

PROJECT MANUAL

Issued for Tender

Victoria University Goldring Student Centre Renewal 150 Charles Street West, Toronto, Ontario M5S 1K9

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Project No. 220370

February 2, 2024

Document Responsibility and Project Directory

1.1 Document Responsibility

- .1 Refer to Project Manual, Section 00 01 10 - Table of Contents, for indication of document responsibility (DR). Abbreviations for entity responsible for document preparation are as follows:
 - .1 O - Denotes documents prepared by Owner.
 - .2 A - Denotes documents prepared by Architect.
 - .3 E - Denotes documents prepared by Electrical Engineer.
 - .4 M - Denotes documents prepared by Mechanical Engineer.
- .2 Professional seals if applied next to company names in the project directory (below) govern only those specification sections and schedules identified by the corresponding document responsibility (DR) abbreviation in Section 00 01 10.

1.2 Project Directory

- .1 Owner:
Victoria University
73 Queen's Park Crescent
Toronto, Ontario
M5S 1K7

Tel: 416-420-6751
- .2 Architect (the *Consultant*):
Moriyama Teshima Architects
117 George Street
Toronto, Ontario
M5A 2N4

Tel: 416-925-4484
- .3 Mechanical Engineer:
Smith + Andersen
100 Shepard Avenue East
North York, Ontario
M2N 6N5

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100 Shepard Avenue East
North York, Ontario
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Tel: 416-487-8151

END OF SECTION

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DR - indicates entity responsible for preparation of listed documents (see Section 00 01 05)

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1.1 Information Available for Review

- .1 The following documents are made available for review:
 - .1 *Owner's* guidelines and policies:
 - .1 Refer to Open Request for Proposal (RFP) and Victoria University's Health and Safety Policy (<https://vicu.utoronto.ca/about-victoria/human-resources/health-and-safety/>).
- .2 The accuracy of the information contained in the above listed documents has not been independently verified by the *Consultant*.

END OF SECTION

Contract Security

PART 1 - GENERAL

1.1 Section Includes

- .1 Contract security requirements.

1.2 Administrative Requirements

- .1 The *Contractor* shall provide to the *Owner* any *Contract* security specified in Section 00 73 63. *Contract* security specified shall be submitted to the *Owner* as indicated in Open Request For Proposal (RFP) prior to commencement of the *Work*,

1.3 Contract Performance Security

- .1 The *Contractor* shall provide a performance bond, and a labour and materials payment bond, each issued by a bonding company acceptable to *Owner* and licensed to issue such instruments in the Province of Ontario, in the amounts and forms as follows:
 - .1 Performance bond:
 - .1 Amount of performance bond shall be equal to not less than 50% of the *Contract Price*.
 - .2 The form of performance bond shall be Form 32 under Section 85.1 of the Construction Act.
 - .2 Labour and material payment bond:
 - .1 Amount of Labour and material payment bond shall be equal to not less than 50% of the *Contract Price*.
 - .2 The form of Labour and material payment bond shall be Form 31 under Section 85.1 of the Construction Act.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Summary of Work

PART 1 - GENERAL

1.1 Section Includes

- .1 *Contract Documents* conventions.
- .2 Law, notices, permits and fees.
- .3 Use of premises and the *Place of the Work*.
- .4 Items supplied by *Owner*.
- .5 Electronic files.

1.2 *Contract Documents* Conventions

- .1 The *Contract Documents* have been arranged into various divisions, sections, drawings, and schedules for the purpose of presenting the *Work* in a logical and organized form and to enable ease of reference and interpretation, and are not intended to be an arrangement of precise and independent *Subcontractors*, or jurisdiction of responsibility for the various parts of the *Work*.
 - .1 The *Contractor* shall be solely responsible for coordinating the execution of the *Work* of this *Contract* in accordance with the requirements of the *Contract Documents*.
 - .2 The *Consultant* and *Owner* shall not be required to decide on questions arising with regard to agreements or contracts between the *Contractor* and *Subcontractors* or *Suppliers*, nor to the extent of the parts of the *Work* assigned thereto, nor to establish subcontract limits between Sections or Divisions of the *Work*.
 - .3 No extra will be allowed as a result of the failure to coordinate and allocate the *Work* such that the *Work* is provided in accordance with the *Contract Documents*.
- .2 The *Specifications* are written in the imperative mood and in streamlined form. The imperative language is directed to *Contractor*, unless stated otherwise.
- .3 Complete sentences by reading "shall", "*Contractor* shall", "shall be", and similar phrases by inference. Where a colon (:) is used within sentences and phrases, read the words "shall be" by inference.
- .4 Fulfill and perform all indicated requirements whether stated imperatively or otherwise.
- .5 When used in the context of a *Product*, read the word "provide" to mean "supply and install to result in a complete installation ready for its intended use".
- .6 Named *Products* alternates or equals, indicated by the phrases "or approved alternate by XYZ Manufacturing" or "or approved equal by XYZ Manufacturing", shall be interpreted to mean that named *Product* alternate or equal, if selected for use in lieu of indicated or specified *Product*, meets or exceeds performance, appearance, general arrangement, dimensions, availability, code and standards compliance, and colour of specified *Product*. Be responsible for costs and modifications associated with the inclusion of named *Product* alternate or equal at no additional cost to the *Owner*.

Summary of Work

- .7 The words “make good” or “making good” shall mean that, when a finish or material has been altered, the material or finish shall be repaired or replaced, and refinished to match existing quality and appearance to acceptance of *Consultant*, and that repaired or replaced and refinished *Work* shall not be discernible from existing materials or finishes when judged by the *Consultant* from a viewing distance of 1830 mm (6'), and that such work is included in the *Contract Price*.
- .8 Where a component, device, item or part of materials or equipment is referred to in the singular number, such reference shall require the provision of as many components, devices, items or parts of material or equipment necessary to complete the *Work*.
- .9 Reference standards:
 - .1 “Reference standards” means consensus standards, trade association standards, guides, and other publications expressly referenced in *Contract Documents*.
 - .2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing, except as follows:
 - .1 If a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the edition or version referenced in the applicable code or other regulatory requirement shall apply.
 - .3 The *Contract Documents* may specify, indicate, or schedule requirements that exceed the requirements of the building code, other applicable codes, requirements of authorities having jurisdiction, and standards cited in the *Contract Documents*. In such cases, the requirements specified, indicated, or scheduled in the *Contract Documents* shall govern.
 - .4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to *Consultant* for clarification.

1.3 **Contract Documents for Construction Purposes**

- .1 *Owner* shall supply *Contractor* with a complete set of *Contract Documents* in electronic form before commencement of the *Work*.

1.4 **Laws, Notices, Permits, and Fees**

- .1 The building code - Ontario Regulation 332/12, including amendments, shall govern the *Work*.
- .2 Comply with codes, by-laws, and regulations of authorities having jurisdiction over the *Place of the Work*. Codes and regulations form an integral part of the *Contract Documents*.
- .3 *Owner* shall apply and pay for the building permit. The *Contractor* shall pick up building permit from the municipal department having jurisdiction at the *Place of the Work*. Obtain and pay for all other permits, licenses, deposits and certificates of inspection as part of the *Work*.
- .4 Arrange for inspection, testing and acceptance of the *Work* required by the authorities having jurisdiction. Be responsible for necessary preparations, provisions and pay costs.
- .5 Obtain permits required to execute work on municipal rights of way. Obtain damage deposits for sidewalks, roads and services, unless otherwise indicated.

Summary of Work

- .6 It is the responsibility of the *Contractor* to schedule notifications and inspections required by authorities having jurisdiction such that notifications can be properly received and that inspections can be properly undertaken without causing a delay in the *Work*. The *Contractor*, at no additional cost to the *Owner*, shall be solely responsible for any delay in the *Work* caused by failure to properly schedule required notifications and inspections.
- .7 The *Contractor* shall provide to the chief building official or the registered code agency, where a registered code agency is appointed under the Ontario Building Code Act in respect of the construction to which the notice relates, the required notices set out in Division C – Part 1 Sentence 1.3.5.1(2) and Sentence 1.3.5.2 of the Ontario Building Code, O. Reg. 332/12 as amended. The *Contractor* shall be present at each site inspection by an inspector or registered code agency as applicable under Division C – Part 1 Sentence 1.3.5.2 of the building code.
 - .1 It is the responsibility of the *Contractor* to schedule notifications to the chief building official or the registered code agency such that the inspection pertaining to the notifications can be made within the time frame as required under Division C – Part 1 Sentence 1.3.5.3 of the Ontario Building Code, O. Reg. 332/12 as amended, without causing a delay in the *Work*. The *Contractor*, at no additional cost to the *Owner*, shall be solely responsible for any delay in the *Work* caused by failure to properly schedule required notifications and inspections.

1.5 Documents at the *Place of the Work*

- .1 Maintain at the *Place of the Work*, a copy of documents in accordance with GC 3.9, and the following:
 - .1 *Contract Documents* including drawings, specifications, addenda, and other modifications to the *Contract*.
 - .2 'Reviewed' or 'Reviewed as Noted' submittals.
 - .3 Construction and submittal schedules.
 - .4 *Supplemental Instructions*, proposed *Change Orders*, *Change Orders*, and *Change Directives*.
 - .5 RFI responses and RFI log.
 - .6 Field test reports and independent testing reports.
 - .7 *Consultant's* field review reports and deficiency reports.
 - .8 Manufacturer's field review reports.
 - .9 Reports by authorities having jurisdiction.
 - .10 Building and other applicable permits, and related permit documents.
 - .11 Daily log including:
 - .1 Number of workers actively working at the *Place of the Work* by each subcontract.
 - .2 *Subcontractors* working at the *Place of the Work*.
 - .3 Parts of the *Work* being worked on.
 - .4 Working hours worked at the *Place of the Work*.
 - .5 Activities with intermittent progress.

Summary of Work

- .6 Time lost and explanation for such time lost.
- .7 Difficulties (work scheduled to start but did not with the reason why, delays, labour inefficiencies, labour shortage).
- .8 *Products* and materials delivered.
- .9 Equipment mobilized and/or demobilized.
- .10 Demolition conditions.
- .11 Start and finish date of each part of the *Work*.
- .12 As-built drawings recording as-built conditions, instructions, changes for structure, equipment, wiring, plumbing, and the like, as called for in Section 01 78 00 and Divisions 21, 22, and 23 and Divisions 26, 27, and 28, prior to being concealed.
- .2 Make above material available to *Consultant* upon request.

1.6 Use of Premises and the *Place of the Work*

- .1 Except as otherwise specified, *Contractor* has unrestricted use of *Place of the Work* from time of *Contract* award until *Ready-for-Takeover*.
- .2 Confine *Construction Equipment*, *Temporary Work*, storage of *Products*, waste products and debris, and all other construction operations to limits required by laws, ordinances, permits, and *Contract Documents*, whichever is most restrictive. Do not unreasonably encumber *Place of the Work*.

1.7 Not In Contract Items and Items Supplied by Owner

- .1 NIC (Not In *Contract*) shall be used to designate various items of equipment that require coordination for installation although are not provided as part of the *Work*.
- .2 SBO (Supplied by *Owner*) shall be used to designate various items of equipment that will be supplied by the *Owner* for installation by the *Contractor* as part of the *Work*.
 - .1 *Owner* Responsibilities:
 - .1 Order and pay for items supplied by *Owner* not already in *Owner's* possession.
 - .2 Arrange and pay for delivery of items supplied by *Owner* F.O.B. the *Place of the Work*, within time frames required by *Contractor's* progress schedule. If delivered sooner than required by *Contractor's* latest progress schedule submitted to *Owner*, arrange and pay for delivery to a temporary storage location and subsequent delivery to the *Place of the Work*.
 - .3 Advise *Contractor* in writing of the value of items supplied by *Owner* for *Contractor's* insurance purposes.
 - .4 Arrange and pay for delivery to *Contractor* of reviewed *Shop Drawings*, *Product* data, samples, and manufacturer's installation instructions.
 - .5 Inspect deliveries jointly with *Contractor*.
 - .6 Submit claims for transportation damage.
 - .7 Arrange for replacement of damaged, defective or missing items identified at time of delivery.
 - .8 Arrange for manufacturer's field services.

Summary of Work

- .9 Arrange for delivery of manufacturer's warranties to *Contractor* for inclusion in operation and maintenance manual.
- .2 **Contractor Responsibilities:**
 - .1 Designate in progress schedule, time frames for delivery of items supplied by *Owner* to the *Place of the Work* and for receipt of related submittals. If the *Place of the Work* is not ready to receive delivery of items supplied by *Owner* within the time frame indicated in the latest progress schedule submitted to *Owner*, arrange and pay for delivery to a temporary storage location and subsequent delivery to the *Place of the Work*.
 - .2 Review all required submittals and notify *Consultant* of any observed discrepancies or anticipated problems.
 - .3 Ensure that course of construction insurance is adequate to cover items supplied by *Owner*.
 - .4 Receive and unload items supplied by *Owner* at the *Place of the Work*.
 - .5 Inspect deliveries jointly with *Owner*. Record and notify *Owner* and *Consultant* of shortages and visibly damaged or defective items.
 - .6 Handle items supplied by *Owner* at the *Place of the Work*, including uncrating and storage. Dispose of waste materials and debris.
 - .7 Take appropriate precautions to protect items supplied by *Owner* from loss or damage.
 - .8 Repair or replace items damaged at the *Place of the Work*.
 - .9 Assemble, install, connect, adjust, and finish items supplied by *Owner* as specified.
 - .10 Arrange for inspections required by authorities having jurisdiction as specified.
 - .11 Arrange for or perform testing as specified.
 - .12 Workmanship warranty for installation.

1.8 Electronic Files

- .1 In the event that the *Contractor*, a *Subcontractor*, or a *Supplier* requests AutoCAD files from the *Consultant*, the *Consultant* will be allowed to use their discretion whether or not they will provide them. The *Consultant* may charge a fee for providing the electronic files and/or require a copyright waiver to be signed, also at the *Consultant's* discretion.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 Cash allowances.

1.2 Cash Allowances

- .1 Expenditure of cash allowances:
 - .1 The *Owner*, through the *Consultant*, will provide the *Contractor* with documentation required to permit pricing of a cash allowance item.
 - .2 The *Owner*, through the *Consultant*, may request the *Contractor* to identify potential *Suppliers* or *Subcontractors*, as applicable, and to obtain at least three competitive prices for each cash allowance item.
 - .3 The *Owner*, through the *Consultant*, may request the *Contractor* to disclose originals of all bids, quotations, and other price-related information received from potential *Suppliers* or *Subcontractors*.
 - .4 The *Owner*, through the *Consultant*, will determine by whom each cash allowance item will be performed and for what amount. Obtain *Owner's* prior written approval in the form of a *Change Order* before entering into a subcontract, amending an existing subcontract, or before performing by own forces, work that is covered by a cash allowance. Upon issuance of the *Change Order*, the *Contractor's* responsibilities for a cash allowance item shall be the same as for other work of the *Contract*.
- .2 Cash allowances are for supply and installation unless otherwise specified.
- .3 Amount of each cash allowance does not include *Contractor's* overhead and profit, and other related costs, which shall be included in the *Contract Price* and not in the cash allowance.
- .4 Cash allowances for supply only:
 - .1 Amount of each cash allowance includes:
 - .1 Cost of *Products* as invoiced by the *Supplier*, including delivery and applicable taxes but excluding Value Added Taxes.
 - .2 Amount of each cash allowance does not include costs of the following items, which costs shall be included in the *Contract Price* and not in the cash allowance:
 - .1 Unloading, handling and storage at the *Place of the Work*.
 - .2 Installation and all other related costs.
- .5 Cash allowances for install only:
 - .1 Amount of each cash allowance includes:
 - .1 Unloading, storing, handling of *Products* at the *Place of the Work*.
 - .2 Installation, finishing, and commissioning of *Products*.
 - .3 Applicable taxes and duties (excluding Value Added Taxes).

Allowances

- .2 Amount of each cash allowance does not include costs of the following items, which costs shall be included in the *Contract Price* and not in the cash allowance:
 - .1 Net cost of *Products*.
 - .2 Delivery to the *Place of the Work*.
- .6 Cash allowances for supply and install:
 - .1 Amount of each cash allowance includes:
 - .1 All costs to provide the specified *Products*, including supply, installation, and related costs, excluding Value Added Taxes.
 - .2 *Subcontractor's* and sub-*Subcontractor's* overheads and profits related to the cash allowance.
 - .7 Cash allowances for services:
 - .1 Amount of each cash allowance includes:
 - .1 All costs related to the services, excluding Value Added Taxes.
 - .2 *Subcontractor's* and sub-*Subcontractor's* overheads and profits related to the cash allowance.
 - .8 List of cash allowances
 - .1 The *Contract Price* includes a total cash allowance of value as indicated in Open Request for Proposal (RFP).

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Substitution Procedures

PART 1 – GENERAL

1.1 Section Includes

- .1 Substitution procedures.
- .2 Submission requirements for proposed substitutions.

1.2 Definition

- .1 In this Section “Substitution” means a *Product*, a manufacturer, or both, not originally specified in *Contract Documents* by proprietary name but proposed for use by *Contractor* in place of a *Product*, a manufacturer, or both, specified by proprietary name.

1.3 Substitution Procedures

- .1 Proposals for substitutions of *Products* and materials must be submitted in accordance with procedures specified in this section.
- .2 *Contractor* may propose a Substitution wherever specifications include the phrases "or equal", "or approved equal", "Substitutions: in accordance with Section 01 25 00", or words conveying this intent. Where specifications do not include such language, *Contractor* proposed substitutions shall not be permitted.
- .3 Do not order or install any substitution without a *Supplemental Instruction* or *Change Order*.
- .4 Provided a proposed Substitution submission includes all of the information specified in this Section under Submission Requirements For Proposed Substitutions, *Consultant* may review submissions, if directed by *Owner*, but in any case with the understanding that the *Contract Time* will not be altered due to the time required by the *Consultant* to review the submission and by the *Contractor* to implement the substitution in the *Work*.
 - .1 *Consultant's* services to review substitutions will be performed on an additional services basis to their contract with the *Owner*. Costs of these services will be discounted from any reductions in the *Contract Price* that might be forthcoming from the substitution. Therefore, to be acceptable, a substitution must present a reduction in the construction cost at least equal to the cost to the *Owner* of the *Consultant's* additional services to review the substitution. *Contractor* shall cover directly costs and administration associated with courier services, reproduction costs, and other direct costs associated with these substitution reviews.
 - .2 Should it appear to the *Consultant* that the value of services required to evaluate the substitution exceeds the potential reduction, the *Consultant* will advise the *Owner* that the substitution does not merit consideration before proceeding with a full evaluation. If the substitution will produce a reduction commensurate with or exceeding the value of the *Consultant's* services to evaluate the substitution, the *Consultant* will request the *Owner's* direction to proceed with evaluation.
- .5 *Consultant* may recommend to *Owner* acceptance of a Substitution proposed by *Contractor* if satisfied that:
 - .1 The proposed substitute *Product* is the same type as, is capable of performing the same functions as, interfaces with adjacent work the same as, and meets or exceeds the standard of quality, performance and, if applicable, appearance and maintenance considerations, of the specified *Product*.

Substitution Procedures

- .2 The proposed substitute manufacturer has capabilities comparable to the specified manufacturer.
- .3 The Substitution provides a benefit to *Owner*.
- .6 If *Contractor* fails to order a specified *Product* or order a *Product* by a specified manufacturer in adequate time to meet *Contractor's* construction schedule, neither *Consultant* nor *Owner* will consider that a valid reason to accept a Substitution. Refer to Section 01 60 00, paragraph 1.2 "Availability of Products".
- .7 If *Owner* accepts a Substitution, the change in the *Work* will be documented in the form of either a *Supplemental Instruction* or *Change Order* as specified in Section 01 26 00.
- .8 If a Substitution is accepted in the form of a *Supplemental Instruction* or *Change Order*, *Contractor* shall not revert to an originally specified *Product* or manufacturer without *Consultant's* prior written acceptance.

1.4 Submission Requirements for Proposed Substitutions

- .1 Include with each proposed Substitution the following information:
 - .1 Identification of the Substitution, including *Product* name and manufacturer's name, address, telephone numbers, and web site.
 - .2 Reason(s) for proposing the Substitution.
 - .3 A statement verifying that the Substitution will not affect the *Contract Price* and *Contract Time* or, if applicable, the amount and extent of a proposed increase or decrease in *Contract Price* and *Contract Time* on account of the Substitution.
 - .4 A statement verifying that the Substitution will not affect the performance or warranty of other parts of the *Work*.
 - .5 Manufacturer's *Product* literature for the Substitution, including material descriptions, compliance with applicable codes and reference standards, performance and test data, compatibility with contiguous materials and systems, and environmental considerations.
 - .6 *Product* samples as applicable.
 - .7 A detailed comparison of the physical properties and performance characteristics of the specified *Product* and the Substitution, with any significant variations clearly highlighted.
 - .8 Availability of maintenance services and sources of replacement materials and parts for the Substitution, as applicable, including associated costs and time frames.
 - .9 If applicable, estimated life cycle cost savings resulting from the Substitution.
 - .10 Details of other projects and applications where the Substitution has been used.
 - .11 Identification of any consequential changes in the *Work* to accommodate the Substitution and any consequential effects on the performance of the *Work* as a whole. A later claim for an increase to the *Contract Price* or *Contract Time* for other changes in the *Work* attributable to the Substitution will not be considered.
 - .12 Confirmation of proposed substitution delivery, in writing by *Product* manufacturer.
 - .13 Compliance with the building codes and requirements of authorities having jurisdiction.

Substitution Procedures

- .14 Copy of manufacturer's warranty for any *Product* or system for which an extended warranty has been specified, along with copy of manufacturer's warranty for specified *Product* or system with differences highlighted.
- .2 Substitutions submitted on *Shop Drawings* without following requirements of this section prior to submission of the affected *Shop Drawings* will cause the *Shop Drawings* to be rejected.
- .3 Proposed substitutions shall include costs associated with modifications necessary to other adjacent and connecting portions of the *Work*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1- GENERAL

1.1 Section Includes

- .1 Fees for overhead and profit – Definition
- .2 Method of *Contract Price* adjustment - *Change Orders*.
- .3 *Change Order* procedures.
- .4 Fees for overhead and profit – *Change Orders*.
- .5 Method of *Contract Price* adjustment - *Change Directives*.
- .6 *Change Directive* procedures.
- .7 Fees for overhead and profit – *Change Directives*.
- .8 *Supplemental Instructions*.

1.2 Fees for overhead and profit – Definition

- .1 Fees for overhead and profit to cover all profit, general expenses and overhead costs incurred by the Contractor as a result of a proposed change including, but not limited to site and head office administration and head office personnel costs, estimating, on-site supervision, Subcontractor and Supplier coordination, project management, submittals, quality control, general cleanup, small hand and power tools, As-Built Drawings, warranty, job safety costs, parking, and all fees, expenses and cost of the Contractor personnel engaged in the processing and the performance of the change, except where such items contribute directly to the implementation of the change.

1.3 Method of Contract Price Adjustment - *Change Orders*

- .1 Unless otherwise agreed, the adjustment of the *Contract Price* on account of a proposed change in the *Work* shall be based on a quotation for a fixed price increase or decrease to the *Contract Price* regardless of the *Contractor's* actual expenditures and savings.

1.4 *Change Order* Procedures

- .1 Upon issuance by the *Consultant* to the *Contractor* of a proposed change in the *Work*, and unless otherwise requested in the proposed change or unless otherwise agreed:
 - .1 Submit to the *Consultant* a fixed price quotation for the proposed change in the *Work* within 5 *Working Days* after receipt of the proposed change in the *Work*.
 - .2 Provide a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:
 - .1 Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.
 - .2 Estimated *Product* costs, including *Supplier* quotations, estimated quantities and unit prices.
 - .3 Estimated *Construction Equipment* costs.
 - .4 Enumeration of all other estimated costs included in the price quotation.

