZONTAL CONTROL ESTABLISHED USING LEICA SMARTNET RTK.
COORDINATE SYSTEM: UTM 17 NAD 83, CGVD 1928.

gec architecture

Project Team:
Prime Consultant
GEC ARCHITECTURE

Structural Consultant
ENTUITIVE

Mechanical Consultant
MCW CONSULTANTS LTD

Electrical Consultant
MCW CONSULTANTS LTD

Civil Consultant
PLANMAC ENGINEERING

Passive House Consultant
PEEL PASSIVE HOUSE

LEED Consultant
MCW CONSULTANTS LTD

Client
York Region

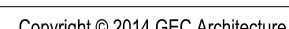
Seal & Permit

20. ISSUED FOR ADDENDUM 5	2025-07-31
19. ISSUED FOR ADDENDUM 4	2025-07-18
18. ISSUED FOR ADDENDUM 2	2025-07-04
17. REISSUED FOR TENDER	2025-05-23
16. ISSUED FOR TENDER	2025-04-25
15. ISSUED FOR 100% CD R5	2025-04-11
14. ISSUED FOR SITE PLAN AGREEMENT	2025-01-09
13. ISSUED FOR BUILDING PERMIT	2024-11-27
12. ISSUED FOR SPA 2ND RESUBMISSION	2024-11-22
11. ISSUED FOR 80% CD R4	2024-11-12
10. PRE-TENDER REVIEW	2024-10-31
9. ISSUED FOR SPA 1ST RESUBMISSION	2024-10-07
8. ISSUED FOR 100% CD R3	2024-08-02
7. ISSUED FOR 100% CD R2	2024-07-15
6. ISSUED FOR 100% CD R1	2024-06-30
5. ISSUED FOR 100% CD	2024-06-03
4. ISSUED FOR 80% CD R1	2024-05-02
3. ISSUED FOR 80% CD	2024-04-24
2. ISSUED FOR SPA SUBMISSION	2024-04-12
1. ISSUED FOR 100% DD	2024-03-19

NO. ISSUED FOR DATE

Drawing History
AS INDICATED
Region of York Project Number
22046
G013-B
Project
YORK REGION NORTH ROADS OPERATIONS CENTRE
3525 BASELINE RD. SUTTON WEST, ON, L0E 1R0
Drawing Title
GRADING PLAN

Project Number
6016
Drawing Number
C-02
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Reference: ET25-1438B

July 30, 2025

Angela Ng
GEC Architecture
430-179 John Street,
Toronto, ON
M5T 1X4

Email: Angela.ng@gecarchitecture.com

Dear Angela,

Summary of Salt-Impacted and Contaminated Soils – York Region North Road Operations Centre at 3525 Baseline Road, Georgina, Ontario.

Engtec Consulting Inc. (Engtec) was retained by GEC Architecture on behalf of The Regional Municipality of York ("the Client"), to provide quantities of excess soil of various quality, based on excess soil investigations conducted at the York Region North Road Operations Centre at 3525 Baseline Road, Georgina, Ontario (Site).

1 Soil Assessment Standards:

The soil volumes and types were surveyed and assessed by Planmac Engineering Inc., with other volumes estimated based on site-specific conditions by Engtec. The soil analysis results were compared to the Excess Soil Condition Standards outlined in the following tables (various tables were compared as destination site is unknown at this stage of the project):

- Table 2.1: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition (Volume-independent) for Industrial/Commercial/Community Property Use (Table 2.1 ICC ESQS); and,
- Table 3.1: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition (Volume-independent) for Industrial/Commercial/Community Property Use (Table 3.1 ICC ESQS).

As part of the ongoing soil management assessment at the Site, we have categorized the excavated soils based on their contamination levels and potential reuse options.

2 Summary of Soil Categories and Volumes:

This table below categorizes the total volumes of each type of soil and provides an overview of the areas and proposed actions for handling them accordingly. The distribution of these soil types is shown in the attached figure. The excess volumes are based on comparisons to both Table 2.1 ICC ESQS and Table 3.1 ICC ESQS (there is no difference in quantities between the comparisons to these tables).

Soil Category	Total Volume (m ³)	Areas/Description	Recommendations
Excess Soil with no impacts	8,700 m ³	A. Pond Area - Clean Soil to be re- used in berm (5,600 m ³). B. Existing Soil Stockpile (3,100 m ³).	Can be reused in berm construction.
Salt-Impacted Excess Soil and Excess Soil with no impacts are to be reused as Granular B Type I material, provided they meet the gradation and quality requirements outlined in OPSS.MUNI 1010; otherwise, they are to be disposed of off-site.	Up to 5,400 m ³	C. Excess Soil with no impacts to be sent off-site (500 m ³) D. Pond Area - Salt-Impacted Soil (620 m ³). E. Existing Building and Building Expansion (1,800 m ³). F. Paved Area - Tested Soil (880 m ³). G. New Pavement Area Excavation – Not tested but assumed to be Salt-Impacted (1,600 m ³)	Salt-Impacted Excess Soil and Excess Soil with no impacts are to be reused as Granular B Type I material, provided they meet the gradation and quality requirements outlined in OPSS.MUNI 1010; otherwise, they are to be disposed of off-site.
PHC Contaminated Soil	Up to 900 m ³	H. H. Gravel Area on Southwest Portion of Site (900 m ³).	The PHC impacts are likely due to the presence of recycled aggregate in the gravel area, and disposal offsite will be considered as contaminated material.