Contract Modification Procedures

- .5 Estimated credit amounts for labour and *Products* not required on account of the proposed change.
- .6 Fees, not exceeding the applicable percentages for overhead and profit as specified in this Section.
- .7 Where applicable, *Subcontractor* quotations, also including a detailed breakdown of all of the above.
- .3 Include in the quotation the increase or decrease to the *Contract Time*, if any, for the proposed change, stated in number of days.
- .4 Include in the quotation the number of days for which the quotation is valid.
- .5 The quotation will be evaluated by the *Consultant* and the *Owner* and, if accepted by the *Owner*, be documented in the form of a signed *Change Order*.

1.5 Fees for Overhead and Profit – *Change Orders*

- .1 Where the *Contractor's* price quotation for a *Change Order* results in a net increase to the *Contract Price*, the *Contractor's* entitlement to a fee for overhead and profit in the quotation shall be as follows, as applicable:
 - .1 For work to be performed by the *Contractor's* own forces, 10% of the *Contractor's* price quotation before the *Contractor's* fee is applied.
 - .2 For work to be performed by a *Subcontractor*, 7.5% of the *Subcontractor's* price quotation including the *Subcontractor's* fee.
- .2 Where a *Subcontractor's* price quotation for a *Change Order* results in a net increase to the *Subcontractor's* contract price, the *Subcontractor's* entitlement to a fee for overhead and profit in the quotation shall be as follows, as applicable:
 - .1 For work to be performed by the *Subcontractor's* own forces, 10% of the *Subcontractor's* price quotation before the *Subcontractor's* fee is applied.
 - .2 For work to be performed by a sub-*Subcontractor*, 7.5% of the sub-*Subcontractor's* price quotation including the sub-*Subcontractor's* fee.
- .3 Where the *Contractor's* or a *Subcontractor's* price quotation for a *Change Order* results in a net decrease in price before adjustment for fees for overhead and profit, such a price quotation shall be for the net decrease without any adjustment for fees for overhead and profit.

1.6 Method of Contract Price Adjustment - *Change Directives*

- .1 Unless the *Owner* and the *Contractor* reach an earlier agreement on the adjustment to the *Contract Price* by means of a *Change Order* that cancels the *Change Directive*, the adjustment in the *Contract Price* for change carried out by way of a *Change Directive* shall be determined as specified in the General Conditions of *Contract* after the change in the *Work* is completed.

Contract Modification Procedures

1.7 Change Directive Procedures

- .1 If a *Change Directive* is issued for a change in the *Work* for which a proposed change was previously issued, but no *Change Order* has yet been signed, the *Change Directive* shall cancel the proposed change and any *Contractor* quotations related to that change in the *Work*.
- .2 When proceeding with a change in the *Work* under a *Change Directive*, keep accurate records of daily time sheets for labour and *Construction Equipment*, and invoices for *Product* and *Construction Equipment* costs. Submit such records to the *Consultant* daily, until the *Change Order* superseding the *Change Directive* is issued.

1.8 Fees for Overhead and Profit – Change Directives

- .1 The *Contractor's* entitlement to a fee for overhead and profit on the *Contractor's* expenditures and savings attributable to a *Change Directive* shall be as follows, as applicable:
 - .1 For work performed by the *Contractor's* own forces, 10% of the *Contractor's* net increase in costs.
 - .2 For work performed by a *Subcontractor*, 7.5% of the sum of the *Subcontractor's* net increase in costs plus the *Subcontractor's* fee.
- .2 A *Subcontractor's* entitlement to a fee for overhead and profit on the *Subcontractor's* expenditures and savings attributable to a *Change Directives* shall be as follows, as applicable:
 - .1 For work performed by the *Subcontractor's* own forces, 10% of the *Subcontractor's* net increase in costs.
 - .2 For work performed by a Sub-*Subcontractor*, 7.5% of the sum of the Sub-*Subcontractor's* net increase in costs plus the Sub-*Subcontractor's* fee.
- .3 Where a *Change Directive* results in net savings on account of work not required to be performed and a net decrease in the *Contractor's* or *Subcontractor's* cost, the net savings to the *Contractor* or *Subcontractor* shall be calculated without any adjustment for fees for overhead and profit.
- .4 When a *Change Directive* is ultimately recorded as a *Change Order*, there shall be no additional entitlement to fees for overhead and profit beyond those specified in this article.

1.9 Supplemental Instructions

- .1 The *Consultant* may issue *Supplemental Instructions* to provide clarifications to the *Contract Documents*, provide additional information, or make minor variations in the *Work* not involving adjustment in the *Contract Price* or *Contract Time*.
- .2 If the *Contractor* considers a *Supplemental Instruction* to require an adjustment in *Contract Price* or *Contract Time*, the *Contractor* shall promptly notify the *Consultant* and the *Owner* in writing and shall not proceed with any work related to the *Supplemental Instruction* pending receipt of a *Change Order*, a *Change Directive*, or, in accordance with the dispute resolution provisions of the General Conditions of *Contract*, a Notice in Writing of a dispute and instructions to proceed.

Contract Modification Procedures

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Payment Procedures

PART 1 - GENERAL

1.1 Section Includes

- .1 Schedule of values.
- .2 Cash flow projection.
- .3 Workers' compensation clearance.
- .4 Payment for *Products* stored off site.

1.2 Schedule of Values

- .1 Prior to the first application for payment, submit for *Consultant's* review an initial schedule of values. Modify the initial schedule of values if and as requested by *Consultant*. Obtain *Consultant's* written acceptance of the initial schedule of values prior to the first application for payment.
- .2 Together with the first and all subsequent applications for payment, submit updated versions of the schedule of values to indicate the values, to the date of application for payment, of work performed and *Products* delivered to *Place of the Work*.
- .3 Provide the schedule of values in an electronic spreadsheet format based on the format provided and content described in latest edition of CCDC 24 – A Guide to Model Forms and Support Documents.
 - .1 Identifying information including title and location of the *Work*, name of *Contractor*, number and date of application for payment, and period covered by the application for payment.
 - .2 A work breakdown structure based on *Contractor*, *Subcontractor*, and sub-*Subcontractor* work, systems description, Specification sections, or material and labour breakdown, as appropriate.
 - .3 Provisions for approved unit price work, assignable contracts, *Change Orders*, and allowances, so that the breakdown amounts indicated in the schedule of values aggregate to the current total *Contract Price*. Also provide for indicating the estimated value of *Change Directives* within the schedule of values, separately from the current total *Contract Price*.
 - .4 Line items identifying full costs for the following:
 - .1 Preparation of construction progress schedule in accordance with the requirements of Section 01 32 00, with a value not less than 0.5% of the Contract Price or \$10,000.00, whichever is greater.
 - .2 To *Provide* mock-ups in accordance with Section 01 45 00.
 - .3 Progressive cleaning, specified under Section 01 74 00, as distinct from final cleaning, also specified under Section 01 74 00.
 - .4 Final cleaning, specified under Section 01 74 00, as distinct from progressive cleaning, also specified under Section 01 74 00.
 - .5 Preparation and submission of closeout submittals in accordance with the requirements of Section 01 78 00, with a value not less than 0.5% of the Contract Price or \$10,000.00, whichever is greater.

Payment Procedures

- .6 Preparation and submission of the deficiency list in accordance with the requirements of Section 01 77 00.
- .5 For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:
 - .1 Breakdown Amount: A dollar amount, including an appropriate pro rata portion of *Contractor's* overhead and profit.
 - .2 Performed to Date: The value of *Work* performed and *Products* delivered to *Place of the Work* up to the date of the application for payment, stated as a percentage of the *Contract Price* and in dollars.
 - .3 Previously Performed: The value of *Work* performed and *Products* delivered to the *Place of the Work* for which payment has been previously certified, stated in dollars.
 - .4 Current Period: The value of *Work* performed and *Products* delivered to *Place of the Work* for which *Contractor* is currently applying for payment, stated in dollars.
 - .5 Balance to Complete: The value of *Work* not yet performed and *Products* not yet delivered to *Place of the Work*, stated in dollars.

1.3 Cash Flow Projection

- .1 Prior to the first application for payment submit, for *Consultant's* review, a forecast of approximate monthly progress payments for each month of the *Contract Time*.
- .2 Submit revised cash flow forecasts monthly. Submit additional revised cash flow forecasts when there are significant changes in rate of progress of the *Work* or significant changes in the *Contract Price* as determined by the *Consultant*. Submit additional revised cash flow forecasts when requested by *Consultant*.

1.4 Workers' Compensation Clearance

- .1 Submit Certificate of Clearance from the Workplace Safety and Insurance Board (WSIB) with each application for payment.

1.5 Payment for Products Stored Off Site

- .1 *Owner* may, due to extraordinary circumstances and at *Owner's* sole discretion, make payments for *Products* delivered to and stored at a location other than *Place of the Work*, subject to:
 - .1 A request submitted by *Contractor* in writing, with appropriate justification.
 - .2 Whatever conditions *Owner* or *Consultant* may establish for such payments, as required to protect *Owner's* interests.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 Building dimension, templates, built-ins, and coordination.
- .2 Superintendent.
- .3 Discrepancies and clarifications.
- .4 Request for interpretation (RFI) procedures.

1.2 Building Dimension, Templates, Built-ins, and Coordination

- .1 Take necessary dimensions for the proper execution of the *Work*. Assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.
- .2 Verify dimensions at the *Place of the Work* before commencing *Shop Drawings*. Before fabrication commences report discrepancies to *Consultant* in writing. Incorporate accepted variances on shop drawings and as-built records.
- .3 Supply forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the *Work* and set in place or instruct separate *Subcontractors* as to their location.
- .4 Supply items to be built in, as and when required together with templates, measurements, shop drawings and other related information and assistance.
- .5 Pay the cost of extra work and make up time lost as a result of failure to provide necessary information and items to be built in.
- .6 Verify that the *Work*, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the *Contract Documents*, and ensure that work installed in error is rectified before construction resumes.
- .7 Check and verify dimensions referring to interfacing of services. Verify such dimensions with interconnected portions of the *Work*.
- .8 Do not scale directly from drawings. Obtain clarification from *Consultant* if there is ambiguity or lack of information.
- .9 Details and measurements of any work which is to fit or to conform with work installed shall be taken at the *Place of the Work*.
- .10 Prepare and submit setting drawings, templates and other information necessary for the location and installation of material, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels.
- .11 *Subcontractors* shall direct related *Subcontractors* on site of specific locations required for sleeves and openings.

1.3 Superintendent

- .1 Provide superintendent and necessary supporting staff personnel who shall be in attendance at the *Place of the Work* while *Work* is being performed, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

Project Management and Coordination

- .2 The *Contractor* shall appoint superintendent at the *Place of the Work* who shall have overall authority at the *Place of the Work* and shall speak for the *Contractor* and represent the *Contractor's* interest and responsibilities at meetings at the *Place of the Work* and in dealings with the *Consultant* and the *Owner*.

1.4 Discrepancies and Clarifications

- .1 Advise *Consultant* of discrepancies discovered in requirements of the *Contract Documents* and request clarification in written form.
- .2 Advise *Consultant* when clarifications are required pertaining to meaning or intent of requirements of *Contract Documents* and request clarification from *Consultant* in written form.
- .3 Do not proceed with related work until written clarification is provided by *Consultant*.
- .4 Failure to notify *Consultant* shall result in *Contractor* incurring responsibility for resulting deficiencies and expense at no additional cost to the *Owner*.
- .5 Written requirements issued by *Consultant* for the purpose of clarification, implicitly supersede applicable and relevant aspects of the *Contract Documents* irrespective of whether or not these documents are explicitly or specifically cited in clarification requests or clarification requirements.

1.5 Request for Interpretation - RFI

- .1 A request for interpretation (RFI) is a formal process used during the *Work* to obtain an interpretation of the *Contract Documents* pursuant to GC 2.2.6 through GC 2.2.9 (inclusive).
 - .1 An RFI shall not constitute notice of claim for a delay.
- .2 Submittal procedures:
 - .1 RFI form:
 - .1 Submit RFI on "Request for Interpretation" in form acceptable to the *Consultant*, an example of which is appended to this section. The *Consultant* shall not respond to an RFI except as submitted on this form.
 - .2 Where RFI form does not provide sufficient space for complete information to be provided thereon, attach additional sheets as required.
 - .3 Submit with RFI form necessary supporting documentation.
 - .2 Submit RFI form as follows:
 - .1 Submit RFIs sufficiently in advance of affected parts of the *Work* so as not to cause delay in the performance of the *Work*. Costs resulting from failure to do this will not be paid by the *Owner*.
 - .2 RFIs shall be submitted only to the *Consultant*.
 - .3 RFIs shall be submitted only by *Contractor*. RFIs submitted by *Subcontractors* or *Suppliers* shall not be accepted.
 - .4 Number RFIs consecutively in one sequence in order submitted.
 - .5 Submit one distinct RFI per RFI form.
- .3 RFI log:

Project Management and Coordination

- .1 Maintain log of RFIs sent to and responses received from the *Consultant*, complete with corresponding dates.
- .2 Submit updated log of RFIs with each progress draw submittal.
- .4 *Consultant* shall review RFIs from the *Contractor* submitted in accordance with this section, with the following understandings:
 - .1 *Consultant's* response shall not be considered as a *Change Order* or *Change Directive*, nor does it authorize changes in the *Contract Price* or *Contract Time* or changes in the *Work*.
 - .2 Only the *Consultant* shall respond to RFIs. Responses to RFIs received from entities other than the *Consultant* shall not be considered.
- .5 Allow 5 *Working Days* for review of each RFI by the *Consultant*.
 - .1 *Consultant's* review of RFI commences on date of receipt by the *Consultant* of RFI submittal and extends to date RFI returned by *Consultant*.
 - .2 When the RFI submittal is received by *Consultant* before noon, review period commences that day; when RFI submittal is received by *Consultant* after noon, review period begins on the next *Working Day*.
 - .3 If, at any time, the *Contractor* submits a large enough number of RFIs such that the *Consultant* cannot process these RFIs within 5 *Working Days*, the *Consultant*, will confer with the *Contractor* within 1 *Working Day* of receipt of such RFIs, and the *Consultant* and the *Contractor* will jointly prepare an estimate of the time necessary for processing the RFIs and determine the order of priority between the RFIs submitted. The *Contractor* shall accommodate such necessary time at no increase in the *Contract Time* and at no additional cost to the *Owner*.
- .6 Undertake a review of the *Contract Documents* to determine that the matter in question relating to the interpretation of the *Contract Documents* cannot be resolved by direct reference to the *Contract Documents*. Describe this review in detail on the RFI form. RFI submittals that lack a detailed review description, or where the detail provided is insufficient, in the sole opinion of the *Consultant*, shall not be reviewed by the *Consultant* and shall be rejected.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Contractor's Request for Interpretation

Consultant's Supplemental Instructions

Date	# of Pages
To	From
Co.	Co.
Phone #	Phone #
Fax #	Fax #
Email	Email

Project: _____

Owner: _____

To: _____

(Consultant's
Representative)

Project No.: _____

**Consultant's Fax
No.:** _____

RFI No.: _____

Date of _____

Request: _____

Contractor: _____

**Contractor's
Representative:** _____

Fax No.: _____

Interpretation Requested: (Description of request for interpretation and references to relevant portions of *Contract Documents*)

Attachments: _____

Requested by: _____

Consultant's Supplemental Instruction:

Attachments: _____

Reply By: _____

The work shall be carried out in accordance with these *Supplemental Instructions* issued in accordance with the *Contract Documents* without change in *Contract Price* or *Contract Time*. Prior to proceeding with these instructions, indicate acceptance of these instructions as being consistent with the *Contract Documents* by returning a signed copy to the *Consultant*.

Supplemental Instruction Issued:

By: _____

Consultant

Date

Supplemental Instruction Accepted:

By: _____

Contractor

Date

Cc: ☐ Owner ☐ Consultant ☐ Contractor ☐ Field ☐ Other:

Project Meetings

PART 1 - GENERAL

1.1 Section Includes

- .1 Project meeting requirements.

1.2 Administrative

- .1 The *Contractor* shall schedule meetings as specified herein.
 - .1 Such scheduling shall be in consultation both with the *Owner* and with the *Consultant*.
- .2 The *Contractor* shall prepare agendas for meetings specified herein.
 - .1 Agendas shall include, as a minimum, the agenda items specified in the *Contract Documents*.
- .3 The *Contractor* shall distribute written notice of each meeting specified herein, complete with meeting agenda, 5 *Working Days* in advance of meeting date to the *Consultant* and the *Owner* and other affected parties.
- .4 The *Contractor* shall chair and record the minutes of meetings specified herein.
 - .1 *Contractor* shall distribute copies of minutes to the *Owner*, the *Consultant*, and all others in attendance within 3 *Working Days* after date of meeting.
- .5 Representatives of parties attending meetings shall be authorized to act on behalf of the parties they represent.
- .6 *Subcontractors* and *Suppliers* shall attend meetings only when directed by the *Consultant*, or when specifically called for in the *Contract Documents*.
- .7 The *Contractor* shall prepare, and distribute to the *Consultant* and the *Owner* 4 days in advance of next progress meeting date, the following:
 - .1 Monthly progress reports containing updated construction schedule, submittal logs, requests for interpretation logs, and budget.

1.3 Contract Start-Up Meeting

- .1 Within 5 days after award of *Contract*, request a meeting of parties in *Contract* to discuss and resolve administrative procedures and responsibilities prior to the commencement of the *Work*.
- .2 Attendees at *Contract* start-up meeting shall include the following:
 - .1 *Contractor*.
 - .2 *Contractor's* site superintendent(s).
 - .3 *Contractor's* waste management coordinator.
 - .4 *Consultant*.
 - .5 *Owner*.
 - .6 Independent inspection and testing company.
- .3 Agenda to include the following:
 - .1 *Owner's* guidelines and policies.

Project Meetings

- .2 Appointment of official representative of participants in the *Project*.
- .3 Status of permits, fees and requirement of authorities having jurisdiction. Action required.
- .4 Establishing a schedule for progress meetings.
- .5 Requirements for *Contract* modification and interpretation procedures, including, but not limited to: requests for interpretation, contemplated change orders, *Change Orders*, *Change Directives*, *Supplemental Instructions*, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
- .6 Submittal requirements and procedures.
- .7 Schedule of submission of samples, colour chips, and items for *Owner's* and/or *Consultant's* consideration.
- .8 Construction schedule and progress scheduling.
- .9 Delivery schedule of specified equipment.
- .10 Appointment of independent inspection and testing agencies or firms.
- .11 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to *Consultant* for review of the *Work*.
- .12 Requirements for *Temporary Work*.
- .13 Requirements for firestopping coordination and preparation of firestopping manual (refer to Section 01 33 00).
- .14 Security requirements at and for the *Place of the Work*.
- .15 *Owner* supplied *Products*.
- .16 As-built documents.
- .17 Operation and maintenance manuals.
- .18 Take-over procedures, acceptance, warranties.
- .19 Publication to be used for publishing certificate of substantial performance.
- .20 Progress claims, administrative procedures, holdbacks.
- .21 Insurances, transcripts of policies.
- .22 *Contractor's* safety procedures.
- .23 Certificate of Clearance from the Workplace Safety and Insurance Board (WSIB).

1.4 Pre-Installation Meetings

- .1 During the course of the *Work* prior to *Substantial Performance of the Work*, schedule pre-installation meetings as required by the *Contract Documents* and coordinated with the *Consultant*.
- .2 As far as possible, pre-installation meetings shall be scheduled to take place on the same day as regularly scheduled progress meetings.
- .3 Attendees at pre-installation meetings shall include the following:
 - .1 *Contractor*.

Project Meetings

- .2 *Subcontractors* affected by the work for which the pre-installation meeting is being conducted.
- .3 *Consultant*.
- .4 Manufacturer's representatives, as applicable.
- .5 Independent inspection and testing company, as applicable.
- .4 Agenda to include the following:
 - .1 *Owner's* guidelines and policies.
 - .2 Appointment of official representatives of participants in the *Project*.
 - .3 Review of existing conditions and affected work, and testing thereof as required.
 - .4 Review of installation procedures and requirements.
 - .5 Review of environmental and site condition requirements.
 - .6 Schedule of the applicable portions of the *Work*.
 - .7 Schedule of submission of submittals, samples, mock-ups, and items for *Consultant's* consideration.
 - .8 Requirements for *Temporary Work*.
 - .9 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to *Consultant* for review of the *Work*.
 - .10 Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests.
 - .11 Delivery schedule of specified equipment.
 - .12 Special safety requirements and procedures.
 - .13 Publication to be used for publishing certificate of substantial performance.

1.5 Progress Meetings

- .1 During the course of the *Work* prior to *Substantial Performance of the Work*, schedule regular progress meetings to occur weekly.
- .2 Attendees at progress meetings shall include the following:
 - .1 *Contractor*.
 - .2 *Contractor's* site superintendent(s).
 - .3 *Consultant*.
 - .4 *Owner*.
- .3 Agenda to include the following:
 - .1 *Owner's* guidelines and policies.
 - .2 Review, approval of proceedings of previous meeting.
 - .3 Review of items arising from proceedings.
 - .4 Review of progress of the *Work* since previous meeting and *Contractor's* monthly progress report.
 - .5 Field observations, problems, conflicts.

Project Meetings

- .6 Update construction schedule.
- .7 Problems that impede compliance with construction schedule.
- .8 Review of off-site fabrication delivery schedules.
- .9 Review material delivery dates/schedule.
- .10 Corrective measures and procedures to regain construction schedule.
- .11 Revisions to construction schedule.
- .12 Progress, schedule, during subsequent period of the *Work*.
- .13 Review submittal schedules.
- .14 Review status of submittals.
- .15 Maintenance of quality standards.
- .16 Pending changes and substitutions.
- .17 Review of *Contract* modifications and interpretations including, but not limited to: requests for interpretation and log, contemplated change orders, *Change Orders*, *Change Directives*, and *Supplemental Instructions* for effect on construction schedule and on *Contract Time*.
- .18 Review of status of as-built documents.
- .19 Other business.

1.6 Pre-Takeover Meeting

- .1 60 days prior to application for *Substantial Performance of the Work*, schedule a pre-takeover meeting.
- .2 Agenda to include the following:
 - .1 Review, approval of proceedings of previous meeting.
 - .2 Review of items arising from proceedings.
 - .3 Review of procedures for *Substantial Performance of the Work*, completion of the *Contract*, and handover of the *Work*.
 - .4 Field observations, problems, conflicts.
 - .5 Review of outstanding *Contract* modifications and interpretations including, but not limited to: requests for interpretation and log, contemplated change orders, *Change Orders*, *Change Directives*, and *Supplemental Instructions* for effect on construction schedule and on *Contract Time*.
 - .6 Problems which impede *Substantial Performance of the Work*.
 - .7 Review of procedures for deficiency review. Corrective measures required.
 - .8 Review of arrangements for hydro, heating, and other services.
 - .9 Progress, schedule, during succeeding period of the *Work*.
 - .10 Review submittal requirements for warranties, manuals, and all demonstrations and documentation required for *Substantial Performance of the Work*.
 - .11 Review of keying and hardware requirements.
 - .12 Review of status of as-built documents and record drawings.

Project Meetings

- .13 Status of commissioning and training.
- .14 Review *Contractor's* deficiency list and status.
- .15 Cleaning for occupancy.
- .16 Other business.

1.7 Post-Construction Meeting

- .1 Prior to application for completion of *Contract*, schedule a post-construction meeting. 5 *Working Days* prior to date for meeting, *Consultant* shall confirm a date for meeting based on evaluation of completion requirements.
- .2 Agenda to include the following:
 - .1 Review, approval of proceedings of previous meeting.
 - .2 Confirmation that no business is arising from proceedings.
 - .3 Confirmation of completion of the *Contract*, and handover of reviewed documentation from the *Consultant* to the *Owner*.
 - .4 Confirmation of completion of contemplated change orders, *Change Orders*, *Change Directives*, and *Supplemental Instructions*.
 - .5 Problems that impede *Contract* completion.
 - .6 Identify unresolved issues or potential warranty problems.
 - .7 Confirmation of completion of deficiencies.
 - .8 Corrective measures required.
 - .9 Confirmation of arrangements for hydro, heating and other services.
 - .10 Confirm submittal requirements for warranties, manuals, and demonstrations and documentation for *Contract* completion are in order.
 - .11 Review of procedures for communication during post-construction period.
 - .12 Handover of reviewed record documents by the *Contractor* to the *Owner*.
 - .13 Submission of final application for payment.
 - .14 Review and finalize outstanding claims, pricing, and allowance amounts.
 - .15 Status of commissioning and training.
 - .16 Demobilization and the *Place of the Work* restoration.
 - .17 Review of requests for interpretation log.
 - .18 Other business.

1.8 Special Meetings

- .1 *Owner* and/or *Consultant* reserves the right to require special meetings which may be held on short notice and at which attendance by *Contractor* and representatives of affected *Subcontractors* and *Suppliers* is mandatory. *Contractor* shall keep detailed and accurate meeting notes and distribute copies within 3 *Working Days* to all in attendance and those affected by agreements made at such meetings.

Project Meetings

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section includes

- .1 Construction progress schedule.
- .2 Submittals schedule.
- .3 Inspection and testing schedule.
- .4 Schedule management.
- .5 Recording actual site conditions on as-built documents.
- .6 Digital photographs.

1.2 Summary

- .1 This Section specifies *Contractor's* responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.
- .2 The schedule shall:
 - .1 Show actual progress versus planned progress.
 - .2 Demonstrate that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.3 Schedule Format

- .1 Prepare schedules in the form of a Critical Path Method (CPM) Gantt chart method utilizing the following software:
 - .1 Prepare schedules utilizing Microsoft Project 2003 (or later version).
- .2 Include horizontal time scale identifying the first *Working Day* of each week.
- .3 Include a separate bar for each trade, work package, or operation.
- .4 Format for listings: The chronological order of the start of each item or part of the *Work*.
- .5 Identification of listings: By systems description.

1.4 Construction Progress Schedule

- .1 Format and content:
 - .1 Include the complete sequence of construction activities, including provision for climate and weather.
 - .2 Provide a work breakdown structure identifying key activities, work packages, and major milestones at a sufficient level of detail to effectively manage construction progress, including:
 - .1 Long delivery *Products*.
 - .2 Dates for the commencement and completion of inspection and testing.
 - .3 Preparation and review of mock-ups.
 - .4 *Owner* decisions for cash allowances.

Construction Progress Documentation

- .5 Shutdown or closure activities.
- .6 Delivery of items supplied by *Owner*.
- .7 *Owner* performed work.
- .8 Demonstration and training activities.
- .9 Dates for the commencement and completion of each major element of the *Work* parallel to the sections of the specifications.
- .10 Dates for *Ready-for-Takeover* and *Substantial Performance of the Work*.
- .11 Dates for delivery of *Products*, equipment, finish items, factory-finished manufactured items. Show last dates for order, shipment, and delivery in order to meet construction schedule.
- .3 Show projected percentage of completion for each item as of the first *Working Day* of each week.
- .2 Submission:
 - .1 Submit initial schedule to *Owner* and *Consultant* within 10 *Working Days* after *Contract* award.
 - .2 Submit schedule in pdf format to *Consultant* using the *Consultant's* document management system.
 - .3 *Consultant* will review format and content of initial schedule and request necessary changes, if any, within 10 *Working Days* after receipt.
 - .4 If changes are required, resubmit finalized initial schedule within 5 *Working Days* after return of review copy.
 - .5 Submit updated progress schedule to *Owner* and *Consultant* at each regularly scheduled progress meeting in accordance with Section 01 31 19. In addition to requirements specified in Section 01 32 00 for each submission of construction schedule, include a written report on the activities completed in the week preceding the progress meeting, and a summary indicating the activities planned to be undertaken in the 2 weeks subsequent to the progress meeting, including human resource loading.
 - .6 Submit updated progress schedule to *Owner* and *Consultant* with each application for progress payment, indicating actual and projected start and finish dates with report date line and progress. Submit more frequently if requested by *Owner* or *Consultant*.
 - .7 At each date of submission of construction schedule, indicate progress of each activity.
 - .1 Show changes occurring since previous submission of the construction schedule:
 - .1 Major changes in scope.
 - .2 *Change Orders* and *Change Directives*.
 - .3 Activities modified since previous submission.
 - .4 Revised projections of progress and completion.
 - .5 Other identifiable changes.

Construction Progress Documentation

- .2 Include a narrative report to define:
 - .1 Problem areas, anticipated delays, and the impact on the schedule.
 - .2 Corrective action recommended and its impact on the schedule.
- .3 Include cash flow projection with minimum look ahead as directed by the *Consultant*.

1.5 Submittals Schedule

- .1 Format and content:
 - .1 Prepare a detailed schedule of submittals required by the *Contract Documents*, including samples required for testing, and including those for items supplied by *Owner*.
 - .2 Provide a separate line for each required submittal, organized by *Specifications* section names and numbers, and further broken down by individual *Products* and systems as required.
 - .3 Indicate dates for submitting, review time, resubmission time, float time, and last date for meeting construction schedule.
 - .4 Schedule submissions of submittals well in advance of scheduled dates for installation, to provide lead time for reviews and possible resubmissions and for placing orders and securing delivery so as to avoid delays in the *Work*.
 - .5 Make provisions in schedule for at least 10 *Working Days* for *Consultant's* review of submittals. When submittals have to be reviewed by one or more of *Consultant's* subconsultants, add 5 more *Working Days* for a total 15 *Working Days* review period.
 - .6 If the *Consultant* requires resubmission of submittals, allow for an additional 10 *Working Days* review for each resubmission.
 - .7 If, at any time, the *Contractor* submits a large enough number of submittals such that the *Consultant* cannot process these submittals within 10 *Working Days*, the *Consultant*, in consultation with the *Contractor* within 3 *Working Days* of receipt of such submittal, will provide the *Contractor* with an estimate of the time necessary for processing same. The *Contractor* shall accommodate such necessary time at no increase in the *Contract Time* and at no additional cost to the *Owner*.
 - .8 Changes in the construction schedule shall maintain the minimum review periods for the *Consultant's* review specified above.
- .2 Submission:
 - .1 Submit initial schedule to *Consultant* within 15 *Working Days* after *Contract* award.
 - .2 Submit schedule in pdf format to *Consultant* using the *Consultant's* document management system.
 - .3 *Consultant* will review format and content of initial schedule and request necessary changes, if any, within 10 *Working Days* after receipt.

Construction Progress Documentation

- .4 *Consultant* will review submittal schedule and advise *Contractor* if volume and timing of submittals will permit review of and response to submittals within timeframes specified under Section 01 32 00. *Consultant* may require modifications to submittals schedule in order to allow adequate time for review of submittals. Adjust submittals schedule and construction schedule as required to comply with *Consultant's* needs.
- .5 If changes are required, resubmit finalized schedule within 5 *Working Days* after return of review copy.
- .6 Submit updated submittals schedule monthly to the *Consultant* or more frequently as directed by the *Consultant*.
- .7 Schedule shall be accompanied by a checklist, correlated to each of the schedule of submittals, the construction schedule, and the schedule of inspections and tests, listing the following:
 - .1 *Shop Drawings*.
 - .2 *Samples*.
 - .3 *Mock-ups*.
 - .4 *Reviews, tests and inspections by:*
 - .1 *Manufacturers*.
 - .2 *Authorities having jurisdiction*.
 - .3 *The Owner*.
 - .4 *The Consultant*.
 - .5 *Independent inspection and testing companies*.
 - .5 *Demonstration and training*.

1.6 Inspection and Testing Schedule

- .1 Prepare schedule for inspection and testing by advance discussion with the selected independent inspection and testing company to determine the time required for the independent inspection and testing company to perform its tests and to issue each of its findings, and allow for required time in the construction schedule.
- .2 Refer to Section 01 45 00 for additional requirements for inspection and testing scheduling.

1.7 Schedule Management

- .1 A schedule submitted as specified and accepted by *Consultant* shall become the baseline schedule and shall be used as the baseline for updates.
- .2 At each regular progress meeting, review and discuss current construction progress and submittals schedules with *Consultant* and *Owner*, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.
- .3 Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

Construction Progress Documentation

1.8 Recording Actual Site Conditions on As-Built Documents

- .1 Owner will provide 1 set of *Contract Documents* to the *Contractor* for as-built documentation purposes. Record information and maintain as-built documents in clean, dry and legible condition.
- .2 Clearly label each drawing as “AS-BUILT DRAWING” and each specification “AS-BUILT SPECIFICATION” and each schedule “AS-BUILT SCHEDULE”. Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Accurately document as-built conditions and deviations from *Contract Documents* as the *Work* progresses.
- .4 Mark changes in red ink.
- .5 Document actual construction including:
 - .1 Field changes of dimensions/details.
 - .2 Changes by *Change Orders*, *Change Directives*, and *Supplemental Instructions*.
 - .3 References to *Shop Drawings*, where *Shop Drawings* show more detail.
 - .4 Locations of interior mechanical and electrical equipment and distribution.
 - .5 In specification as-builts: Document as-built *Products*, including manufacturer, manufacturer’s model or system number.
- .6 Do not use as-built drawings for construction purposes.

1.9 Digital Photographs

- .1 Provide photographic documentation in digital format and in accordance with procedures and submission requirements specified in this section.
 - .1 No other photographs of the *Place of the Work* or of any portion of the *Work* will be permitted without written approval of the *Owner*.
- .2 Equipment: Provide photographs using minimum 10 megapixel digital camera.
- .3 Submit the required photographs to the *Consultant* and to the *Owner*.
- .4 Output: Supply date stamped maximum resolution colour photos to *Consultant* in JPEG format, on USB Flash Drive or via file transfer.
- .5 Number of photos required:
 - .1 Prior to construction: Provide necessary number of photographs, as required to document existing conditions and verify damage to adjacent streets and property that may have existed prior to construction or demolition work: Minimum 50 photos.
 - .2 Each Progress draw: Provide 24 construction photographs each month to accompany each application for progress draw to document the stage of the *Work* from points selected by the *Consultant* showing as much as possible of the *Work* installed during the previous month.
 - .3 Provide minimum of 8 photographs on each meeting report and for each progress meeting.
 - .4 Completion: When the *Work* is completed, arrange to take final photographs of the *Work* from a minimum of 8 points of view.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Submittal Procedures

PART 1 - GENERAL

1.1 Section Includes

- .1 Administrative requirements.
- .2 Submission procedures.
- .3 Certificates and Certification Submittals
- .4 *Product* data sheets.
- .5 *Shop Drawings*.
- .6 Engineered Judgements.
- .7 Project firestopping manual and coordination.
- .8 Samples.

1.2 Administrative Requirements

- .1 Submit submittals as requested by the *Contract Documents*, as specified herein, and in accordance with the submittals schedule prepared in accordance with Section 01 32 00.
- .2 In addition to submittals specifically requested by the *Contract Documents*, submit other submittals as may be reasonably requested by the *Consultant*, or as are required to coordinate the *Work* and to provide the *Owner* with choices available, within the scope of *Contract Documents*.
- .3 Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.
- .4 Make submittals with reasonable promptness and in an orderly sequence so as to cause no delay in the *Work*. Be solely responsible for delays, make up time lost, and pay added costs incurred because of not making submittals in due time to permit proper review by *Consultant*.
- .5 Once submitted, a submittal shall not be re-submitted until original submission has been reviewed by *Consultant* and returned to *Contractor*.
- .6 Submittals that contain substitutions will be rejected. Substitutions are permitted only in accordance with Section 01 25 00.
- .7 Do not proceed with work affected by a submittal, including ordering of *Products*, until relevant submittal has been reviewed by *Consultant*.
- .8 Prepare submittals using SI (metric) units.
- .9 *Contractor's* responsibility for deviations in submittal from requirements of *Contract Documents* is not relieved by *Consultant's* review of submittal, unless *Consultant* gives written acceptance of specific deviations.
- .10 Keep copies of reviewed submittals at the *Place of the Work* in an organized condition. Only submittals that have been reviewed by the *Consultant* and are marked with *Consultant's* review stamp, as applicable, are permitted at the *Place of the Work*.
- .11 The *Work* shall conform to reviewed submittals subject to the requirements of this section. Remove and replace materials or assemblies not matching reviewed submittals at no increase in the *Contract Time* and at no additional cost to the *Owner*.

Submittal Procedures

.12 *Contractor's* review of submittals:

- .1 Review submittals for conformity to *Contract Documents* before submitting to *Consultant*. Submittals shall bear stamp of *Contractor* and signature of a responsible official in *Contractor's* organization indicating in writing that such submittals have been checked and coordinated by *Contractor*. Review shall be performed by qualified personnel who have detailed understanding of those elements being reviewed and of the conditions at the *Place of the Work* proposed for installation.
- .2 Check and sign each submittal and make notations considered necessary before submitting to *Consultant* for review. Where submittal is substantially and obviously in conflict with requirements of *Contract Documents*, reject submittal without submitting to *Consultant* and request resubmission. Note limited number of reviews of each submittal covered under *Consultant's* services as specified below.
- .3 Assume sole responsibility for any conflicts occurring in the *Work* that result from lack of comparison and coordination of submittals required for the *Work*.
- .4 Assume sole responsibility for dimensions to be confirmed and correlated at the *Place of the Work* for information that pertains to fabrication processes or to techniques of construction and installation, and for coordination of the *Work*.
- .5 Submittals that have not been reviewed, checked, and coordinated by *Contractor* prior to submission to *Consultant*, or that do not bear the stamp and signature of *Contractor* as described above, will be stamped "REVISE AND RESUBMIT" and returned.
- .6 No changes to the *Work* or the *Contract Documents* shall be made by way of submittals.
 - .1 Changes to the *Work* shall only be made following procedures specified for changes in the *Work*.
 - .2 Submittals that include changes to the *Work* or the *Contract Documents* shall be stamped "REVISE AND RESUBMIT" and returned.

.13 *Consultant's* review of submittals:

- .1 Review of submittals by *Consultant* is for the sole purpose of ascertaining conformance with the general design concepts and the general intent of the *Contract Documents*. This review shall not mean that *Consultant* approves the detail design inherent in the submittals, responsibility for which shall remain with the *Contractor*. Such review shall not relieve the *Contractor* of responsibility for errors or omissions in the submittals, nor of responsibility for meeting requirements of *Contract Documents*.
- .2 As part of their scope of work, *Consultant* shall review *Shop Drawings* no more than twice. Should three or more reviews be required due to reasons of *Contractor* omissions causing resubmission requests, then *Contractor* shall reimburse the *Consultant* for time expended in these extra reviews. Time shall be invoiced to the *Owner* (to be deducted from monies due to the *Contractor* and paid to *Consultant* by *Owner*) at rates recommended by *Consultant's* professional association and disbursements shall be invoiced at *Consultant's* cost. The *Contractor* shall cover directly costs and administration associated with courier services and the like for these extra *Shop Drawings* reviews.

Submittal Procedures

- .3 *Consultant's* review and markings on submittals do not authorize changes in the *Work* nor in the *Contract Time*, and shall be accommodated at no additional cost to the *Owner*. If, in the opinion of the *Contractor*, the *Consultant's* markings on submittals constitute a change in the *Work* or will effect a change in the *Contract Time*, then the *Contractor* shall so notify the *Consultant* in writing and request an interpretation following the procedures for requests for interpretation in accordance with Section 01 31 00. If the *Consultant* finds that the *Consultant's* markings on submittals do constitute a change in the *Work* or will effect a change in the *Contract Time*, then a *Change Order* will be prepared therefore. The time taken to process such a request for interpretation shall not, in and of itself, constitute a change in the *Work* nor an increase the *Contract Time*.
- .4 Submittals that are not required by the *Contract Documents* or not requested by the *Consultant* will not be reviewed by the *Consultant* and will be marked 'NOT REVIEWED' by the *Consultant* and returned to the *Contractor*.
- .14 Engineered submittals:
 - .1 Submittals for items required to be sealed by professional engineer (engineered) shall be duly prepared, sealed, and signed under the direct control and supervision of a qualified professional engineer licensed in the jurisdiction in which the *Place of the Work* is located, having in force professional liability insurance with minimum coverage limit of \$2,000,000 per claim and annual aggregate.
 - .2 Include with engineered submittal, proof of insurance identifying insurer, policy number, policy term, and limit of liability, on duly signed letterhead and / or certificates of insurance.
 - .3 Design includes life safety, sizing of supports, anchors, framing, connections, spans, and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, authorities having jurisdiction, and design requirements of the *Contract Documents*.
 - .4 Engineered submittals shall include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented by the submittal.
 - .5 Professional engineer responsible for the preparation of engineered submittals shall undertake periodic field review, including review of associated mock-ups where applicable, at locations wherever the work as described by the engineered submittal is in progress, during fabrication and installation of such work, and shall submit a field review report after each visit. Field review reports shall be submitted to the *Consultant*, to authorities having jurisdiction as required, and in accordance with the building code.
 - .6 Field reviews shall be at intervals as necessary and appropriate to the progress of the work described by the submittal to allow the engineer to be familiar with the progress and quality of such work and to determine if the work is proceeding in general conformity with the *Contract Documents*, including reviewed shop drawings and design calculations.

Submittal Procedures

- .7 Upon completion of the parts of the *Work* covered by the engineered submittal, the professional engineer responsible for the preparation of the engineered submittal and for undertaking the periodic field reviews described above, shall prepare and submit to the *Consultant* and authorities having jurisdiction, as required, a letter of general conformity for those parts of the *Work*, certifying that they have been provided in accordance with the requirements both of the *Contract Documents* and of the authorities having jurisdiction over the *Place of the Work*.
- .8 Costs for such field reviews and field review reports and letters of general conformity are included in the *Contract Price*.

1.3 Submission Procedures

- .1 Coordinate each submittal with requirements of the *Work* and *Contract Documents*. Individual submittals shall include related information.
- .2 Distribute copies of submittals to parties whose work is affected by submittals except *Consultant* and *Owner* before final submission for review by *Consultant*.
- .3 Accompany submittals with transmittal letter containing:
 - .1 Date.
 - .2 *Project* title and number.
 - .3 *Contractor's* name and address.
 - .4 *Contractor's* review stamp.
 - .5 Identification and quantity of each submittal.
 - .6 Other pertinent data.
- .4 Each submittal shall be identified numerically by relevant *Specifications* section number with a numeric indicator for multiple submittals by that section followed by revisions number, for example 04 05 19-01-R0.
- .5 Submit original PDF documents only: scanned documents shall not be accepted.
 - .1 PDF submittals shall be bookmarked and linked to a Table of Contents or cover letter identifying the contents of the submission.
- .6 Make any changes in submittal that *Consultant* may require, consistent with *Contract Documents*, and resubmit as directed by *Consultant*.
- .7 Notify *Consultant*, in writing, when resubmitting, of any revisions other than those requested by *Consultant*.
- .8 After *Consultant's* review, distribute copies to affected parties.

1.4 Certificates and Certification Submittals

- .1 Certificates and certifications submittals: Provide a statement that includes signature of entity responsible for preparing certification.

1.5 Product Data Sheets

- .1 Submit *Product* data sheets as follows:
 - .1 1 copy digitally as a bookmarked PDF to *Consultant* using the *Consultant's* document management system.

Submittal Procedures

- .2 Submit *Product* data sheets as called-for by the *Contract Documents* or as the *Consultant* may reasonably request where shop drawings will not be prepared due to a standardized manufacture of a *Product*. Manufacturers' catalogue cuts will be acceptable in such cases, providing that they are 213 mm x 275 mm (8-1/2" x 11") originals, and that they indicate choices including sizes, colours, model numbers, options and other pertinent data, including installation instructions. Submissions showing only general information are not acceptable.
- .3 Where requirements of *Contract Documents* are more stringent than design proposed on *Product* data sheets, the requirements of the *Contract Documents* take priority.
- .4 Upon completion of review by *Consultant*, 1 marked set of *Product* data sheets will be returned to *Contractor* in digital format for reproduction and distribution.
- .5 Retain 1 complete set of reviewed *Product* data sheets for issuance as part of closeout submittals in accordance with Section 01 78 00.

1.6 Shop Drawings

- .1 Submit *Shop Drawings* as follows:
 - .1 1 copy digitally as a bookmarked PDF to *Consultant* using the *Consultant's* document management system.
- .2 Lettering on *Shop Drawings* shall be not less than 3 mm (1/8") high.
- .3 Reproduction of construction *Drawings* to serve as background for *Shop Drawings* is not permitted.
- .4 Where requirements of *Contract Documents* are more stringent than design proposed on *Shop Drawings*, the requirements of the *Contract Documents* take priority.
- .5 *Consultant* markings and resulting action required:
 - .1 *Shop Drawings* requiring no changes will be marked 'REVIEWED', and shall be submitted for as-built drawings purposes.
 - .2 *Shop Drawings* requiring several changes will be marked 'REVIEWED as NOTED' and shall be revised and submitted for as-built drawings purposes.
 - .3 *Shop Drawings* requiring substantial changes will be marked 'REVISE AND RE-SUBMIT' and shall be revised and resubmitted until *Consultant* stamps *Drawings* with 'REVIEWED' or 'REVIEWED as NOTED'.
- .6 *Shop Drawings* size shall be multiple of 213 mm and 275 mm (8-1/2" and 11") excluding 38 mm (1-1/2") binding margin and not larger than 838 mm x 1117 mm (33" x 44"). Leave minimum 150 mm x 100 mm (6" x 4") clear space for *Consultant's* comments.
- .7 Upon completion of review by *Consultant*, 1 marked set of *Shop Drawings* will be returned to *Contractor* in digital format for reproduction and distribution.
- .8 Retain 1 complete set of reviewed *Shop Drawings* for issuance as part of closeout submittals in accordance with Section 01 78 00.
- .9 Submit copies of reviewed *Shop Drawings* to authorities having jurisdiction as required.
- .10 *Shop Drawings* shall include:
 - .1 Fabrication and erection dimensions.

Submittal Procedures

- .2 Plans, sections, elevations, arrangements and sufficient full size details which indicate complete construction, components, methods of assembly as well as interconnections with other parts of the *Work*.
- .3 Design calculations for items that require design calculations.
- .4 Clear definition of the division of responsibility for the work described thereon. No *Products*, items or equipment, or description of work, shall be indicated to be supplied, or work to be done, "By Others" or "By Purchaser". *Shop Drawings* marked with either of these phrases shall be rejected without having been reviewed by the *Consultant*.
- .5 Location and type of exposed anchors, attachments and locations and types of fasteners, including concealed reinforcements to accept mounted fasteners.
- .6 Adhesives, joinery methods and bonding agents.
- .7 Kinds and grades of materials, their characteristics relative to their purpose, detailed description of finishes and other fabrication information.
- .8 Configurations, types and sizes required; identify each unit type on drawing and on *Product*.
- .9 Descriptive names of equipment and mechanical and electrical characteristics when applicable.
- .10 Data verifying that superimposed loads will not affect function, appearance and safety or work shown on shop drawings, as well as other interconnected work.
- .11 Assumed design loadings, dimensions of elements and material *Specifications* for load-bearing members.
- .12 Proposed chases, sleeves, cuts and holes in structural members.
- .13 Wall thicknesses of metals.
- .14 Location and types of welds. For structural welds use AWS symbols and clearly show net weld lengths and sizes.
- .15 Materials, gauges, and sizes being supplied including connections, attachments, reinforcement, anchorage and locations of exposed fastenings.
- .16 Installation instructions and details for *Products* to be installed by separate *Subcontractors*, including function of each part.
- .17 A list of *Products* covered by, or included on, the shop drawing. List of *Products* shall be complete and show manufacturer's name, *Product* name, generic description, standard certification where specified, manufacturer's complete installation data and precautions against wrong installation, operation and maintenance.
- .18 Refer to individual sections of the *Specifications* for more particular requirements for *Shop Drawings*.
- .19 Compatibility statement: Include with each *Shop Drawings* a statement that each *Product* and material indicated on the *Shop Drawings* is compatible with each *Product* and material with which it comes into contact.

Submittal Procedures

1.7 Engineered Judgements

- .1 When an engineered judgement is required by authorities having jurisdiction, such engineered judgement shall be prepared as an engineered submittal in accordance with Section 01 33 00.