We trust that this submission meets your requirements. Should you have any questions, please don't hesitate to contact this office.

Yours truly,



Pranav Dave, M.Eng.,
 Environmental Specialist
 Engtec Consulting Inc.

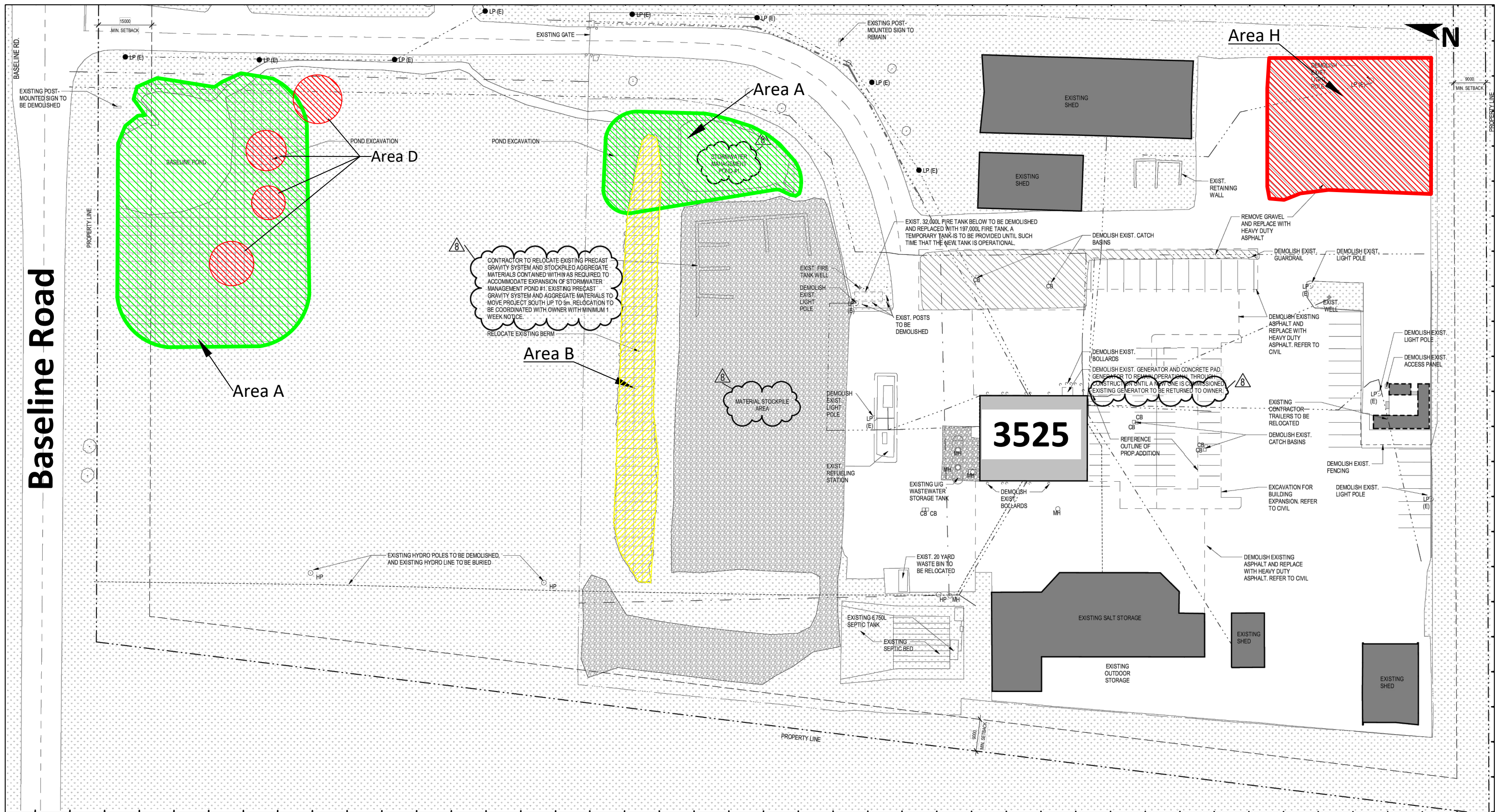


Hammad Din, P. Eng.
 Manager, Environmental Group
 Engtec Consulting Inc.

Attachments:

Figure illustrating soil categories and corresponding areas.

Figure



- Area A - Pond Area - Clean Soil
- Area B - Existing Stockpile - Clean Soil
- Area D - Pond Area - Salt Impacted (Delineated)
- Area H - Gravel Area (PHC Impacted)
- Notes:
- Area C is surplus clean soils from Areas A and B.
 - Area D is contaminated soils (already delineated within Areas A)
 - Areas E, F and G are in paved and building areas of the developed portion of the property with the exception of Area H (PHC Impacted)

Project Name: Engineering Services

Project Location: 3525 Baseline Road, Sutton West

Drawing Title: Soil Areas

Drawing No. 01

Project No. ET25-1438B

Contract No.

Drawn By: L.W Checked By: H.D

Date: July 30, 2025 Scale: NTS

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