1.8 Project Firestopping Manual and Coordination

- .1 The *Contractor* shall assign a firestopping and smoke seal firestopping coordinator to coordinate the firestopping details and systems required in the *Work*. Applicator shall designate a single individual as *Project* foreperson who shall be present at the *Place of the Work* throughout the *Work*.
- .2 Firestopping manual:
 - .1 *Contractor* and firestopping and smoke seal coordinator shall prepare a preliminary fire stopping manual, inclusive of all firestopping systems in the *Work*, to be submitted to the *Consultant* prior to the installation of any firestopping and smoke seal work.
 - .2 Manual shall include:
 - .1 Project key plans of each level, with enlarged key plans at areas where required, which identify and tag each anticipated penetration and fire stopping location and type (i.e. multiple metallic pipes through gypsum board wall assembly; single metallic pipe through concrete floor assembly, and the like).
 - .2 *Product* data sheets: data and installation instructions for *Products* providing descriptions sufficient for identification at the *Place of the Work*.
 - .1 Materials list of *Products* proposed for use in the *Work*; complying with listed systems designs.
 - .2 Listing agency's detailed drawing showing joint assemblies and firestopping materials, identified with listing agency's name and number or designation, fire rating achieved, and date of listing.
 - .3 Manufacturers' installation instructions and recommendations.
 - .3 *Shop Drawings*:
 - .1 Submit drawings indicating fire resistance rated assembly number, required temperature, hose stream, and flame rating, material thicknesses, installation methods and materials of firestopping and smoke seals, primers, supports, damming materials as applicable, reinforcements, anchorages, fastenings and methods of installation for each condition to be encountered.
 - .2 Designate on *Shop Drawings* static through penetrations and dynamic joint systems, relative positions, expansion and control joints in rated slabs and walls, and firestopping details.
 - .3 Engineered *Shop Drawings*; for engineering judgements:

Submittal Procedures

- .1 Where *Project* conditions require modification to an accredited third party testing agency's listed system design to address a particular firestopping condition that is not covered by a listed system, submit engineered shop drawings detailing the modifications to the listed system design as an engineering judgment or equivalent fire-resistance-rated assembly, for each *Project* location and condition.
- .2 Submit the manufacturer's engineering judgment identification number and *Shop Drawings* details prepared by a professional engineer. The engineering judgment submittal shall include both *Project* name, *Project* location, and *Subcontractor's* name who will install firestop system as described in engineering judgement *Shop Drawings*.
- .3 Provide complete details of specific application of listed system and its modifications upon which the engineered judgement is based upon.
- .4 For perimeter fire barrier systems:
 - .1 Submit engineered *Shop Drawings* for engineering judgements covering perimeter fire barrier systems. Identify each cladding assembly type in contact with each perimeter fire barrier system.
- .4 Fire resistance rating test listings for firestopping and smoke seal systems.
- .3 Firestopping manual shall be submitted within 4 weeks of *Contract* award.
- .4 Prior to concealment of firestopping conditions above a ceiling or by another assembly or finish, the *Contractor* shall submit an updated firestopping manual including as-built drawings that identify firestopping conditions and penetrations.
- .3 Closeout submittals:
 - .1 Submit closeout submittals in accordance with Section 01 78 00.
 - .2 Submit the following certification documents with closeout submittals:
 - .1 Manufacturer's certification: Submit manufacturer's certification that installed firestopping and smoke seal *Products* are suitable for the use indicated and comply with specified requirements.
 - .2 Installation certification: Installer shall submit certification that all joint firestopping system installations are completed and that installations comply with listed systems designs.
 - .3 As-built copy of the firestopping manual.

1.9 Samples

- .1 Submit a minimum of 3 samples unless a greater amount is specified.
- .2 Deliver samples to the following location with expenses, including carrying costs, prepaid, unless otherwise instructed:
 - .1 Construction site office.
- .3 Identify samples or assemblies by *Project* number and name, name of *Consultant*, *Contractor* and *Subcontractor*, and date of submission. Identify location, specified material reference and any other pertinent information. Show construction by layered method if necessary, clearly displaying textures and patterns.

Submittal Procedures

- .4 Where a required colour, pattern or texture has not been specified, submit full range of available *Products* meeting other specified requirements.
- .5 *Consultant* selection from samples is not intended to change the *Contract Price* or *Contract Time*. If a selection would affect the *Contract Price* or *Contract Time*, notify *Consultant* in writing prior to proceeding with the *Work*.
- .6 Resubmit samples until written acceptance is obtained from *Consultant*.
- .7 Reviewed and accepted samples will establish the standard against which installed *Work* will be reviewed.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 General scope and responsibility.
- .2 Existing facilities.
- .3 Existing services.
- .4 Protection of the existing building.
- .5 Emergency and fire protection.

1.2 General Scope and Responsibility

- .1 For the purposes of this section:
 - .1 The words “worker” or “workers” shall mean the *Contractor*, *Contractor’s* staff or employees, *Subcontractors*, *Subcontractor’s* staff or employees, *Suppliers*, *Supplier’s* staff or employees, or anyone engaged for the *Work*, directly or indirectly, by the *Contractor*, unless otherwise indicated.
- .2 Operational limitations:
 - .1 The existing building will remain in full use and occupancy throughout the *Work*, except for such parts of the building that have been vacated for the *Work*.
 - .2 *Contractor’s* use of the *Place of the Work* is limited to permit regular use of existing *Owner’s* facilities to continue with the least amount of interference and disruptions possible.
 - .3 Assigned access to the *Place of the Work* and access routes through occupied areas of the existing building are as indicated in the *Contract Documents*.
- .3 Dust tight enclosure and partition doors and entrance doors to the *Place of the Work* shall remain closed.
- .4 Areas of the existing building adjacent to the *Place of the Work* or areas affected by the *Work*, including circulation and access routes, shall be maintained in a clean state equivalent to the level of cleanliness maintained in the existing building, and as follows:
 - .1 Clean and vacuum the *Place of the Work* and areas surrounding the *Place of the Work* daily or more frequently as required.
 - .2 Wet mop floor areas in vicinity of access doors to the *Place of the Work* daily, or more frequently as required.
 - .3 Vacuum carpeted areas daily or more frequently as required.
 - .4 Wet clean carpets in accordance with manufacturer’s recommendations once work in such areas is complete.
 - .5 Final cleaning shall be in accordance with Section 01 74 00.
- .5 Waste protection and removal:
 - .1 Waste management and disposal shall be in accordance with Section 01 74 00 as supplemented herein.

Special Procedures for Work in Occupied Buildings

- .2 Transport waste in containers with tightly fitting lids or cover waste with a wet sheet.
- .3 Remove waste as it is created. Debris shall be contained and covered if it cannot be removed immediately.
- .4 Do not transport waste through occupied areas of existing building.
- .5 Remove waste at the end of each *Working Day* through construction access routes.
- .6 Document condition of the existing building in areas immediately adjacent to the *Place of the Work* by means of construction photographs in accordance with Section 01 32 00.
- .7 Working Hours: Plan and schedule renovation construction work to accommodate anticipated difficulties and to accommodate the on-going operations of the Owner with minimal disruption and coordinate the Work required in the Owner's occupied spaces adjacent to, or above, or below the Place of the Work, on room by room basis and in accordance with a schedule mutually agreed upon with the Owner, while performing the work in accordance to the Owner's constraints of the daily hours of work available to perform the Work, as follows:
 - .1 Work on the second floor of the Goldring Student Centre which results in no significant noise, audible to areas outside the Work area or which does not transmit vibratory sounds through the building assemblies and is not disruptive to the University staff and is in separate rooms from the staff occupied rooms, will be performed between 6:00 am and 5:00 pm.
 - .2 Work which results in significant noise, audible to areas outside the Work area or which transmits vibratory sounds through the building assemblies, shall be performed between 11:00 pm to 7:00 am after regular working hours, during Monday to Friday and on weekends.
 - .1 Examples of work which transmit vibratory sounds through the building assemblies are: Hammer-drilling, core-drilling, powder-activated concrete nails, demolition, saw cutting, chipping or hammering of concrete floors and masonry or concrete walls dropping objects on floors.
 - .3 Work in occupied spaces adjacent to, or above, or below the second floor of the Place of the Work shall be performed between 11:00 pm to 7:00 am after regular working hours, during Monday to Friday and on weekends.
 - .4 Work in the third first and third floors shall be performed between 11:00 pm to 7:00 am after regular working hours, during Monday to Friday and on weekends.
 - .5 Service shutdowns are to be scheduled between 11:00 pm to 7:00 am after regular working hours, during Monday to Friday and on weekends.
 - .6 Contractor shall notify the Owner in writing a minimum of ten (10) Working Days prior their intention to begin work in an occupied area. The Owner shall accommodate the request within ten (10) Working Days of notification. Co-ordination with the proper departments at the University shall be required and to ensure no events are scheduled during weekends and stat holidays.

Special Procedures for Work in Occupied Buildings

1.3 Existing Facilities

- .1 Restrict access, parking, material deliveries, execution of work, operations and procedures to designated locations and times and do not deviate from designated procedures without prior acceptance by the *Consultant* in the presence of the *Owner*.
- .2 Periodically review proposed construction operations with the *Consultant* in the presence of the *Owner* and cooperate as required to ensure that *Owner's* interests and requirements are not unduly compromised with regard to the normal operation and function of occupied areas on the existing building.
- .3 Traffic through occupied areas of the existing building shall be kept to a minimum. Travel within occupied areas of the existing building shall be via the most direct route.
- .4 Noise, dust and debris, and odours shall be minimized to ensure building occupants in adjacent areas are disturbed as little as possible. Corrective action to cease or limit disagreeable annoyances to building occupants shall be implemented immediately upon notification by the *Consultant* or the *Owner*.
- .5 Use of existing containers and garbage bins shall not be permitted.
- .6 Designated existing elevators may be used by construction personnel and for transporting *Products* only during off peak business hours. Coordinate the use of elevators with the *Owner's*.
 - .1 Provide protective coverings for finish surfaces. Assume responsibility for and make good any damage to existing elevators caused by construction personnel.
- .7 Existing fire protection equipment:
 - .1 Existing fire protection equipment shall only be used in an emergency situation.
 - .2 Do not remove existing fire protection equipment.
 - .3 If any existing fire protection equipment is used or interfered with in any way, the *Owner's* fire equipment inspector shall be retained to inspect, test, recharge, and otherwise repair such equipment at no additional cost to the *Owner*.
- .8 Sanitary facilities: in accordance with Section 01 52 00.

1.4 Existing Services

- .1 Existing services requirements shall be in accordance with Section 01 51 00, as supplemented herein.
- .2 Service interruptions:
 - .1 Connection or disconnection of services that will interfere with the operation of the *Owner's* facilities shall not be done without the prior written acceptance of the *Consultant* in the presence of the *Owner* and during the times designated by the *Owner*. Premium charges associated with such work shall be included in the *Contract Price*.
 - .2 Provide at least 10 *Working Days'* prior written notice to the *Consultant* and the *Owner* of requirement or intention to interrupt services, and obtain written permission of the *Consultant* in the presence of the *Owner* prior to commencing such interruption.
 - .3 In no instance shall interruptions affect the entire existing building.

Special Procedures for Work in Occupied Buildings

- .4 As far as possible, coordinate interruptions with the *Owner's* regular maintenance of building services and systems.
- .5 Areas adversely affected by changes in air flows outside the construction areas as a result of a required shut-down of portions of the existing HVAC system within the construction areas are to be re-balanced to comfortable levels as advised by the *Consultant*.
- .3 Should existing services be interrupted in breach of the above, *Make Good* immediately and provide protection against further such disruptions. Costs resulting from such interruptions and for making good shall be the responsibility of the *Contractor* at no additional cost to the *Owner*.

1.5 Protection of the Existing Building

- .1 Protection requirements shall be in accordance with Section 01 56 00, as supplemented herein.
- .2 Keep *Place of the Work* safe and secure, denying access to unauthorized personnel.
- .3 Protect existing work from damage. *Make Good* any damage caused. The onus is on the *Contractor* to substantiate that damage existed prior to commencement of the *Work*.
- .4 Do not overload the existing structure due to the *Work*.
- .5 Take special measures to protect existing work from damage when moving heavy loads or equipment. Protect areas used as passageways or through which materials are moved. Use resilient tired conveyances only when moving materials and equipment inside building. Provide coverings as required to protect existing work from damage.
- .6 Separate exterior access, work and storage areas from *Owner* occupied existing areas, with fencing and hoarding as specified in Section 01 56 00. Rearrange fencing/hoarding as *Work* progresses to suit extent and configuration of the *Work*.
- .7 Provide guards, barricades and other temporary protection to prevent injury to persons.
- .8 Protect existing building components and contents from damage by weather, when executing *Work* affecting integrity of the building envelope. Provide temporary insulated and air tight weatherproof closures to protect openings made in existing building envelope. *Make Good* existing building components and contents damaged by weather resulting from inadequate temporary protection measures.
- .9 Protection of existing occupied areas:
 - .1 Existing exterior walls with windows of plain glazing, when exposed to the *Work*, shall be protected with 16 mm (5/8") gypsum board for interior surfaces and 9.5 mm (3/8") exterior grade plywood for exterior surfaces, mounted on suitable framing.
 - .1 Plywood: in accordance with Section 06 10 53.
 - .2 Metal framing: in accordance with Section 09 22 00.
 - .3 Gypsum board: in accordance with Section 09 29 00.
 - .2 Maintain such protection throughout the *Work*.
 - .3 Other openings in the existing exterior walls, such as doors and louvres, shall be similarly protected or replaced with doors of solid core wood or hollow steel construction.

Special Procedures for Work in Occupied Buildings

1.6 Emergency and Fire Protection

- .1 Provide and maintain ready access to fire protection equipment, in accordance with Section 01 52 00.
- .2 Provide temporary fire resistant closures at existing areas openings exposed to construction areas for the *Work* to maintain fire and life safety of existing building.
- .3 *Contractor* shall coordinate the work with the *Owner* in order to ensure no disruption to the existing fire detection and annunciation systems. Failure to provide such coordination shall result in the *Contractor* incurring the responsibilities and expenses associated with disruption to the existing fire detection and annunciation systems at no additional cost to the *Owner*.
 - .1 Provide fire watch when existing fire detection and annunciation systems are not operational or on bypass.
 - .2 Whenever a changeover time occurs, which is an outage time of at least a portion of the fire alarm system, the municipal fire department shall be notified of the temporary shutdown and alternative measures shall be devised.
- .4 *Contractor* shall coordinate the work carefully with the *Consultant* in the presence of the *Owner* in order to prevent unapproved disruptions to the existing sprinkler system, standpipe system, or other fire protection systems.
 - .1 Where temporary shut-down is necessitated, such shut down shall be in accordance with the requirements of authorities having jurisdiction and the building code.
- .5 Obtain 'Hot Work Permit' from *Owner* prior to hot work operation, which may cause the building's fire alarm system to be activated or create an unwarranted fire risk condition. The prevention of fires and false fire alarms caused by hot work operations is the primary goal of this procedure. Gas hoses, backflow preventers, fire resistive tarpaulins, curtains and other cutting and welding equipment must be in good repair before the permit is issued.
 - .1 'Hot Work' is defined as work using open flames or sources of heat that could ignite materials in the work area.
- .6 Fire separations:
 - .1 Maintain the integrity of fire separations, fire protection systems, and fire rated assemblies.
 - .2 Make good fire separations, fire protection, and fire rated assemblies compromised as a result of the *Work*.
- .7 Temporary fire separations:
 - .1 Provide temporary fire separations between existing occupied floor areas and new areas under construction.
 - .2 Construct temporary fire separations out of steel studs and gypsum board to provide a construction equivalent to a minimum of 1 hour fire resistance rating, unless otherwise indicated.
 - .1 Firestopping and smoke sealant: in accordance with Section 07 84 00.
 - .2 Gypsum board: in accordance with Section 09 29 00.
 - .3 Steel studs: in accordance with Section 09 22 00.

Special Procedures for Work in Occupied Buildings

- .3 Where access is required, the doorway shall be protected by a door of solid core wood or hollow steel construction.
- .4 Finish hardware equivalent to a minimum of 1 hour fire resistance rating, unless otherwise indicated.
- .8 Maintaining existing building exit facilities:
 - .1 Maintain exit facilities serving the existing building.
 - .2 Where an exit is blocked-off or deleted as a result of the *Work*, an alternative exit shall be provided that is acceptable to the *Consultant*, the *Owner*, and authorities having jurisdiction.
 - .3 Where it is necessary for access to be gained to an exit through the *Place of the Work*, the access shall be clearly defined and protected so that it is separated from construction areas by a smoke tight fire separation equivalent to a minimum of 1 hour fire resistance rating, unless otherwise indicated.
- .9 Fire department access:
 - .1 Do not obstruct access route designated for fire department equipment.
 - .2 If it is necessary that existing access routes be obstructed or deleted, alternative access routes acceptable to the fire department and in accordance with the requirements of the *Contract Documents* and authorities having jurisdiction shall be provided prior to commencement of work that will obstruct or delete existing access.
- .10 Combustible materials:
 - .1 Stockpiling of combustible materials adjacent to or inside the existing building shall not be acceptable.
- .11 Temporary protection of openings in fire separations:
 - .1 Openings in existing floor assemblies and vertical fire rated assemblies required by the *Work*, shall be temporarily protected with materials as required to maintain continuity of the required fire resistance rating for existing fire rated assembly.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 *Contractor's* quality assurance program.
- .2 *Contractor's* field quality control.
- .3 Subcontractor Qualification Statements
- .4 Independent inspection and testing – *Owner's* Quality Assurance.
- .5 Inspection and testing schedule.
- .6 Reports and documents.
- .7 Manufacturer's field review.
- .8 Mock-ups.
- .9 Radiometric Infrared Thermographic Scanning/Analysis

1.2 Contractor's Quality Assurance Program

- .1 Submit to the *Owner* and the *Consultant* for their information, a quality assurance program (the "Quality Assurance Program").
- .2 The Quality Assurance Program shall meet the requirements of Canadian Standards Association CSA CAN3-Z299.3 or such other requirements as set out in the *Contract Documents*.
 - .1 The Quality Assurance Program shall be designed so that quality requirements are obtained by progressive implementation of the controls and inspection functions stated in the Quality Assurance Program.
 - .2 Make any modifications to the Quality Assurance Program as reasonably requested by the *Owner* and/or the *Consultant*.
 - .3 The Quality Assurance Program shall include, but shall not be limited to, the following:
 - .1 A system by which changes to the *Contract Documents* and correspondence with *Subcontractor* and other correspondence is handled in a controlled manner.
 - .2 A system for purchased or manufactured materials to be identified, inspected to the specified standard, and covered by a material test report.
 - .3 A system by which measuring and testing equipment is properly stored, handled, and calibrated to a known standard.
 - .4 A system by which incoming materials are: inspected to the specified standard; accepted; allocated safe storage; and properly recorded.
 - .5 A system by which process inspection requirements shall be clearly stated for operations and carried out by qualified personnel.
 - .6 A system by which final inspections will be carried out and accepted by authorized personnel prior to release for shipping or major assembly.

Quality Requirements

- .7 A system by which non-conformance to requirements of the *Contract Documents* shall be recorded and solutions proposed by the *Owner* or the *Consultant* are also recorded.
 - .8 A system by which instructions for handling and storage of equipment shall be given.
 - .9 A system by which SBO items can be inspected and received in a manner which allows replacement or correction.
 - .10 A system by which a record of quality inspections, tests, and actions shall be kept, including field quality control.
 - .11 A system by which the *Owner* and the *Consultant* shall be afforded access to manufacturing areas and quality records and issued with copies of pertinent drawings and manufacturing schedules.
- .3 Provide the *Owner* and the *Consultant* with regular Quality Assurance Reports for their information according to an agreed schedule.

1.3 Contractor's Field Quality Control

- .1 Provide and be responsible for field quality control throughout the *Work*, including quality control of *Subcontractors* and major *Suppliers*.
- .2 Ensure that the only specified or approved *Products* and materials are used.
- .3 Provide and maintain an effective quality control program, in accordance with the Quality Assurance Program, and perform inspections and tests to ensure compliance with *Contract Documents*.
- .4 Furnish appropriate facilities, instruments, and testing devices required for performance of the quality control function.
- .5 Deliver inspection testing reports or approvals in accordance with the requirements of Section 01 45 00.
- .6 Develop a field quality control manual covering field installation. The form of the manual shall be acceptable to the *Owner* and the *Consultant*. This manual will document field quality control practices of the *Contractor*, *Subcontractors*, and major *Suppliers*. The manual shall include, but not be limited to:
 - .1 Concrete slab moisture and pH testing and surface preparation, including flatness and levelness.
 - .2 Surface preparation.
 - .3 Fastener and anchor installation.
 - .4 Material compatibility testing.
 - .5 On line fabrication quality control practices.
 - .6 Shipping.
 - .7 Field installation.
 - .8 Field inspection and testing by *Contractor*.
 - .9 Field inspection and testing independent.

Quality Requirements

- .7 Inspection and testing shall be performed by company qualified to perform the inspections or tests specified or required by the building code, regulations, by-laws, or authorities having jurisdiction.
- .8 Retain and pay for inspection and testing that is for *Contractor's* own quality control or is required by regulatory requirements
- .9 Maintain a logbook (copies to be provided to the *Consultant* at completion of fabrication) documenting date, time, results, and significance of in-plant testing carried out, where applicable, linked to daily production. The form of this logbook shall be acceptable to the *Owner* and the *Consultant*.

1.4 Subcontractor Qualification Statements

- .1 Upon request by the *Consultant*, submit proof, in the form of CCDC 11 - Contractor's Qualification Statement, of qualifications of *Subcontractors* to verify *Subcontractor's* qualifications and experience meet or exceed the requirements of the *Contract Documents*.
 - .1 If, upon review of the Contractor's Qualification Statement, it is found that the *Subcontractor* does not meet the qualification requirements specified in the *Contract Documents* pertaining to the parts of the *Work* for which the *Subcontractor* has been retained, the *Contractor* shall replace the unqualified *Subcontractor* with a qualified *Subcontractor*, satisfactory to the *Contractor* and the *Owner*, at no additional cost to the *Owner* and at no increase in the *Contract Time*.

1.5 Independent inspection and Testing – Owner's Quality Assurance

- .1 Independent inspection and testing services are used by the *Owner* to verify compliance with requirements of the *Contract Documents*.
- .2 Employment of inspection and testing agencies by *Contractor* or *Owner* does not relieve *Contractor* from responsibility to perform the *Work* in accordance with *Contract Documents*.
 - .1 Independent inspection and testing services do not relieve the *Contractor* of responsibility for normal shop and site inspection, and quality control of manufacturing and installation.
 - .2 Specified tests, inspections, and related actions do not limit the *Contractor's* other quality assurance and control procedures that facilitate compliance with the *Contract Documents* requirements.
 - .3 Requirements for the *Contractor* to provide quality control services required by the *Contract Documents*, *Consultant*, *Owner*, or authorities having jurisdiction are not limited by *Owner's* independent inspection and testing services.
 - .4 Inspections and tests specified or required that are not specified as independent inspection and testing are the responsibility of the *Contractor* and are not covered under the *Owner's* quality assurance requirements.
- .3 The *Consultant* will, on behalf of *Owner*, appoint independent inspection and testing companies, representing, reporting and responsible to the *Owner* through the *Consultant*.

Quality Requirements

- .1 Cost of independent inspection and testing company services will be authorized as a disbursement from Cash Allowance as specified in Section 01 21 00. Independent inspection and testing company shall submit monthly invoice original to *Contractor* for review, relating invoices to tests and inspection reports. Provide original receipts for disbursements. Invoices for inspection and testing services shall be forwarded by *Contractor* to *Consultant* for inclusion in progress payment application.
- .4 Additional inspection and testing required because of changes in materials proposed by *Contractor* or *Subcontractors*, by lack of proper notice for inspection and testing specified, or required as a result of failure of such materials to meet requirements of the *Contract Documents* when originally tested, shall be carried out at no additional cost to the *Owner*.
- .5 Inspection and testing required by codes or ordinances, or by an authority having jurisdiction, and made by a legally constituted authority, shall be the responsibility of the *Contractor* and shall be paid for by the *Contractor*, is not part of the *Owner's* quality assurance requirements, and shall not be paid by *Owner*, unless otherwise specified in the *Contract Documents*.
- .6 Inspection or testing performed exclusively for *Contractor's* convenience shall be sole responsibility of *Contractor*, is not part of the *Owner's* quality assurance requirements, and shall not be paid by *Owner*.
- .7 Independent inspection and testing shall be performed by company qualified to perform the inspections or tests specified or required.
- .8 Requirements of regulatory companies:
 - .1 Testing shall be conducted in accordance with requirements of the building code.
 - .2 Obtain certification where required by the building code and standards.
- .9 Cooperation with independent inspection and testing companies:
 - .1 Provide independent inspection and testing companies with materials and installation information as required and/or requested.
 - .2 Submit test samples required for testing.
 - .3 Cooperate with independent inspection and testing companies and give adequate notification of any changes in source of supply, additional work shifts, and other proposed changes.
 - .4 Provide access to the *Work* for independent inspection and testing companies wherever the *Work* is in progress, or wherever *Products*, materials, or equipment are stored prior to shipping.
 - .5 Provide labour, *Construction Equipment*, and temporary facilities required to assist independent inspection and testing companies in sampling and making tests.
- .10 Inspection and test specimens:
 - .1 Inspection and testing will, generally, consist of procedures listed in the following paragraphs, but additional tests may be performed as required to verify conformance to *Contract Documents*.

Quality Requirements

- .2 Specimens and samples for testing, unless otherwise specified in the *Contract Documents*, shall be taken by the independent inspection and testing company; sampling equipment and personnel shall be provided by the independent inspection and testing company; and deliveries of specimens and samples to the testing company shall be performed by the testing company unless otherwise specified.
- .3 Independent inspection and testing company shall take samples necessary to verify quality as specified. Taking of samples shall not endanger the structure or life safety, and shall be taken so as to best represent the *Work* as a whole.
- .4 Samples shall be handled, packaged, stored and delivered in accordance with specified tests. Sample handling where required shall duplicate conditions at the *Place of the Work* (such as site-cured concrete cylinders).
- .11 Where evidence exists that defective workmanship may have occurred, or that the *Work* may have been carried out incorporating defective materials, or where tests demonstrate that installed conditions do not comply with the requirements of the *Contract Documents*, the *Consultant* reserves the right to have additional inspections, tests, analysis, and surveys performed in order to help determine the extent of defect and whether such work must be replaced. Inspections, tests, and surveys carried out under these circumstances will be made at the *Contractor's* expense, and will not be paid by *Owner*, unless the results indicate that the work so tested, inspected or surveyed is not defective or that, in *Consultant's* opinion, the work so tested, inspected, or surveyed may be accepted, in which case tests, inspections or surveys will be paid by *Owner*.
- .12 Repair work damaged as a result of independent inspection and testing work.

1.6 Inspection and Testing Schedule

- .1 Prepare schedule for inspection and testing company services in accordance with Section 01 32 00 and as follows:
 - .1 Establishing schedule:
 - .1 By advance discussion with the selected independent inspection or testing company, determine the appropriate time necessary to perform the required services and to issue related reports.
 - .2 Allow for required time within construction schedule.
 - .2 Adherence to schedule:
 - .1 *Contractor* shall advise independent inspection and testing companies in advance when inspection and testing of the *Work* is required.
 - .1 Amount of advance notice shall be as required by the independent inspection and testing company, but shall be no less than 2 *Working Days*.
 - .2 When independent inspection and testing company is ready to perform inspection and testing according to predetermined schedule, but is prevented from inspection and testing or taking specimens due to incompleteness of the parts of the *Work* scheduled for inspection and testing, extra costs for inspection and testing attributable to the delay may be back-charged to *Contractor* at no additional cost to the *Owner*.

Quality Requirements

- .3 Notify independent inspection and testing company at least 3 *Working Days* before work required to be inspected commences, and arrange for a meeting at the *Place of the Work*, to be held 1 *Working Day* before the work starts with the following present:
 - .1 The *Contractor*, and the *Subcontractor* responsible for the work to inspected and/or tested, the inspection and testing company representatives, the product manufacturer's representative when required, and the *Consultant*.
- .4 For inspection and testing required by *Contract Documents* or by authorities having jurisdiction, provide *Consultant* and inspection and testing agencies with timely notification in advance of required inspection and testing.
- .5 Give 2 *Working Days*' prior notice to independent inspection and testing company of the commencement of each phase of the *Work* requiring inspection, and provide independent inspection and testing company with materials and installation information.

1.7 Reports and Documents

- .1 Inspection and testing company, whether for Owner's quality assurance or for *Contractor's* quality assurance, shall submit shop inspection and site inspection reports within 5 *Working Days* of each inspection.
- .2 Distribute reports digitally as follows:
 - .1 *Owner*.
 - .2 *Consultant*.
 - .3 *Contractor*.
 - .4 Consulting engineers, as applicable.
- .3 Inspection and testing companies, whether for *Owner's* quality assurance or for *Contractor's* quality assurance, shall submit a written report for each inspection or test, including pertinent data such as conditions at the *Place of the Work*, dates, test references, locations of tested materials, actual *Product* identification, testing methodology, procedures, and descriptions, site instructions given, recommendations and/or any other information required by standard applicable to reporting of tests and inspections.
 - .1 Report shall clearly indicate failure of *Product* or procedures to meet applicable standards, give recommendations for retesting or correction. Inspector shall contact *Contractor* and *Consultant* immediately when *Product* or assembly fails to meet requirements of the *Contract Documents*.
- .4 Upon completion of portions of the *Work* subject to inspection and testing, whether for *Owner's* quality assurance or for *Contractor's* quality assurance, submit to the *Consultant* duplicate certificates of acceptance of the installation issued by the inspection and testing company.

1.8 Manufacturer's Field Review

- .1 Where manufacturer's field review is specified, manufacturer's representative shall review the relevant parts of the *Work* at the *Place of the Work*, or wherever such affected work is in progress, to verify that the relevant parts of the *Work* are being executed in accordance with manufacturer's written requirements and verify their product is fit for the purpose intended.

Quality Requirements

- .2 Manufacturer's field review is to verify that the *Products* specified are being used in the *Work* and are being applied on surfaces prepared in accordance with manufacturer's written requirements and the requirements of the *Contract Documents*.
- .3 Unless otherwise indicated, manufacturer's representative shall undertake a minimum of 3 field reviews, with additional reviews as required by the manufacturer, to verify that the relevant parts of the *Work* are in accordance with the manufacturer's written requirements.
- .4 Manufacturer's representative shall submit a type-written report on manufacturer's letterhead after each field review following procedures for reports and documents specified in Section 01 45 00. Report shall document manufacturer's representative's field observations and recommendations.

1.9 Mock-Ups

- .1 Provide field or shop erected example of work complete with specified materials and workmanship.
- .2 Provide field or shop erected mock-ups of *Work* as specified in the *Specifications*. If a mock-up location is not indicated in the *Drawings* or *Specifications*, locate where directed by *Consultant*.
- .3 Do not proceed with work for which mock-ups are required prior to *Consultant's* review of mock-ups.
- .4 Modify mock-up as required until *Consultant* written acceptance is obtained.
- .5 Protect and maintain mock-ups until directed to be removed.
- .6 Commence work demonstrated in mock-up only after review and acceptance of workmanship.
- .7 Remove mock-ups only when the *Work* they represent is complete or when otherwise directed by *Consultant*.
- .8 If possible, mock-up may become part of finished work, at sole discretion, and with prior written acceptance of *Consultant*.
- .9 Reviewed and accepted mock-ups shall be the standard of workmanship and material against which installed work will be compared.
- .10 Remove and replace materials or assemblies appearing in the finished work that do not match reviewed and accepted mock-ups.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Temporary Utilities

PART 1 - GENERAL

1.1 Section Includes

- .1 Temporary utilities - general.
- .2 Temporary electrical services.
- .3 Temporary water supply.
- .4 Temporary heating and ventilation.

1.2 Temporary Utilities - General

- .1 Provide temporary utilities as specified and as otherwise necessary to perform the *Work* expeditiously.
- .2 Arrange and pay for required temporary services, unless otherwise specified.
- .3 Provide connection and disconnection of temporary services and facilities required in the *Work*, including connection to existing services made available by the *Owner*.
- .4 Remove temporary utilities after use.
- .5 Existing services:
 - .1 Do not use any existing services and facilities during construction unless specific written permission is provided by *Owner*.
 - .2 Protect and maintain without interruption, existing water, heating, drainage, and other services within the *Place of the Work* to existing buildings not within the scope of the *Work* of this *Contract*. Obtain written permission of the *Owner* for services required to be temporarily shut off, at least 2 full *Working Days* in advance.
 - .3 Do not use permanent mechanical, or electrical systems during the course of the *Work* unless specific written permission is provided by the *Consultant*. Use of permanent services for temporary construction service shall not prejudice warranties.

1.3 Temporary Electrical Services

- .1 Provide and maintain an adequate temporary electrical service for performance of the *Work* including, but not limited to, operation of electric pumps, motors, vibrators and other power tools, hoisting and related construction and general illumination during the *Work*.
 - .1 Use existing electrical service into building. *Owner* will pay electrical bills.
 - .2 Do not use new building power systems during construction without prior written authorization from *Consultant* and *Owner*.
- .2 Provide and maintain any components and equipment necessary to transform supply power to necessary temporary power voltage.

1.4 Temporary Water Supply

- .1 Provide and maintain a temporary supply of water for use in the *Work*.
 - .1 Use existing water supply. *Owner* will pay water bills.
- .2 Extend supply pipe or pipes from nearest available sources and maintain in good condition until permanent system is installed and ready for use.

Temporary Utilities

1.5 Temporary Heating and Ventilation

- .1 Provide and pay for temporary heating, cooling and ventilating required for the *Work*, including attendance, maintenance and fuel.
- .2 Provide temporary heat and ventilation as required to:
 - .1 Facilitate continuous uninterrupted progress of the *Work*.
 - .2 Protect the *Work* and *Products* against damage and defacement caused by weather, harmful levels of temperature, humidity, and moisture.
 - .3 Protect the *Work* against dampness and cold.
 - .4 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored *Products*.
 - .5 Provide ambient temperatures and humidity levels for proper storage, installation and curing of materials, in accordance with specified standards and manufacturer's requirements.
 - .6 Provide adequate ventilation to meet health regulations for safe working environment.
- .3 Prior to enclosing building, maintain work areas at not less than 7°C. After enclosing, keep premises heated to at least 13°C using temporary heating devices that do not cause moisture and humidity build-up within the facility. Increase temperatures in isolated areas to 20°C as required by various sections of the *Specifications* or by *Product* manufacturers.
- .4 Solid fuel salamanders will not be permitted.
- .5 Provide temporary heat or adequate protection by means of straw or other coverings to floor slabs, footings, or any part of building not specifically designed to withstand frost penetration.
- .6 Furnish other temporary heating as required by various sections of the *Specifications* or by *Product* manufacturers.
- .7 Ventilate to the exterior of the building work areas as required when toxic materials are being utilized or cured.
- .8 Replace with new, any work damaged due to failure to provide adequate heat at no cost to *Owner*.

PART 2 - PRODUCTS

Not applicable.

PART 3 – EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 General scope and responsibility.
- .2 Parking.
- .3 Temporary sanitary facilities.
- .4 Temporary site office.
- .5 Temporary telephone, computer and Wi-Fi.
- .6 Fire protection.
- .7 Elevators.
- .8 Temporary site storage.
- .9 Traffic Control and Road Maintenance.
- .10 Signs and notices.

1.2 General Scope and Responsibility

- .1 Temporary facilities specified in this section shall be supplemented as applicable in accordance with Section 01 35 13.
- .2 Arrange, obtain and pay cost for permits required for temporary facilities and controls.
- .3 Provide and maintain temporary facilities for the *Work* and remove them from the *Work* upon issuance of certificate of *Substantial Performance of the Work*.
- .4 Do not use permanent facilities during the course of the *Work* unless specific written permission is provided by the *Consultant*. Where use of permanent facilities is granted for temporary construction service, such use of permanent facilities shall not prejudice warranties.

1.3 Construction Parking

- .1 A parking area has been designated for the use of workers engaged for the *Project*.
 - .1 Use of the parking area shall be by vehicles with parking permits only.
 - .2 Parking permits must be purchased by the *Contractor* at the Margaret Addison Front Desk.
 - .3 There is no reserved parking. Parking is on a first-come-first-served basis however, occupants of and visitors to the existing building shall have priority over workers. It may be necessary for workers to park off-site.
- .2 Do not interfere with the operation of existing premises. Keep existing parking areas and road system remain free and clear of obstructions resulting from the *Work*.
- .3 Illegally parked vehicles that are ticketed and/or towed shall be the sole responsibility of the vehicle owner.

1.4 Temporary Sanitary Facilities

- .1 The *Owner* will designate existing washrooms for use of workers.

Temporary Facilities

- .1 Regularly maintain and clean these washroom facilities, in compliance with applicable regulations, codes and by-laws, for the duration of the *Work*.
 - .2 At *Substantial Performance of the Work*, turn over to *Owner*, clean washroom facilities, in same condition facilities were prior to commencement of the *Work*. Arrange and pay for repairs, making good and replacement if necessary, as directed by *Consultant*.
 - .3 Provision of such access to existing washrooms does not relieve the *Contractor* of the responsibility to provide and maintain, in compliance with applicable regulations, codes and by-laws, sufficient sanitary temporary water closets and washbasins for use of workers as required by applicable regulations, codes and by-laws. Additional sanitary temporary water closets and washbasins for use of workers, as required, shall be provided by the *Contractor* at no increase in the *Contract Price*.
- .2 Use of new sanitary facilities by workers is prohibited.

1.5 Temporary Site Offices

- .1 Provide site office within the boundaries of the *Place of Work*, of sufficient size to accommodate site meetings for 12 people, and furnished with drawing layout table, computer, and Wi-Fi as described in paragraph 1.6.

1.6 Temporary Telephone, Computer and Wi-Fi

- .1 Provide and maintain a telephone in temporary site office for exclusive use of *Consultant*, *Contractor*, and *Subcontractors*. Pay phone is not acceptable.
- .2 Superintendent shall be equipped with mobile telephone device.
- .3 Long distance charges shall be paid by party making call.
- .4 *Provide* and maintain a computer for the purposes of email and internet access. Computer to have dedicated, high-speed access, and be *Provided* complete with a printer capable of printing 11" x 17" format.
- .5 Provide and maintain internet access for the *Consultant* and other guests through a high bandwidth WiFi hub capable of supporting traffic with 50 connected devices simultaneously; provide for the use of the *Consultant* a WiFi enabled colour printer capable of printing 11" x 17" format.

1.7 Fire Protection

- .1 Provide and maintain temporary fire protection systems and equipment during construction.

1.8 Elevators

- .1 Elevators in accordance with Section 01 35 13.

1.9 Temporary Site Storage

- .1 Handle and store materials so as to prevent damage or defacement to the *Work* and surrounding property.

Temporary Facilities

- .2 Construct weather-tight storage sheds for storage of materials that may be damaged or defaced by weather. Provide floors raised 150 mm (6") clear of ground for storage of *Products*.
- .3 *Owner* is not responsible for securing *Products* or materials at the *Place of the Work*.

1.10 Traffic Control and Road Maintenance

- .1 Provide and maintain adequate access to *Place of the Work*.
- .2 Do not block roads or impede traffic. Keep construction traffic to designated roads only. Provide flagperson to direct traffic as required.
- .3 Provide a hard surface area at the *Place of the Work* for cleaning down trucks prior to entry onto municipal roads or private roads outside of the *Place of the Work*.
- .4 Keep public and private roads free of dust, mud and debris resulting from truck, machinery and vehicular traffic related specifically to this *Project*, for the duration of *Work*.
- .5 Clean roads regularly, public or private. Wash down and scrape flush roads at least daily when earth moving operations take place. Maintain public property in accordance with requirements of authorities having jurisdiction.

1.11 Signs and Notices

- .1 Project sign:
 - .1 Design and erect a 1220 x 2440 mm (4' x 8') free standing project sign including overlaid plywood, backing posts, post foundations, framing and installation.
 - .2 Sign shall contain information regarding the project, *Owner*, *Consultant*, *Contractor* and other information as required.
 - .3 Sign shall be professionally finished according to the design provided by *Consultant*.
 - .4 Location of sign: In prominent location to *Consultant* acceptance.
- .2 *Consultant* signs:
 - .1 Install at the *Place of the Work* corporate signs as provided by *Consultant*.
 - .2 Location of sign: In prominent location to *Consultant's* acceptance.
 - .3 Mount sign on suitable supports.
- .3 No other signs or advertisements, other than safety, warning, or directional signs, are permitted without *Consultant's* prior approval.

PART 2 - PRODUCTS

Not applicable.

PART 3 – EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 General scope and responsibility.
- .2 Temporary enclosures and protection.
- .3 Dust tight hording enclosure.
- .4 Protection of the public.
- .5 Protection of the *Work*.
- .6 Protection of concrete floors to remain exposed in finished work.

1.2 General Scope and Responsibility

- .1 Temporary facilities and controls specified in this section shall be supplemented as applicable in accordance with Section 01 35 13.
- .2 Provide and maintain signs, guard-rails, barriers, warning lights and other protection as required by authorities having jurisdiction for safety of the *Place of the Work*. Be responsible for adequacy of protection.
- .3 Plant, Machinery and Scaffolding:
 - .1 Provide formwork, scaffolding, equipment, tools, machinery and incidental appurtenances necessary for the proper execution of the *Work*.
 - .2 Erect plant, machinery and scaffolding to permit access to building and the *Work*.
 - .3 Use scaffolds in such manner as to interfere as little as possible with other trades' operations.
 - .4 Support scaffolds from finished surfaces only after taking precautions to prevent damage. No supports, clips, brackets, or similar devices shall be welded, bolted, or otherwise affixed to any finished member or surface without prior permission.
- .4 Maintain temporary barriers and enclosures in good condition for the duration of the *Work*.
- .5 Remove temporary barriers and enclosures from *Place of the Work* when no longer required.

1.3 Temporary Enclosures and Protection

- .1 Provide temporary enclosures and protection of adequate construction to prevent dispersion of dust and dirt into other areas of existing building and to prevent dispersion of dust and dirt beyond the *Place of the Work*.
- .2 Erect, maintain, and relocate enclosures as required to facilitate construction operations and *Owner's* operational requirements.
- .3 Temporary enclosure and protection shall be of finished appearance and painted to colour approved by *Owner*.
- .4 Provide dust seal and sound resistant enclosures to protect existing building and operations as indicated. Include temporary doors, fastenings and keys.
- .5 Insulate and airseal exterior enclosures to prevent condensation and drafts.

Temporary Barriers and Enclosures

1.4 Dust Tight Hording Enclosures

- .1 Dust tight enclosures shall be in accordance with Section 01 57 00, as supplemented herein.
- .2 Design hoarding to meet bylaws and regulations of authorities having jurisdiction and obtain approvals from authorities having jurisdiction.
- .3 Engage and pay for professional engineer(s) registered in *Place of the Work*, experienced in this type of engineering, to design and supervise construction and maintenance of dust tight hording. Designs included in the *Contract Documents* for such work cover general appearance only.
- .4 Permits: Arrange and pay for necessary permits for proper execution and completion of the work of this section.
- .5 Construct full height dust tight partitions as follows:
 - .1 Framing lumber and posts: NLGA No. 2 Construction SPF. Reused material may be used.
 - .2 *Provide* tarpaulins fastened to studs on the side of the partition opposite to the occupied areas. Lap joints 100 mm (4") minimum, and seal laps and perforations dust tight with 75 mm (3") wide plastic film tape.
 - .3 *Provide* 1 layer of 12.7 mm (1/2") thick Plywood, sheathing grade conforming to CSA 0141-M1978. Reused material may be used. *Provide* felt gaskets around perimeter of partitions.
 - .4 Paint sides of partitions exposed to occupied areas of the existing building in accordance with Section 09 91 00, colour: White.
 - .5 *Provide* Custom Graphic for occupied side of hording. Custom graphic image file to be provided by Consultant.
 - .6 Provide locked access door and coordinate keying with Owner.
- .6 Maintain and relocate dust tight partitions and enclosures until dust generating work is complete, or until directed otherwise in writing by the *Consultant* in consultation with the *Owner*.

1.5 Protection of the Public

- .1 Provide fencing, barricades, hoarding, notices and warning boards and maintain lights and signals for protection of workers engaged on the *Work*, for protection of adjoining property and for protection of the public.
- .2 Where any special hazard exists from which it is not possible to protect the public safety by other means, watchpersons shall be employed to preserve public safety until the area of special hazard no longer poses a risk to public safety.

1.6 Fire Routes

- .1 Maintain fire access routes, including overhead clearances, for use by emergency response vehicles.

1.7 Protection of the *Work*

- .1 Protect the *Work* from damage, discolouring, and defacement. Maintain protection until the *Work* is complete.

Temporary Barriers and Enclosures

- .2 Provide necessary temporary barriers and enclosures to protect existing surfaces from damage during performance of the *Work*.
- .3 Have damaged or defaced work corrected by workers meeting qualification requirements of the *Contract Documents*.

1.8 Protection of Concrete Floors to Remain Exposed in Finished Work

- .1 Non-marking protection material shall be placed over concrete floors designated as exposed.
- .2 Post the following on warning signs at locations leading to areas of where concrete floors are to remain exposed in finished work (see Concrete Floor Contractors Association of Canada):
 - .1 Concrete floors shall be protected from staining, damage and excessive loading at all times:
 - .1 No traffic is permitted on new concrete floors for the first 3 days after placement.
 - .2 Foot traffic is permitted between 3-7 days after placement (curing materials must be replaced where disturbed by traffic).
 - .3 Scissorlifts and light equipment are permitted 7 days after slab placement.
 - .4 Vehicles shall be diapered to prevent oil and other liquid spills (remove leaking equipment from the jobsite immediately).
 - .5 Tires shall be non-marking or taped with non-marking tape to prevent marking of the floors.
 - .6 Trucks, forklifts and any other heavy loads may only to be placed on the floor if they have been previously approved by the *Consultant*.
 - .7 Spills must shall be cleaned up immediately to avoid permanent staining of the concrete.
 - .8 Concrete shall be protected from scratching and impact damage at all times. No cutting, painting, welding or other injurious activities shall be performed without protecting the concrete from damage prior to the commencement of work.

PART 2 - - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

PART 4END OF SECTION

Temporary Controls

PART 1 - GENERAL

1.1 Section Includes

- .1 General scope and responsibility.
- .2 Security.
- .3 Pest control.
- .4 Dust, debris and noise control.
- .5 Pollution control.

1.2 General Scope and Responsibility

- .1 Temporary controls specified in this section shall be supplemented as applicable in accordance with Section 01 35 13.
- .2 Arrange, obtain and pay cost for permits required for temporary controls.
- .3 Provide temporary controls as necessary for performance of the *Work* and in compliance with applicable regulatory requirements.
- .4 Maintain temporary controls in good condition for the duration of the *Work*.
- .5 Remove temporary controls and *Construction Equipment* used to provide temporary controls from *Place of the Work* when no longer required.

1.3 Security

- .1 The *Contractor* shall be solely responsible for securing the *Place of the Work* in accordance with GC 3.10.4. The *Owner* shall have no responsibility in this regard.
 - .1 Provide and maintain security lighting.
 - .2 Provide and maintain temporary locks. Premises to be locked after working hours.
- .2 Provide security for the *Place of the Work* by methods compatible with the security system for the existing building.
 - .1 *Contractor* shall coordinate the work carefully with the *Owner* in order to ensure no disruption to the existing building's security system.
 - .2 Where existing building's security system is breached due to *Contractor's* negligence, be responsible for any damage or theft of property, regardless if area where damage or theft occurred is under *Contractor's* control or not.

1.4 Pest Control

- .1 Provide rodent control and other pest control programs during the *Work* in accordance with the requirements of authorities having jurisdiction.

1.5 Dust, Debris and Noise Control

- .1 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .2 Control dust and dirt produced during the *Work* to prevent dispersion beyond the immediate work areas.

Temporary Controls

- .3 Prevent materials from contaminating air beyond application area, by providing temporary enclosures and ventilation/filtration.
- .4 Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.
- .5 Execute *Work* by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.
- .6 Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.
- .7 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .8 Use appropriate covers on trucks hauling fine, dusty, or loose materials.
- .9 Limit noise levels in accordance with requirements of authorities having jurisdiction, the *Owner* and as indicated in 01 35 13.
- .10 Prevent abrasive-blasting, pressure-washing spray, and other extraneous materials from contaminating air beyond application area.
- .11 The surrounding buildings and campus are occupied year round. Pay special attention to control and minimization of dust, noise, and garbage. Protect surrounding site work and building cladding from damage during construction.

1.6 Pollution Control

- .1 Prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.
- .2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur. Promptly report spills and releases that may occur to:
 - .1 Authority having jurisdiction.
 - .2 Person causing or having control of pollution source, if known.
 - .3 *Owner* and *Consultant*.
- .4 Take immediate action to contain and mitigate harmful effects of the spill or release.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Product Requirements

PART 1 - GENERAL

1.1 Section Includes

- .1 Availability of *Products*.
- .2 *Product* handling.
- .3 *Product* requirements and quality.

1.2 Availability of Products

- .1 Promptly upon *Contract* award and periodically during construction, review and confirm *Product* availability and delivery times. Order *Products* in sufficient time to meet the construction progress schedule and the *Contract Time*.
- .2 If a specified *Product* is no longer available, promptly notify the *Consultant*. The *Consultant* will take action as required.
- .3 In the event of delays in supply of *Products*, and should it subsequently appear that the *Work* may be delayed for such reason, *Consultant* reserves the right to substitute more readily available *Products* of similar character, at no additional cost to the *Owner*.

1.3 Product Handling

- .1 Handle and store *Products* in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturers' and *Supplier's* recommendations and so as to ensure preservation of their quality and fitness for the *Work*, and protect from vandalism and theft.
- .2 Store packaged or bundled *Products* in original and undamaged condition with manufacturer's seals and labels intact, facing to outside. Do not remove from packaging or bundling until required in the *Work*.
- .3 Store materials susceptible to environmental damage in a weathertight enclosure raised clear of ground so that they are protected from weather, dampness and deterioration. Do not use such materials which have been damaged by exposure to moisture.
- .4 Keep sand, when used as ingredients for grout, mortar or similar mixed materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .5 Store sheet materials, lumber and other *Products* susceptible to deterioration on flat, solid supports and keep clear of ground or slab. Slope to shed moisture.
- .6 Handle materials to preclude damaging existing surfaces and work of others.
- .7 Remove damaged *Products* and replace with new undamaged *Products*.
- .8 Transportation:
 - .1 Pay cost of transportation of *Products* required in performance of *Work*.
 - .2 Transportation cost of *Products* supplied by *Owner* will be paid for by *Owner*. Unload, handle and store such *Products* at the *Place of the Work*.
 - .3 Reject *Products* damaged during transport.

Product Requirements

- .4 Transportation of *Products* must be undertaken to suit construction schedule. *Contractor* is responsible for determining mode of transport to ensure delivery, obtaining *Shop Drawings*, placement of orders, and on-time premium costs, air freight, and the like.

PART 2 - PRODUCTS

2.1 *Product Requirements and Quality*

- .1 Compatibility of options: If given option of selecting between two or more *Products*, select *Product* compatible with products previously selected, even if previously selected products were also options.
 - .1 Unless otherwise indicated in the *Contract Documents*, maintain uniformity of *Product* and manufacturer for any like item, material, equipment or assembly for the duration of the *Work*.
- .2 *Products* used for temporary facilities may have been previously used, providing they are sound in structural qualities.
- .3 *Products* and *Product* installation shall be in compliance with building code, regulations and requirements of authorities having jurisdiction.
- .4 Specified options: The *Work* is based on materials, *Products* and systems specified by manufacturer's catalogued trade names, references to standards, by prescriptive *Specifications* and by performance *Specifications*.
 - .1 Wherever a *Product* or manufacturer is specified by a single proprietary name, provide the named *Product* only.
 - .2 Wherever more than one *Product* or manufacturer is specified by proprietary name for a single application, provide any one of the named *Product*.
 - .3 Wherever a *Product* is specified by reference to a standard only, provide any *Product* that meets or exceeds the specified standard. If requested by *Consultant*, submit information verifying that the proposed *Product* meets or exceeds the specified standard.
 - .4 Wherever a *Product* is specified by descriptive or performance requirements only, provide any *Product* that meets or exceeds the specified requirements. If requested by *Consultant*, submit information verifying that the proposed *Product* meets or exceeds the specified requirements.
 - .5 The onus is on the *Contractor* to prove compliance with governing published standards, prescriptive *Specifications* and with performance *Specifications*.
 - .6 Visual selection *Specifications*:
 - .1 Where *Specifications* include the phrase "as selected by *Consultant* from manufacturer's full range" or similar phrase, select a product that complies with requirements. *Consultant* will select colour, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
 - .7 Visual matching *Specifications*:
 - .1 Where *Specifications* require "match *Consultant's* sample", provide a product that complies with requirements and matches *Consultant's* sample. *Consultant's* decision will be final on whether a proposed product matches.

Product Requirements

- .5 Provide *Products* that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by *Consultant*, furnish evidence as to type, source and quality of *Products* provided.
 - .1 Defective *Products*, whenever identified prior to completion of the *Work*, will be rejected, regardless of previous reviews. Review of the *Work* by the *Consultant* or independent inspection and testing companies does not relieve the *Contractor* of the responsibility for executing the *Work* in accordance with the requirements of the *Contract Documents*, but is a precaution against oversight or error.
- .6 Basis of design:
 - .1 Where *Contract Documents* list “basis of design”, this indicates the *Product* or system that was used in the preparation of the design included in the *Contract Documents*, and which shall be an acceptable *Product*.
 - .2 The basis of design establishes the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products from other manufacturers.
 - .3 The term “basis of design” does not preclude the use of other *Products* or systems in the *Work*, provided the proposed *Product* or system complies with the design and performance requirements contained in the *Contract Documents*.
 - .1 Proposals for use of *Products* or systems in the *Work* that are not the named “basis of design” shall follow procedures for product substitutions in accordance with Section 01 25 00.
- .7 Where *Contract Documents* require design of a *Product* or system, and minimum material requirements are specified, the design of such *Product* or system shall employ materials specified within applicable section. Where secondary materials or components are not specified, augment with materials meeting applicable code limitations, and incorporating compatibility criteria with adjacent work.
- .8 Should dispute arise as to quality or fitness of *Products*, the decision rests strictly with *Consultant* based upon the requirements of the *Contract Documents*.
- .9 *Products* exposed in the finished work shall be uniform in colour, texture, range, and quality, and be from one production run or batch, unless otherwise indicated.
- .10 *Owner* retains right to select from choices available within specified *Products* for colours, patterns, finishes or other options normally made available. Submit full range of *Product* options in accordance with Section 01 33 00 for such selection.
- .11 Exposed to weather: *Products* and materials in environments not protected by the building’s HVAC and/or climate control systems shall be considered exposed to weather.

PART 3 – EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 Examination of the *Place of the Work*, documents, surfaces and conditions.
- .2 Public utilities and services.

1.2 Examination of the *Place of the Work*, Documents, Surfaces and Conditions

- .1 Examine the *Place of the Work* and investigate matters relating to the nature of the *Work*, means of access and egress, obstacles, rights and interests of other parties which may be interfered with during the execution of the *Work*, conditions and limitations including obstructions, existing structures or facilities, local conditions, actual levels, character and nature of the *Work*, documents related to existing building or buildings, as applicable and when available, and other consideration which may affect performance of the *Work*.
- .2 Examine the extent of work to be performed and matters which are referred to in the *Contract Documents* prior to start of the *Work*.
- .3 Examine work to which work is to be applied, anchored or connected, and relevant as-built conditions.
- .4 Each work operation following on a previous work operation of a differing *Subcontractor*, shall include a thorough examination of the condition of the previous work to verify that work is complete and in a condition suitable to receive the subsequent work. Conditions found unacceptable, either for the commencement of the new work or its satisfactory completion, shall be reported in writing to the *Consultant*.
- .5 Verify that ambient conditions are suitable before commencing the work of any Section and will remain suitable for as long as required for proper setting, curing, or drying of *Products* used.
- .6 Ensure that substrate surfaces are clean, dimensionally stable, cured and free of contaminants.
- .7 Do not commence work until unsatisfactory conditions are corrected. Commencement of work shall mean acceptance of surfaces, tolerances, and conditions, and existing conditions will not be accepted as a contributing factor to subsequent failure or unacceptability of the *Work*.

1.3 Setting Out the *Work*

- .1 Assume full responsibility for and execute complete layout of the *Work* to required locations, lines and elevations.
- .2 Arrange meeting with *Consultant* to discuss critical setting out assumptions for the *Work* and establish limiting conditions for setting out the *Work*. *Consultant* shall chair and prepare minutes of the meeting, and prepare and submit sketches recording understanding of key setting out principles.
- .3 Provide devices needed to lay out and construct the *Work*.

PART 2 - PRODUCTS

Not applicable.

PART 3 – EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 Concealed services.
- .2 Trademarks and labels.
- .3 Interferences.
- .4 Publicity releases and photographs.
- .5 Smoking policy.
- .6 Coordination with *Owner's* commissioning activities.
- .7 Manufacturer's instructions.
- .8 Galvanic/dissimilar metal corrosion.
- .9 Workmanship.
- .10 General construction tolerances.

1.2 Inserts, Anchors, and Fasteners

- .1 Use only factory made, threaded or toggle type inserts as required for supports and anchors, properly sized for load to be carried.
- .2 Where inserts cannot be placed, use factory made expansion shields for light weights only.
- .3 Supply and locate inserts, holes, anchor bolts and sleeves during placement or fabrication of structural elements.
- .4 Fasteners stressed in withdrawal are not acceptable, except where otherwise indicated.
- .5 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to prevent direct contact.
- .6 Use non-corrosive fasteners and anchors for securing exterior work and in spaces where high humidity levels are anticipated.
- .7 Space anchors within individual load limit or shear capacity and install such that they provide positive permanent anchorage.
- .8 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .9 Fastenings for prefinished materials shall be of concealed type unless otherwise indicated, and when exposed finish is required, of matching prefinishing materials.
- .10 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.
- .11 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .12 Bolts shall not project more than one diameter beyond nuts.
- .13 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials being fastened.

Execution

.14 Power actuated fasteners:

- .1 Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190-11 conducted by a qualified independent testing agency.
- .2 Do not use power actuated fasteners which are stressed in withdrawal in finished work.
- .3 Do not use power actuated fasteners within 100 mm (4") of the edge of concrete or masonry, unless otherwise accepted in writing by *Consultant*.
- .4 Do not use power actuated fasteners in post-tensioned concrete.

1.3 Penetrations

- .1 Holes or voids created in assemblies or partitions for penetrating mechanical, electrical, or sprinkler service items, shall be of sufficient size to accommodate the penetrating item as well as additional required fill materials, such as sealants, firestopping and smoke sealants, insulation, and the like, without exceeding the maximum opening allowable by the manufacturer of the additional required fill material.
- .2 When penetrating fire rated walls, ceiling, or floor assemblies, completely seal voids with firestopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

1.4 Concealed Services

- .1 Unless otherwise indicated, conceal pipes, ducts, and wiring in floors, walls, and ceilings in finished areas. Do not conceal until after:
 - .1 Review by *Consultant* and authority having jurisdiction.
 - .2 Recording actual locations on as-built drawings where locations differ from those shown on *Drawings*.
- .2 Provide incidental furring or other enclosures as required.
- .3 Notify *Consultant* in writing of interferences before installation.

1.5 Trademark and Labels

- .1 Trademarks and labels, including applied labels, shall not be visible in finished work in finished areas, unless otherwise accepted or indicated by *Consultant*, and except for trademarks and labels:
 - .1 That are essential to identify materials, systems, assemblies, and equipment for maintenance and replacement purposes.
 - .2 That are essential for life safety, fire resistance, and temperature rise ratings.

1.6 Interferences

- .1 Coordinate placement of equipment to ensure that components will be properly accommodated within spaces provided prior to commencement of the *Work*.
- .2 Take complete responsibility for remedial work that results from failure to coordinate aspects of work prior to its fabrication/installation.

Execution

- .3 Maintain accesses and clearance required by jurisdictional authorities and/or for easy maintenance of equipment in layout of equipment and services, Notify *Consultant* if indicated clearances are in conflict.

1.7 Publicity Releases and Photographs

- .1 No press or publicity releases, including photographs of the *Place of the Work*, will be permitted without prior written approval of the *Owner*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

- .1 Install, erect, or apply *Products* in accordance with manufacturer's written requirements. Do not rely on labels or enclosures supplied with *Products*. Obtain written requirements directly from manufacturers.
- .2 Notify *Consultant*, in writing, of conflicts between *Contract Documents* and manufacturer's instructions where, in *Contractor's* opinion, conformance with *Contract Documents* instead of the manufacturer's instructions may be detrimental to the *Work* or may jeopardize the manufacturer's warranty.
- .3 Improper installation or erection of *Products*, due to failure in complying with these requirements, shall result in removal and re-installation of such *Products* as part of the *Work* at no additional cost to the *Owner*.
- .4 Provide manufacturer's representatives with access to the *Work* at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities.

3.2 Galvanic/Dissimilar Metal Corrosion

- .1 Insulate dissimilar metals from each other by suitable plastic strips, washers or sleeves to prevent galvanic corrosion where conductive liquid or electrolyte exists or may reasonably be expected to exist.

3.3 Workmanship

- .1 General:
 - .1 Execute the *Work* using workers experienced and skilled in the respective duties for which they are employed.
 - .2 Do not employ an unfit person or anyone unskilled in their required duties.
 - .3 Remove *Products* or materials that have been broken, chipped, cracked, discoloured, abraded, or damaged during construction period and provide undamaged *Products* or materials meeting the requirements of the *Contract Documents*.
- .2 Coordination:
 - .1 Ensure cooperation of workers in layout of the *Work*. Maintain efficient and continuous supervision.

Execution

- .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- .3 Backer plates:
 - .1 Provide backer plates to support and provide anchorage base to carry loads from surface or recessed applied materials.
- .4 Cutting and remedial work:
 - .1 Perform cutting and remedial work required to make parts of the *Work* come together. Coordinate the *Work* to ensure this requirement is maintained. Comply with requirements of Section 01 73 29.
 - .2 Notify *Consultant* of, and perform remedial work required to, repair or replace defective or unacceptable work. Refer also to GC 2.4.3. Ensure that properly qualified workers perform remedial work. Coordinate adjacent affected work as required.
- .5 Location of fixtures:
 - .1 Locations of fixtures, access panels, outlets, and mechanical and electrical items indicated on *Drawings* are approximate only.
 - .2 Locate fixtures, outlets, and devices to provide minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements. Architectural drawings will relate these items to known dimensions, such as ceiling tile grid or wall locations and the like.
 - .3 Obtain *Consultant's* acceptance for precise locations of fixtures, access panels, outlets, mechanical, and electrical items.
 - .4 *Consultant* reserves the right to relocate electrical outlets and mechanical fixtures at a later date, but prior to installation, without cost, provided that the relocation per outlet does not exceed 3050 mm (10') from the original location.
 - .5 Promptly notify *Consultant* in writing of conflicting installation requirements for fixtures, outlets, and devices. If requested, indicate proposed locations and obtain approval for actual locations.
- .6 Protection of work in progress:
 - .1 Provide protection required by authorities having jurisdiction.
 - .2 Protect parts of the *Work* completed or in progress from soiling, abrasion, punctures, damage, and defacement, and maintain protection until the surrounding or overhead work is complete.
 - .3 Remove and replace materials damaged or defaced as a result of failure to provide adequate protection.
 - .4 Do not cut, drill, or sleeve any load bearing structural member without written permission of *Consultant*. Comply with requirements of Section 01 73 29.
 - .5 Do not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety or integrity of the *Work*.
 - .6 Protect finished flooring from damage. Take special measures when moving heavy loads or equipment on them.

Execution

- .7 Keep surfaces free of oils, grease or other materials that may damage or deface them or affect bond of applied *Products*.
- .8 Protect existing buildings, curbs, roads and lanes. If, during the *Work*, any buildings, curbs, roads or lanes are damaged, bear costs for repairs.
- .7 Protection of mechanical and electrical *Products* or materials:
 - .1 Wrap in protective plastic and seal mechanical and electrical items and equipment prior to and during shipment, storage at the *Place of the Work* and after installation.
 - .2 Remove protective coverings only to the extent required for installation of the items. Re-install protection immediately following installation.
 - .3 Remove protective coverings in stages, as work areas are completed, or when directed by *Consultant*.
- .8 Operational requirements:
 - .1 Operable *Products* shall be provided fully operational and ready for intended use.
 - .2 Adjust operating hardware and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts for smooth squeak-free function, in accordance with manufacturer's requirements.
- .9 Alterations:
 - .1 Restore new or existing work which is altered as a result of the *Work* and *Make Good*.
 - .2 Materials and workmanship shall match existing materials and workmanship. Exposed materials shall match and blend in with the appearance of the existing undamaged surfaces in all respects including colours, textures, layout, jointing, and material types so as to not vary in appearance when compared to adjacent materials from a viewing distance of 1830 mm (6').

3.4 General Construction Tolerances

- .1 Match existing tolerances in every respect unless otherwise specified.
- .2 Where tolerances are not defined elsewhere in the *Contract Documents* or building code, construct the *Work* to the following tolerances:
 - .1 Maximum variation from plumb in vertical lines, surfaces of columns, walls, and arrises:
 - .1 6.4 mm (1/4") in 3 m (10 ft)
 - .2 9.6 mm (3/8") in a storey height not to exceed 6 m (20 ft)
 - .3 12.7 mm (1/2") in 12 m (40 ft) or more
 - .2 Maximum variation from plumb for external corners, expansion joints, and other conspicuous lines:
 - .1 6.4 mm (1/4") in any storey or 6 m (20 ft)
 - .2 12.7 mm (1/2") in 12 m (40 ft) or more
 - .3 Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

Execution

- .1 6.4 mm (1/4") in any bay or 6 m (20 ft)
- .2 12.7 mm (1/2") in 12 m (40 ft) or more
- .4 Maximum variation from drawing location of columns, walls, and partitions:
 - .1 12.7 mm (1/2") in any storey or 6 m (20 ft)
 - .2 19 mm (3/4") in 12 m (40 ft) or more.
- .5 Maximum variation in cross-sectional dimension of columns and thicknesses of wall from dimensions indicated:
 - .1 Minus 6 mm (1/4")
 - .2 Plus 12.7 mm (1/2")
- .6 Maximum variation from plane or from straight:
 - .1 3.2 mm (1/8") in 3 m (10 ft) under a 3 m (10 ft) straight edge.
- .7 Maximum variation from angle indicated:
 - .1 10 seconds.
- .8 Tolerances shall be non-cumulative.

END OF SECTION

Cutting and Patching

PART 1 - GENERAL

1.1 Section Includes

- .1 Cutting, patching and remedial work.

1.2 Request for Cutting, Patching and Remedial Work

- .1 Submittal Items:
 - .1 Comply with administrative requirements of Section 01 33 00.
 - .2 Submit written request in advance of cutting, coring, and alteration that affects or is likely to affect:
 - .1 Structural integrity of any element of *Work*.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 *Owner* or work of other contractors.
 - .6 Warranty of *Products* affected.
 - .3 Include in request:
 - .1 Identification of *Project*.
 - .2 Location and description of affected work, including drawings or sketches as required.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed work, and *Products* to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on *Owner* or work of other contractors.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be performed.
 - .9 Non-destructive structural survey: Radiography (X-ray) imaging of work to be cut or cored.
- .4 Do not commence cutting, patching, or remedial work until request has been reviewed by *Consultant*.

PART 2 - PRODUCTS

2.1 Materials

- .1 Unless otherwise specified, when replacing existing or previously installed *Products* in the course of cutting and patching work, use replacement *Products* of the same character and quality as those being replaced.
- .2 If an existing or previously installed *Product* must be replaced with a different *Product*, submit request for substitution in accordance with Section 01 25 00.

Cutting and Patching

PART 3 - EXECUTION

3.1 Preparation

- .1 Inspect existing conditions in accordance with Section 01 71 00, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of the *Work*.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to maintain structural integrity of surroundings. Provide devices and methods to protect other portions of the *Work* from damage.
- .5 Provide protection from elements for areas which may be exposed by uncovering work.
- .6 Where uncovering of area exposes local deterioration, cracking, evidence of water infiltration, structural settlement, previous modifications, or other unexpected conditions, advise *Consultant* immediately in writing and leave conditions exposed until receipt of *Consultant's* written instructions. If area is exposed to the exterior, provide temporary protection from inclement weather.

3.2 Existing Services and Utilities

- .1 Protect, relocate, or maintain existing active services or utilities except where breaking into or connecting to them. When inactive services are encountered, cap off in a manner approved by authority having jurisdiction and stake or otherwise record location of capped service. Record location of services, including depth, on as-built drawings.
- .2 When breaking into or connecting to existing active services or utilities, execute the *Work* at times approved by *Owner*, with a minimum of disturbance to *Owner's* ongoing operations, the *Work*, and traffic. Give notice to authorities having jurisdiction as required by such authorities.
- .3 Keep duration of interruptions to a minimum.
- .4 Carry out interruptions outside regular working hours of occupants unless *Owner's* prior written approval is obtained.
- .5 Construct or erect barriers in accordance with Section 01 56 00 as required to protect pedestrian and vehicular traffic.

3.3 Cutting and Patching

- .1 Coordinate and perform the *Work* so that cutting and patching work is kept to a minimum.
- .2 Execute cutting, fitting, and patching to complete the *Work*. Under no circumstances will overcutting of corners of opening be accepted. Ensure corners of openings to be cut are predrilled or sawed.
- .3 Remove and replace defective and non-conforming work.
- .4 Remove samples of installed work for testing if directed by *Consultant*.
- .5 Provide openings in non-structural elements of the *Work* for penetrations of mechanical and electrical work.
- .6 Perform work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

Cutting and Patching

- .7 Employ qualified installer with at least 3 years of relevant experience to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Perform cutting, patching, and remedial work using competent and qualified specialists familiar with the *Products* affected, in a manner that neither damages nor endangers the *Work*.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed to be used anywhere within existing buildings unless approved by *Consultant*.
- .10 Restore work with new *Products* in accordance with requirements of *Contract Documents*.
- .11 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and with suitable allowance for deflection, expansion, contraction, and firestopping.
- .12 Enclose pipes, ducts, conduit and wires passing through floors at areas where faucets occur in a 100 mm (4") high metal sleeve and make air and watertight with water resistant firestopping.
- .13 Completely seal voids of penetrations of fire rated wall, ceiling, and floor constructions with firestopping and smoke seals.
- .14 Execute cutting, patching, and remedial work in manner that does not jeopardize manufacturers' warranties.
- .15 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection. Refinish entire assembly units.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 Waste management.
- .2 Storage, handling, and protection.
- .3 Coordination.
- .4 Cleaning.
- .5 Disposal of waste.

1.2 Waste Management

- .1 Comply with requirements of authorities having jurisdiction.
- .2 Remove waste material from the *Place of the Work* daily. If waste is collected in bins, bins to be removed from site once full.
- .3 Arrange and pay for removal of debris and waste from the *Place of the Work*.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris. Pay fees.

1.3 Storage, Handling and Protection

- .1 Store, materials to be reused, recycled and salvaged in locations to prevent contamination of materials being diverted from landfill.
- .2 Prevent contamination of materials to be salvaged and recycled, and handle such materials, in accordance with requirements for acceptance by designated facilities.

1.4 Coordination

- .1 Coordinate waste management and disposal procedures and requirements with other activities at the *Place of the Work* so that there is no delay in the *Work*, and at no increase in either the *Contract Time* or the *Contract Price*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 Cleaning

- .1 General cleaning requirements:
 - .1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws, and in accordance with GC 3.12.
 - .2 Store volatile wastes in covered metal containers, and remove from *Place of the Work* daily.
 - .3 Prevent accumulation of wastes which create hazardous conditions.
 - .4 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.

Cleaning and Waste Management

- .5 Prevent cross-contamination during the cleaning process.
- .6 Notify the *Consultant* of the need for cleaning caused by *Owner* or other contractors.
- .2 Materials:
 - .1 Use only cleaning materials in accordance with written requirements of manufacturer of surface to be cleaned and in accordance with written requirements of cleaning material manufacturer.
- .3 Cleaning during construction/progressive cleaning:
 - .1 Clean-up the *Place of the Work* daily. Maintain clean and clear egress routes at all times.
 - .2 Maintain *Place of the Work*, grounds and public properties free from accumulations of waste materials and rubbish.
 - .3 Provide appropriate, clearly marked containers at the *Place of the Work* for collection of waste materials and rubbish. Remove waste materials and rubbish from the *Place of the Work* when containers become full.
 - .4 Clean interior building areas prior to start of finish work and maintain free of dust and other contaminants during finishing operations.
 - .5 Vacuum and clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until *Substantial Performance of the Work*.
 - .6 Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces nor contaminate building systems.
 - .7 Promptly as the *Work* proceeds, on a daily basis and upon completion, clean up and remove rubbish, surplus materials and equipment.
 - .8 Remove as the work of this section progresses, corrosive and foreign materials which may set or become difficult to remove at time of final cleaning or which may damage members.
 - .9 Wash exposed surfaces with a cleaning solution approved by *Product* manufacturers.
 - .10 Debris and waste not permitted within cavities of *Work*.
- .4 Cleaning prior to *Ready-for-Takeover*:
 - .1 Immediately prior to *Consultant's* review to determine if *Ready-for-Takeover* has been achieved, perform cleaning in accordance with GC 3.12.2. Cleaning shall be to a sufficient extent to permit the *Consultant's* review to be performed properly and reasonably.
- .5 Final cleaning:
 - .1 Provide professional cleaning company for final cleaning.
 - .2 Before final cleaning, arrange a meeting at *Place of the Work* to determine the acceptable standard of cleaning. Ensure that cleaning company, *Owner*, *Consultant*, and *Contractor* are in attendance.

Cleaning and Waste Management

- .3 Remove from *Place of the Work* surplus *Products*, waste materials, recyclables, *Temporary Work*, and *Construction Equipment* not required to perform any remaining work and other than that caused by the *Owner*, and leave the *Work* clean and suitable for occupancy by *Owner*.
- .4 Remove waste material and debris from crawlspaces and other accessible concealed spaces.
- .5 Clean and polish prefinished and finished surfaces including: glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or otherwise damaged glass.
- .6 Clean exterior and interior window glass and frames.
- .7 Remove stains, spots, marks and dirt from decorative parts of the *Work*, electrical and mechanical fixtures, furniture fittings, walls, and floors.
- .8 Vacuum clean and remove dust from building interiors, exposed wall, floor, and ceiling surfaces, behind grilles, louvres, and screens, and above suspended ceiling tiles and panels. Vacuum clean interior of electrical equipment.
- .9 Clean floor finishes in accordance with manufacturer's written requirements.
- .10 Remove non-permanent labels.
- .11 Remove dirt and residue from surfaces.
- .12 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.
- .13 Remove protective coatings, clean surfaces and remove excess compounds and sealant materials. Make good defective, scratched or damaged work.
- .14 Clean equipment and fixtures to a sanitary condition,
- .15 Remove seal wrap and protective coverings from mechanical and electrical *Products* and materials and clean as required.
- .16 Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment.
- .17 Clean and/or replace lighting reflectors, lamps, light fixtures, lenses, bulbs, and other lighting surfaces, and grilles.
- .18 Clean architectural concrete to remove surface discolouration, efflorescence, and the like. Use a suitable cleaning agent which will not stain the surfaces or mar the texture.
- .19 Lock or otherwise restrict access to each room or area after completing final cleaning in that area.
- .20 Re-clean as necessary areas that have been accessed by *Contractor's* workers prior to *Owner* occupancy.

3.2 Disposal of Waste

- .1 Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each *Working Day*. Collect packaging materials for recycling or reuse.

Cleaning and Waste Management

- .2 Handle waste materials not reused, salvaged or recycled in accordance with appropriate regulations and codes.
- .3 Do not bury rubbish and waste materials at the *Place of the Work*.
- .4 Do not dispose of waste or volatile materials into waterways or storm or sanitary sewers.
- .5 Do not burn waste materials at the *Place of the Work*.
- .6 Comply with waste disposal requirements of authorities having jurisdiction.
- .7 Deliver to nearest appropriate depot materials accepted for recycling by region or municipality having jurisdiction over the *Place of the Work*, including but not limited to cardboard, paper, plastic, aluminum, steel, and glass. Deliver to nearest appropriate depot scrap and excess gypsum wallboard for recycling of this material. Costs for this work are included in the *Contract Price*.
- .8 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris. Pay fees.

END OF SECTION

Closeout Procedures

PART 1 - GENERAL

1.1 Section Includes

- .1 General *Contract* closeout procedures.
- .2 *Substantial Performance of the Work*.
- .3 *Ready-for-Takeover*.
- .4 Inspection and review before *Ready-for-Takeover*
- .5 Partial user occupancy.
- .6 Final inspection for completion of the *Contract*.
- .7 Warranty period.

1.2 General *Contract* Closeout Procedures

- .1 The procedures for completing *Contract* and acceptance by the *Owner* shall be in accordance with the methods described in OAA/OGCA Document 100 (July 1, 2018, and reissued January 8, 2019) and any additional requirements described below.
- .2 Stages will be reviewed at the *Contract* start-up meeting to ensure that parties understand their responsibilities. Refer to Section 01 31 19 for procedures and requirements for *Contract* start-up meeting.
- .3 Within 4 weeks of commencement of the *Work*, submit to the *Consultant* a list of closeout submittals required by the *Contract Documents*.

1.3 *Substantial Performance of the Work*

- .1 The prerequisites to, and the procedures for, attaining *Substantial Performance of the Work*, or similar such milestone as provided for in the Construction Act, shall be:
 - .1 As described in Section 01 77 00.
 - .2 Independent of those for attaining *Ready-for-Takeover* of the *Work*.
 - .3 In accordance with the Construction Act.
- .2 Deficiency review:
 - .1 Neither *Owner* nor *Consultant* will be responsible for preparation or issuance of extensive lists of deficiencies. *Contractor* assumes prime responsibility for ensuring that items shown and described in the *Contract Documents* are complete. Any reviews to approve the certificate of *Substantial Performance of the Work* will be immediately cancelled if it becomes obvious to the *Consultant* that extensive deficiencies are outstanding.
 - .2 The *Contractor* shall conduct an inspection of the *Work* to identify deficiencies and defects, which shall be repaired. When the *Contractor* considers that the *Work* is substantially performed, the *Contractor* shall prepare and submit to the *Consultant* a comprehensive list of items to be completed or corrected (the deficiency list) and apply for a review of the *Work* by the *Consultant* to determine if *Substantial Performance of the Work* has been achieved.

Closeout Procedures

- .3 The *Contractor's* request described above shall include a statement by *Contractor* that the *Work* to be reviewed by *Consultant* for deficiencies is, to the best of the *Contractor's* knowledge, in compliance with *Contract Documents*, reviewed *Shop Drawings*, and samples, and that deficiencies and defects previously noted by *Consultant* have been repaired.
- .4 No later than 10 *Working Days* after the receipt of the *Contractor's* request described above, but contingent upon the prior receipt, by the *Consultant*, of the closeout submittals in the manner and form specified in Section 01 78 00, the *Consultant* and the *Contractor* will review the *Work* to identify any defects or deficiencies. If necessary, the *Contractor* shall tabulate a list of deficiencies to be corrected prior to *Substantial Performance of the Work* being certified by the *Consultant*. During review, the *Consultant* and the *Contractor* will decide which deficiencies or defects must be rectified before *Substantial Performance of the Work* can be certified, and which defects are to be treated as warranty items.
- .5 Provide a schedule of planned deficiency review having regard to the foregoing.
- .3 Certification of *Substantial Performance of the Work*:
 - .1 When the *Consultant* considers that the deficiencies and defects have been completed and that it appears that the requirements of the *Contract Documents* have been substantially performed, the *Consultant* shall issue a certificate of *Substantial Performance of the Work* to the *Contractor*, stating the date of *Substantial Performance of the Work*.
 - .2 The certificate of *Substantial Performance of the Work* shall be prepared and issued in accordance with the Construction Act.
 - .1 Inform *Owner*, *Consultant*, *Subcontractors*, and *Suppliers* which publication is to be used for publishing certificate of substantial performance in accordance with Section 01 31 19.

1.4 **Ready-for-Takeover**

- .1 The prerequisites to attaining *Ready-for-Takeover* of the *Work* are described in the General Conditions of the *Contract*.

1.5 **Inspection and Review Before Ready-for-Takeover**

- .1 *Contractor's* Inspection: Before applying for the *Consultant's* review to establish *Ready-for-Takeover* of the *Work*:
 - .1 Ensure that the specified prerequisites to *Ready-for-Takeover* of the *Work* are completed.
 - .2 Conduct an inspection of the *Work* to identify defective, deficient, or incomplete work.
 - .3 Prepare a comprehensive and detailed list of items to be completed or corrected.
 - .4 Provide an anticipated schedule and costs for items to be completed or corrected.

Closeout Procedures

- .2 *Consultant's Review*: Upon receipt of the *Contractor's* application for review, together with the *Contractor's* list of items to be completed or corrected, the *Consultant* will review the *Work*. The *Consultant* will advise the *Contractor* whether or not the *Work* is *Ready-for-Takeover* and will provide the *Contractor* with a list of items, if any, to be added to the *Contractor's* list of items to be completed or corrected. Provide the *Consultant* with a copy of the *Contractor's* revised list.
- .3 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. The *Contractor's* inspection and *Consultant's* review procedures specified above shall be repeated until the *Work* is *Ready-for-Takeover* and no items remain on the *Contractor's* list of items to be completed or corrected.
- .4 When the *Consultant* determines that the *Work* is *Ready-for-Takeover*, the *Consultant* will notify the *Contractor* and the *Owner* in writing to that effect.

1.6 Partial User Occupancy

- .1 If partial *Owner* occupancy of a part of the *Work* is required before the date of *Ready-for-Takeover* of the entire *Work* of the *Contract*, the provisions of this Section shall apply, to the extent applicable, to that part of the *Work* that the *Owner* intends to occupy.

1.7 Final Inspection for Completion of the Contract

- .1 Deficiencies and defects shall be made good before the *Contractor* submits a written request for final review of the *Work* and before the *Contract* is considered complete.
- .2 When *Contractor* is satisfied that the *Work* is complete, and after the *Contractor* has reviewed the *Work* to verify its completion in accordance with the requirements of the *Contract Documents*, the *Contractor* shall submit a written request for a final review by the *Consultant*, who in turn will notify the *Owner*.
- .3 If there are any deficiencies identified as a result of this review, they shall be listed by the *Consultant* and submitted to the *Contractor*. This list shall be recognized as the final deficiency list for purposes of acceptance of the *Work* under the *Contract*.
- .4 Such deficiencies shall be corrected by a date mutually agreed upon between *Consultant* and the *Contractor*, unless a specific date is required by *Contract*, and a further review by the *Consultant* shall be called for by the *Contractor* following his own review to take place within 7 days from date of request.
- .5 *Contractor* shall thereafter submit invoice for final payment.
- .6 Money withheld for deficiency work shall be released only when all deficiencies have been completed. No partial payment to be recognized until all work is completed.

1.8 Warranty Period

- .1 Provide on-going review and attendance to building call-back, maintenance and repair problems during the warranty periods.
- .2 At the beginning of the 12th month after *Substantial Performance of the Work*, the *Owner*, *Contractor* and *Consultant*, along with key *Subcontractors* as designated, shall carry out a complete review of building and its systems to determine which deficiencies are to be rectified under the warranty. *Contractor* shall be responsible for timely written notification of *Owner*, and *Consultant* prior to such end of warranty period inspection and any delay in such notification shall extend such warranty period until proper notification is received by *Owner*, and *Consultant*.

Closeout Procedures

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 As-built documents.
- .2 Record drawings.
- .3 Operation and maintenance manuals.
- .4 Operation and maintenance book.
- .5 *Project* data book.
- .6 Shop drawing book.
- .7 Warranty book.
- .8 Posted operating instructions.
- .9 Spare parts, maintenance materials, and special tools.

1.2 Administrative Requirements

- .1 Collect reviewed submittals, and assemble required closeout submittals executed by *Subcontractors*, *Suppliers*, and manufacturers. Prior to submitting closeout submittals to the *Consultant*:
 - .1 Review maintenance manual contents (operating, maintenance instructions, as-built drawings, materials) for completeness.
 - .2 Review supply and completeness of spare parts required by *Contract Documents* and manufacturers.
 - .3 Review in relation to *Contract Price*, *Change Orders*, *Change Directives*, holdbacks and other adjustments to the *Contract Price*.
 - .4 Review inspection and testing reports to verify conformance to intent of *Contract Documents* and that changes, repairs or replacements have been completed.
 - .5 Execute transition of performance bond and labour and materials payment bond to warranty period requirements.
 - .6 Submit a final statement of accounting giving total adjusted *Contract Price*, previous payments, and monies remaining at time of application for completion of the *Contract*. *Consultant* will issue a final change order reflecting approved adjustments to *Contract Price* not previously made.
- .2 No later than 10 *Working Days* prior to submitting request for *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved, submit to the *Consultant* the closeout submittals specified in this section and elsewhere in the *Contract Documents*.
- .3 For equipment put into use with *Owner's* permission during the *Work*, submit required closeout submittals within 10 *Working Days* after start-up.
- .4 For items of the *Work* delayed materially beyond date of *Substantial Performance of the Work*, provide updated closeout submittals within 10 *Working Days* after acceptance, listing date of acceptance as start of warranty period.

Closeout Submittals

- .5 Neither the *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved, nor acceptance of the *Work*, will take place until receipt, by the *Consultant*, of acceptable copies of the closeout submittals required herein and by the *Contract Documents*.

1.3 As-Built Documents

- .1 Prepare as-built documents in accordance with Section 01 32 00.
- .2 Submit as-built documents as follows:
 - .1 Submit 4 sets of as-built documents in hard copy.
 - .1 In addition, submit digital scanned copy as a bookmarked PDF of as-built documents. Submit using digital storage medium or transfer process acceptable to the *Consultant* and the *Owner*.

1.4 Operation and Maintenance Manuals

- .1 Prepare a comprehensive operation and maintenance manual, in the language of the *Contract*, using personnel qualified and experienced for this task.
- .2 Submit an initial draft of the operation and maintenance manual for *Consultant's* review. If required by *Consultant's* review comments, revise manual contents and resubmit for *Consultant's* review. If required, repeat this process until *Consultant* accepts the draft manual in writing.
- .3 Submit operation and maintenance manuals as follows:
 - .1 Submit 4 copies of operation and maintenance manuals in hard copy.
 - .2 In addition, submit digital copies ("PDF" files) of operation and maintenance manuals. Submit using digital storage medium or transfer process acceptable to the *Consultant* and the *Owner*.

1.5 Operation and Maintenance Manual Format

- .1 Organize operation and maintenance manuals into the following general components:
 - .1 Operation and maintenance book.
 - .2 *Project* data book.
 - .3 Shop drawing book.
 - .4 Warranty book.
- .2 Organize data in the form of an instructional manual.
- .3 Bind each general component of the operation and maintenance books in separate vinyl hard covered, 3 ring loose leaf binders.
- .4 Enclose title sheet, labelled as applicable, with project name, date and list of contents.
- .5 Organize contents into applicable sections of work to parallel project *Specifications* breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .6 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

Closeout Submittals

- .7 Cover: Identify each binder with typed or printed title "Operation and Maintenance Manual", name of *Project* or facility, and subject matter of contents.
- .8 Text: Manufacturer's printed data, or typewritten data.

1.6 Operation and Maintenance Book

- .1 Operation and maintenance books shall contain operating and maintenance data and information specified below for supplied *Products*.
- .2 Neatly type lists and notes. Use clear drawings, diagrams of manufacturers' literature.
- .3 Each Item of Equipment and Each System: include description of unit or system and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .4 Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.
- .5 Include installed colour coded wiring diagrams.
- .6 Description, operation and maintenance instructions for equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number.
- .7 Operating Procedures: include start up, break in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .8 Maintenance Requirements: include routine procedures and guide for trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .9 Provide servicing and lubrication schedule, and list of lubricants required.
- .10 Include manufacturer's printed operation and maintenance instructions.
- .11 Include sequence of operation by controls manufacturer.
- .12 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .13 Provide installed control diagrams by controls manufacturer.
- .14 Provide *Contractor's* coordination drawings, with installed colour coded piping diagrams.
- .15 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .16 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .17 Include testing and balancing reports.
- .18 Include additional content as specified in technical *Specifications* sections.

1.7 Project Data Book

- .1 *Project Data Book* shall include the following information supplemented by additional required data specified elsewhere in the *Contract Documents*:
 - .1 Maintenance instructions for finished surfaces and materials.

Closeout Submittals

- .2 Copy of hardware and paint schedules.
- .3 Names, addresses and phone numbers of *Subcontractors* and *Suppliers*, as applicable.
- .4 Additional material used in the *Work* listed under various sections showing name of manufacturer and source of supply.
- .5 Report recording demonstration and instruction provided to *Owner* for operation and maintenance of building systems as described in Section 01 79 00.
- .6 Key construction photos.
- .7 Permits and forms:
 - .1 Certificate of Clearance from the Workplace Safety and Insurance Board (WSIB).
 - .2 Certificates of approval of the *Work* by local building department (if available).
 - .3 Electrical authority certificate of inspection.
- .8 Waste management and disposal reports, prepared in accordance with Section 01 74 00.

1.8 Shop Drawing Book

- .1 Submit one copy of each final accepted *Shop Drawings* issued for the *Work* on which have been recorded changes made during fabrication and installation caused by unforeseen conditions.
- .2 Engineered *Shop Drawings* shall include copies of the certificate of insurance, the engineer's field review reports, and the engineer's letters of general conformity that were provided as part of the engineered submittal in accordance with Section 01 33 00 appended to the pertinent engineered *Shop Drawings* in the shop drawing manual.

1.9 Warranty Book

- .1 Submit copies of bonds, guarantees, warranties and extended warranties together, complete with an indexed summary list of warranties and expiration dates. Warranties to be in accordance with Section 01 78 36.
- .2 Separate each warranty with index tab sheets keyed to Table of Contents listing.
- .3 List each warrantor with complete contact information.
- .4 Verify that documents are in proper form and contain full information. Warranties shall be for the correct duration and shall be in *Owner's* name.
- .5 Include maintenance bond(s).

1.10 Posted Operating Instructions

- .1 Prepare operating instructions in English for posting near equipment and systems. Posted instructions to be glass covered, framed and mounted.
- .2 Posted instructions to consist of simplified, consolidated equipment, control and power diagrams graphically representing the entire system, including concise instructions on how to start and stop systems, what settings and conditions are to be observed by the operators, and what control adjustments are to be made or maintained by the operator.

Closeout Submittals

- .3 Posted instructions shall include control diagrams with added specific operating instructions, controls, interlocks, and the like.
- .4 Posted instructions shall include:
 - .1 HVAC controls for each system.
 - .2 One line schematic diagrams of water supply.
 - .3 One line isometric diagrams of sanitary drainage.
 - .4 One line diagrams of steam distribution, hot and cold water systems, including risers, valves, control devices, etc.

1.11 Spare Parts, Maintenance Materials, and Special Tools

- .1 Provide overage, extra stock, and maintenance materials, including keys, in quantities specified in the *Contract Documents*.
- .2 Submit to *Consultant* a typed inventory list of maintenance materials prior to application for *Substantial Performance of the Work*. List all items, complete with quantities, and storage locations. Include *Consultant* reviewed inventory listing in final submission to *Owner*.
- .3 Prepare and submit a master list identifying maintenance materials and maintain a log of when materials are turned over to *Owner* and signing authority for acceptance of materials on behalf of *Owner*.
- .4 Provide tags for special tools identifying their function and associated *Product*.
- .5 Supply spare parts, maintenance materials, and special tools in quantities specified in technical *Specifications* sections.
- .6 Ensure spare parts and maintenance materials are new, not damaged nor defective, and of same quality, manufacturer, and batch or production run as installed *Products*.
 - .1 Replace incorrect or damaged maintenance materials.
- .7 Deliver to and store items at location and time directed by *Owner*. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.
 - .1 Clearly mark cartons or packaging as to contents, project name, and *Supplier*.
 - .2 If applicable give colour and finish, room number or area where material is used.
 - .3 Include necessary information for re-ordering of materials as part of packaging of materials.
- .8 Catalogue all items and submit to *Consultant* an inventory listing organized by *Specifications* section. Include *Consultant* reviewed inventory listing in operation and maintenance manual.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Warranties

PART 1 - GENERAL

1.1 Warranties

- .1 Warranties shall be in accordance with GC 12.3, as amended.

1.2 Extended Warranties

- .1 Extended warranties shall be in accordance with GC 12.3, as amended, and as follows:
 - .1 Where specifically identified in the *Contract Documents*, extended warranties shall be furnished by individual manufacturer for particular product/system/assembly.
 - .2 Extended warranties shall include for proper performance of the portion of the *Work* as defined by the scope of the applicable *Specifications* section to the extent that the design and *Contract Documents* permit such performance.
 - .3 The *Owner* shall promptly give the warrantor notice in writing of observed defects and deficiencies which occur during the warranty period.
 - .4 Extended warranties shall commence at date of *Substantial Performance of the Work*.
 - .5 Extended warranties specified shall be in addition to, and run concurrent with, other warranties required by the *Contract Documents*. Manufacturer's disclaimers and limitations on product warranty do not relieve *Contractor* of obligations under requirements of the *Contract Documents*.
 - .6 Submit extended warranty on warrantor's standard form specifically endorsed by the warrantor to the *Owner* and shall include the following information:
 - .1 Name and address of *Project*.
 - .2 Warranty commencement date.
 - .3 Warranty period.
 - .4 Specific warranty terms as required in applicable portion of *Contract Documents*.
 - .5 Name and title of authorized signing officer and seal of warrantor.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

Demonstration and Training

PART 1 - GENERAL

1.1 Section Includes

- .1 Systems demonstration and training.

1.2 Preparation

- .1 Prior to scheduling demonstration and training:
 - .1 Review condition of equipment or systems for which demonstration and training is required and that have been used in the course of the *Work* to ensure turning over at completion in "as new condition", with warranties dated and certified from time specified.
 - .2 When partial occupancy of uncompleted project is required by *Owner*, coordinate *Owner's* uses, requirements, access, and the like, with requirements to complete the *Work*.

1.3 Submittals

- .1 Submit proposed dates, times, durations, and locations for demonstration and training of each item of equipment and each system for which demonstration and training is required. Allow sufficient time for training and demonstration for each item of equipment or system, or time as may be specified in technical *Specifications*.
 - .1 Correlate with construction schedule in accordance with Section 01 32 00.
- .2 *Consultant* and *Owner* will review submittal and advise *Contractor* of any necessary revisions.
- .3 Submit report(s) within 5 *Working Days* after completion of demonstration and training:
 - .1 Identifying time and date of each demonstration and training session.
 - .2 Summarizing the demonstration and training performed.
 - .3 Including a list of attendees.

1.4 Demonstration and Training

- .1 Perform system demonstration work no later than 15 *Working Days* prior to submitting request for *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved.
 - .1 Provide *Owner* with 5 *Working Days* prior written notice of dates scheduled for demonstration and training.
- .2 Submit required certificates of approval or acceptance from authorities having jurisdiction.
- .3 Prerequisites to demonstration and training:
 - .1 Testing, adjusting, and balancing has been performed in accordance with *Contract Documents*.
 - .2 Equipment and systems are fully operational.
 - .3 Copy of completed operation and maintenance manual is available for use in demonstration and training.

Demonstration and Training

- .4 Conditions for demonstration and training comply with requirements specified in technical *Specifications*.
- .4 Demonstration and training:
 - .1 Demonstrate and provide training to *Owner's* personnel.
 - .2 Instruct *Owner's* personnel in operation and maintenance of equipment and systems, using operation and maintenance data provided as the basis for instructions. Arrange and coordinate instruction of *Owner's* staff in care, maintenance, and operation of building systems and finishes
 - .3 *Contractor*, manufacturer's representatives, and responsible personnel from *Subcontractors* whose work is being demonstrated shall be present at these demonstrations, as well as *Owner's* personnel.
 - .4 *Owner* shall provide list of personnel to receive training and shall coordinate their attendance at agreed upon times.
 - .5 Demonstration shall include start up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment and system.
 - .6 Review operation and maintenance manual in detail to explain all aspects of operation and maintenance.
 - .7 Instruct *Owner's* representative on use of software required for operation and maintenance of building systems and provide a toll-free telephone number or website address for further assistance to the *Owner*.
 - .8 Prepare and insert additional data in the operation and maintenance data manuals when the need for additional data becomes apparent during demonstration or instruction.
- .5 Correct deficiencies and defects identified during demonstration, instruction, or commissioning.
- .6 Attend 'end-of-work' testing and break-in or start-up demonstration.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1- GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Demolition and removal of selected non-structural portions of building.
 - .2 Salvage:
 - .1 Salvage of designated items to be reused or recycled.
 - .3 Removal of surplus materials from the *Place of the Work*.
 - .4 Related mechanical and electrical work and demolition requirements are covered under Divisions 21, 22, and 23 and Divisions 26, 27, and 28 respectively.
- .2 Section excludes:
 - .1 Demolition, removal, remediation, or abatement of designated substances or materials and toxic and hazardous substances.

1.2 Administrative Requirements

- .1 Pre-demolition meeting:
 - .1 Schedule a pre-demolition meeting following the procedures specified for pre-installation meetings in accordance with Section 01 31 19.
 - .2 Review existing conditions at the *Place of the Work* thoroughly to establish full extent of items to be removed and items to remain. Commencement of demolition work will be considered to be acceptance of existing conditions at the *Place of the Work* and removal of such items.
 - .3 Examine adjacent properties to determine extent of protection required.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Special procedures submittals:
 - .1 Inventory of items to be salvaged:
 - .1 Prepare typed inventory of units to be salvaged and cross-reference to drawing showing existing elevations and ceiling plans.
 - .2 Submit inventory following procedures for submittal of *Shop Drawings* in accordance with Section 01 33 00.

1.4 Quality Assurance

- .1 Qualifications:
 - .1 *Subcontractor*:
 - .1 Shall have 5 years' specialized demolition experience, minimum.
 - .2 Shall be able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 Examination

- .1 Verify that utilities have been disconnected and capped.
- .2 Observe existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .4 When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to *Consultant*.
- .5 Survey of existing conditions: Record existing conditions by use of photographs in accordance with Section 01 32 33.

3.2 Utility Services and Mechanical / Electrical Systems

- .1 Refer to Divisions 21, 22, and 23 and Divisions 26, 27, and 28 respectively.

3.3 Selective Demolition, General

- .1 Demolish and remove existing construction only to the extent required by new construction, and as otherwise indicated. Use methods required to complete the work within limitations of governing regulations and as follows:
 - .1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - .2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - .3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - .4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - .5 Maintain adequate ventilation when using cutting torches.
 - .6 Remove decayed, infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - .7 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - .8 Dispose of demolished items and materials promptly.

Demolition

- .2 Dispose of demolished materials from *Project* site except where noted otherwise and in accordance with authorities having jurisdiction. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- .3 Do not sell demolished material at the *Place of the Work*.
- .4 Clean existing surfaces specified to receive new applied finishes to assure proper adherence.

3.4 Salvage

- .1 Remove and store items indicated or directed for salvage. Remove, handle and transport such items to storage area designated in the *Contract Documents*, to an area within the *Place of the Work* designated by *Consultant*, or to an area away from the *Place of the Work* as directed by the *Consultant*. Perform such work to prevent damage to the items during removal and in storage.
- .2 The *Owner* shall review *Place of the Work* prior to commencement of demolition and instruct the *Contractor* of the items to be retained for re-use or be turned over to the *Owner*.
- .3 Remove and store indicated items for future use by *Owner*. Remove, handle and transport such items to storage area indicated in the *Contract Documents* or to an area within the *Place of the Work* designated by *Consultant*. Perform such work carefully and with diligence to prevent any damage to the items during removal and in storage.

3.5 Protection

- .1 Protect work to remain against damage. Repair or replace damaged work at no additional cost to the *Owner*.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Work of this section includes architectural metal fabrications and related metals identified on the drawings.

1.2 Administrative Requirements

- .1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Submit engineered shop drawings.
 - .2 Submit a list of fabrications to be provided as part of the work of this section.
 - .3 Include plans, sections and large scale details, exposed-to-view edge conditions.
 - .4 Indicate materials, including material characteristics, profiles of each metal fabrication member, methods of assembly and joinery, fittings, fastenings, finishes, anchorages, welds, solders, brazing, and their structural characteristics relative to their purpose, accessory items, and other fabrication information required.
 - .5 Indicate proposed *Place of the Work* connections and methods.
 - .6 Submit coordination drawings indicating locations of concealed grounds, cutouts, plates, and other required fabrications.
 - .7 Show relation to adjoining construction, details of outside and inside corners and door openings.
- .4 Samples:
 - .1 Submit 3 sets of samples of architectural metals and shop finished materials, show each type of finish and colour, 200 mm x 200 mm (8" x 8") size.
 - .2 Provide samples of welded joints showing quality of workmanship.
 - .3 Provide fastener samples for each type required.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Manual shall include detailed maintenance and cleaning procedure for materials and finishes requiring specific care, noting particularly those procedures or materials which will cause damage to finished surfaces.

1.5 Quality Assurance

.1 Qualifications:

.1 Installers / applicators / erectors:

.1 *Subcontractor*, shop foreperson, and *Place of the Work* installation foreperson:

- .1 Have adequate plant, equipment, and skilled tradespersons to perform work expeditiously.
- .2 Has successfully completed installations similar to that specified during a period of at least the immediate past 10 years.
- .3 Fabricators shall have experience working with all metal types specified in this section.

.2 Provide separation of stainless steel or non-ferrous metals fabrication areas from mild steel fabrication areas.

.3 Grinders, wire brushes, and tools used on stainless steel or non-ferrous metals shall be free of materials which will leave or produce dissimilar material or metal oxides deposits. Tools previously used on mild steel shall not be used on stainless steel or non-ferrous metal work.

.4 Do not bring iron or mild steel surfaces into contact with stainless steel or non-ferrous metals, including lifting tools, steel tables, storage racks, and other storage and handling equipment.

.5 Cutting or grinding debris from iron or mild steel materials shall not be permitted to settle on stainless steel or non-ferrous materials and fabrications.

.6 Perform water-wetting and drying tests during finishing indicating free iron on finished stainless work in accordance with ASTM A380-06.

1.6 Delivery, Storage, and Handling

.1 Label, tag or otherwise mark work supplied for installation by other sections to indicate its function, location in building and shop drawing designation.

.2 Metals subject to corrosion during handling and storage shall be protected from exterior and adverse conditions to preserve finish.

.3 Deliver work to location at the *Place of the Work* designated by *Contractor* and to meet requirements of construction schedule.

.4 For metalwork items which are susceptible to damage from construction activities provide strippable temporary protective film on factory finished or prefinished surfaces before shipping.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 Design, fabricate, and install work of this section in accordance with the building code and requirements of authorities having jurisdiction.

.2 Welding:

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- .1 Steel: Weld components to conform to requirements of CSA W59-18, and by a fabricator fully certified by the Canadian Welding Bureau to conditions of CSA W47.1-19 and CSA W55.3-08 (R2018) as applicable.
- .3 Design assemblies and connections to withstand own dead load, super-imposed dead loads, live load, and fabrication forces, without permanent distortions or deformation, to maximum allowable deflection of $L/360$, within the following construction tolerances:
 - .1 Edges and surfaces shall be uniform for like metalwork.
 - .2 Limit inconsistencies in edge and surfaces to those which can be identified when viewed from distance of not greater than 300 mm (12").
 - .3 Surfaces of panels shall be flat and free of distortion when viewed from any distance or angle from surface.
 - .4 Finish shall be uniform when viewed from any distance from surface or from like surfaces which are viewed from within the same viewing area.
 - .5 Limit variations from plumb and level:
 - .1 3.2 mm in 6096 mm (1/8" in 20'-0") vertically and horizontally.
 - .2 6.4 mm in 12192 mm (1/4" in 40'-0") either direction.
 - .6 Limit offsets in theoretical end-to-end and edge-to-edge alignment:
 - .1 1.6 mm (1/16") where surfaces are flush or less than 12.7 mm (1/2") out of flush and separated by not more than 50 mm (2").
 - .2 3.2 mm (1/8") for surfaces separated by more than 50 mm (2").
 - .7 Step in face: 1.6 mm (1/16") maximum.
 - .8 Jog in alignment: 1.6 mm (1/16") maximum.
 - .9 Location: 6.4 mm (1/4") maximum deviation of any member at any location.
 - .10 Tolerances are not cumulative.
- .4 Comply with NAAMM AMP 555-92 – Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).

2.2 Materials

- .1 General:
 - .1 Unless detailed or specified otherwise, standard *Products* will be acceptable if construction details and installation meet requirements of the *Contract Documents*.
 - .2 Include materials, *Products*, accessories, and supplementary parts necessary to complete assembly and installation of work of Section 05 50 10.
 - .3 Incorporate only metals that are free from defects that are visible, or that impair strength or durability. Install only new metals that are of best quality, free from rust or waves and buckles, clean, straight, with sharply defined profiles.
- .2 Steel:
 - .1 Structural shapes, plate, bars: hot-rolled, in accordance with CSA G40.21-13, Grade 300W.

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- .2 Hollow structural sections: hot-formed, seamless, in accordance with CSA G40.21-13, Grade 350W, Class H.
- .3 Mild steel sheet and strip: hot rolled, in accordance with ASTM A1011/A1011M-14, Commercial.
- .4 Cold rolled sheet: stretcher levelled, fully pickled, in accordance with ASTM A1008/A1008M-13, Grade CS Type A exposed, matte finish, oiled, unless otherwise indicated.
- .5 Steel pipe: in accordance with ASTM A53/A53M-12, Type E or S, Grade A or B, standard weight, Schedule 40 seamless black or AISI MT 1010/1015.

2.3 Accessories

- .1 Fasteners:
 - .1 Exposed fasteners to match the material surface on which they occur.
 - .2 For fastening steel: Zinc plated screws and bolts, and in accordance with ASTM A307-21, Type 304 stainless steel where exposed to exterior.
 - .3 High strength bolts: in accordance with ASTM A325-14.
 - .4 Other types of fasteners as appropriate to meet design requirements.
 - .5 Fasteners shall be tamperproof where exposed.
- .2 Welding materials:
 - .1 Steel: in accordance with CSA W59-18.
- .3 Grout:
 - .1 Epoxy grout; non-shrink, non-expanding.
 - .1 Acceptable *Products*:
 - .1 Hilti 'HY-200'.
 - .2 Sika 'Sika AnchorFix 3001'.
 - .3 W.R. Meadows 'REZI-WELD 3/2 EPOXY GROUT/PATCH'.
 - .2 Cementitious grout: non-shrink, non-expanding to ASTM C1107/C1107M-20:
 - .1 Acceptable *Products*:
 - .1 Sika 'Sika Grout 212' or 'Sika M-Bed Standard'.
 - .2 W.R. Meadows 'Sealtight CG-86 Construction Grout'.
 - .3 Substitutions: in accordance with Section 01 25 00.
 - .2 Dielectric separator: Best grade, quick drying non-staining alkali resistant bituminous paint in accordance with CAN/CGSB 1.108-M89, or membrane type to acceptance of *Consultant*.

2.4 Finishes

- .1 Shop primer; premium quality:
 - .1 Acceptable *Product*:

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- .1 Sherwin Williams 'Pro Industrial Pro-Cryl Universal Primer', 0.0076 mm (3 mils) DFT.
- .2 Zinc rich paint; steel: Two-component zinc-rich coating, zinc powder to ASTM D520-00(2019) Type III, SSPC-Paint 20, Type 1 Inorganic or single-component zinc-rich coating to SSPC-Paint, Type 2 Organic, CAN/CGSB 1.181-M99, VOC content <100 g/l to ASTM-D1475.
 - .1 Acceptable *Products*:
 - .1 Aervoe Industries, Inc. 'Low VOC Cold Galvanize Coating 93% Zinc'.
 - .2 ZRC Worldwide 'ZRC Zero-VOC Galvanizing Compound'.
 - .3 Substitutions: in accordance with Section 01 25 00.
 - .3 Hot dip galvanizing: for irregular sections, in accordance with ASTM A123/A123M-13, minimum zinc coating of 600 g/m². Use air cooling method (no water or chromate dipping treatment permitted).
 - .4 Field painting: in accordance with Section 09 91 00.

2.5 Fabrication

- .1 General:
 - .1 Fabricate architectural metal fabrications with machinery and tools specifically designed for the intended manufacturing processes and by skilled tradesmen.
 - .2 Fit and assemble architectural metal fabrications in shop. When this is not possible, make a trial shop assembly.
 - .3 Incorporate means for fastenings of other work secured to work of this section.
- .2 Construction:
 - .1 Fabricate with materials, component sizes, metal thicknesses (gauges), reinforcing, anchors, and fasteners of adequate strength to withstand intended use, and within allowable design factors imposed by jurisdictional authorities. Fabricate items from steel unless otherwise noted.
 - .2 Architectural metal fabrications shall remain free of warping, buckling, opening of joints and seams, distortion, and permanent deformation to expansion and contraction forces and loads.
 - .3 Construct items that are part of floor construction, such as gratings and trench covers, to support the same live loads for which surrounding construction is designed.
- .3 Assembly:
 - .1 Accurately cut, machine and fit joints, corners, copes and mitres so that junctions between components fit together tightly and in true planes.
 - .2 Corners shall be mitred unless otherwise noted.
 - .3 Fasten work with concealed methods unless otherwise indicated.
 - .4 Weld connections where possible, bolt where not possible, and cut off bolts flush with nuts. Countersink bolt heads, and provide method to prevent loosening of nuts. Ream holes drilled for fastenings.

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- .1 Except where exposed to view:
 - .1 Finish welds shall comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter as shown in NAAMM AMP 521.
- .2 Where exposed to view:
 - .1 Weld behind finished surfaces without distorting or discolouring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Joint Finish Guidelines", for "Finish #1 - no evidence of a welded joint".
- .5 Allow for differential movements within assemblies and at junctions of assemblies with surrounding work.
- .6 Field welding of hot dipped galvanized members permitted only when other fastening methods are not possible. Locations of field welds to be clearly identified on shop drawings.
- .7 Incorporate holes and connections for work installed under other sections.
- .8 Cleanly and smoothly finish exposed edges of materials including holes.
- .9 Cap open ends of sections exposed to view, such as pipes, channels, angles, and other similar work.
- .4 Shop prime painting; premium quality:
 - .1 Clean loose mill scale, rust, dirt, weld flux and spatter from work after fabrication.
 - .2 Clean and prepare surfaces to meet specified requirements of SSPC SP-6 and paint manufacturer's installation requirements.
 - .3 Apply primer in accordance with paint manufacturer's installation requirements.
- .5 Galvanizing:
 - .1 Galvanize metal fabrications following fabrication.
 - .2 Paint damaged galvanized surfaces with zinc rich paint, immediately following damage to galvanized protection. Prepare substrate to remove oil and grease to SSPC-SP1-16, rust scale to SSPC-SP3-18, mill scale to SSPC-SP6/NACE No. 3-07.
 - .3 At interior locations, fill vent and drain holes exposed in the finished *Work*, by plugging with zinc solder and filing off smooth.
- .6 Fabrications exposed to view:
 - .1 Fabrications exposed to view shall be of the highest architectural quality, free of scratches, pitting, roughness, marring, discolouration, seams, staining and other imperfections with the quality of workmanship conforming to the workmanship classifications of Class 1 as defined in NAAMM-AMP 555-92, paragraph 8.3 of Section 8, Quality Control or Assurance and as follows:
 - .1 Exposed surfaces are finished smooth with pits, mill marks, nicks and scratches filled or ground off. Defects shall not show when painted or polished. Remove sharp corners and edges.

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- .2 Conceal welds where possible. Where exposed, grind welds to small radius with uniform sized cove. Welds shall appear continuous in appearance. When painted or polished welds shall be undetectable.
- .3 Use only flat head countersunk bolts in exposed locations unless indicated otherwise.
- .4 Distortions shall not be visible to the eye.
- .5 Exposed joints shall be fitted to hairline finish.
- .2 Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- .3 Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- .4 Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the work.
- .5 Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- .6 Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1 mm (0.040") unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- .7 Mill joints to a tight, hairline fit. Cope or mitre corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- .8 Surface preparation; non-ferrous metals: Remove tool and die marks and stretch lines, or blend into finish. Grind and polish surfaces to produce uniform finish, free of cross scratches. Run grain of directional finishes with long dimension of each piece.

PART 3 - EXECUTION

3.1 Examination

- .1 Take measurements at the *Place of the Work* to verify that architectural metal fabrications fit surrounding construction, around obstructions and projections in place, or as indicated, and to suit service locations.
- .2 Inspect surfaces on which work of this section is dependent for any irregularities detrimental to installation and performance of the work of this section. Confirm conditions are satisfactory before proceeding.

3.2 Installation

- .1 Install work plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding Work and as required for proper performance.

Architectural Metal Fabrications

- .2 Supply and install anchor bolts, high tensile bolts, washers and nuts, expansion bolts, toggles, straps, sleeves, brackets, clips, and other items necessary for secure installation as required by loading and jurisdictional authorities.
- .3 Countersink holes at wood screws where wood is attached to work of this section.
- .4 Attach metal fabrications to interior concrete and masonry with corrosion resistant expansion bolts to support load with a safety factor of 3.
- .5 Insulate between dissimilar metals, between metal and masonry, and between metal and concrete with bituminous paint to prevent electrolytic action.
- .6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .7 Erect members and component parts plumb, level and true to building lines, in correct relation to work of other sections and established lines, curves and levels indicated.
- .8 Securely anchor metal framing to concrete by means of anchor rods with epoxy adhesive, shim and pack to true straight lines and levels.
- .9 Field welding:
 - .1 Comply with applicable specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections given above in this section.
 - .2 Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- .10 Field painting: in accordance with Section 09 91 00.

3.3 Field Quality Control

- .1 Conduct quality control in accordance with Section 01 45 00.

3.4 Adjusting and Cleaning

- .1 After erection, touch up primed surfaces that are burned, scratched or otherwise damaged with prime paint to match shop paint.
- .2 Repair areas of bare metal and welds on galvanized surfaces with zinc rich paint.
- .3 Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new.
- .4 Clean and polish surfaces after installation is complete. Use only materials that will not scratch or mar finished surfaces and as approved by material manufacturers.

END OF SECTION

Rough Carpentry

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 The work of this section includes, but is not necessarily limited to, the following:
 - .1 Plywood backing panels.
 - .2 Wood grounds, nailers, blocking and sleepers.

1.2 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Shop drawings:
 - .1 Clearly indicate details of construction, profiles, jointing, fastening and other related details.
- .3 Certificates:
 - .1 Pressure treated lumber and plywood shall be accompanied by supplier's certificate of conformance with this specification.

1.3 Delivery, Storage, and Handling

- .1 When it is required that wood maintain dimensional stability and tolerances to ensure accurate installation of later work, store and install it only in dry areas, and where no further installation of moist materials is contemplated.

PART 2 – PRODUCTS

2.1 Sustainable Design Requirements

- .1 Wood products used in work of this section shall be Forestry Stewardship Council (FSC) Certified, with chain of custody verification, except for products made with recycled material.
- .2 Wood-based materials are to contain no added urea-formaldehyde.

2.2 Wood Materials

- .1 General requirements:
 - .1 Except as indicated or specified otherwise lumber shall be softwood, S4S, moisture content not greater than 19% at time of installation, in accordance with following standards:
 - .1 CSA O141-05.
 - .2 NLGA-2014 Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds:
 - .1 Use S2S material.
 - .2 Dimension lumber sizes: in compliance with Section 12 of the NLGA-2014.
 - .3 Dimension lumber species and grades:

Rough Carpentry

- .1 Spruce-Pine-Fir.
- .2 Light framing in accordance with NLGA-2014 Construction grade, S-Dry.
- .3 Planks in accordance with NLGA-2014 No. 2 grade, S-Dry.
- .4 Boards in accordance with NLGA-2014 No. 4 Common grade, S-Dry.

2.3 Wood Treatment

- .1 Wood preservative pressure treatment:
 - .1 Wood shall be pressure treated with wood preservative treatment in accordance with CAN/CSA O80. Treat end cuts with compatible end cut preservative.

2.4 Panel Materials

- .1 Softwood plywood (CSP): in accordance with CSA O151-09.
- .2 Douglas Fir plywood (DFP): in accordance with CSA O121-08.

2.5 Fastenings and Hardware

- .1 General:
 - .1 Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 38 mm (1-1/2") into wood substrate.
 - .2 Anchors to concrete and unit masonry: Capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M-22.
 - .3 Use surface fastenings of following types, except where specific type is indicated.
 - .1 To hollow masonry, plaster and panel surfaces use 9 mm (11/32") expansion bolts or other acceptable anchor.
 - .2 To solid masonry and concrete use expansion bolts.
 - .3 To structural steel use bolts through drilled hole, or welded stud-bolts or power driven self-drilling screws, or welded stud-bolts.
 - .4 To steel deck use bolts through drilled hole or power driven self-drilling screws.
 - .4 Fastener materials:
 - .1 Hot-dip galvanized fasteners: in accordance with ASTM A153/A153M-09 Class A or B1 G185 and connectors meeting ASTM A653/A653M-13 Class G-185 sheet or better.
 - .1 For pressure-preservative-treated wood, use stainless steel Type 304 fasteners.
 - .5 Hardware materials:
 - .1 Hot-dipped galvanized in accordance with ASTM A153/A153M-09, Class A or B1, and connectors in accordance with ASTM A653/A653M-13, Class G185.

Rough Carpentry

2.6 Source Quality Control

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

PART 3 - EXECUTION

3.1 General

- .1 Layout work to accommodate work of others. Cut and fit accurately. Erect in position indicated. Align, level, square, plumb, and secure work permanently in place.
- .2 Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit, and use plates or washers for bolt head and nut bearings. Turn up bolts and lag screws tightly when installed, and again just before concealed by other work or at completion of work.
- .3 Include in work of this section rough hardware such as nails, bolts, nuts, washers, screws, clips, and connectors required for complete and proper installations; and operating hardware required on work of this section for temporary use.
- .4 Do not attach work by wood plugs or blocking in concrete or masonry.
- .5 Do not regard nailers, blocking, and such other fastening provision indicated as exact or complete. Install required provisions for fastening, located and secured to suit *Place of the Work* conditions, and adequate for intended support.
- .6 Verify that grounds required for fastening of components and equipment are located correctly, and sized for adequate support.
- .7 Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood.

3.2 Equipment Backboard

- .1 Provide backboards for mounting equipment as required. Use 19 mm (3/4") Softwood Plywood.
- .2 Refer to Divisions 21, 22, and 23 and Divisions 26, 27, and 28 for requirements for electrical backboards.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Work of this section includes architectural woodwork as set-out in the architectural woodwork schedule including, but not limited to, the following:
 - .1 Standing and running trim.
 - .2 Cabinetry and hardware.
 - .3 Plastic laminate countertops.
 - .4 Engineered stone and fabrications.
 - .5 Factory and site finishing of architectural woodwork.
- .2 Section excludes:
 - .1 AWP-1; Moss wall: in accordance with Section 09 77 13.

1.2 Administrative Requirements

- .1 Coordination:
 - .1 Coordinate with other work for satisfactory and expeditious completion of the work of this section. Coordinate with partition accessories, electrical, communications, and finish components to ensure that proper provisions are made for the installation of the work of this section and for work by others.
 - .2 Where woodwork is to be fitted to other construction, check actual dimension of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delays in the *Work*.
 - .3 Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the work of this section and set in place. Instruct applicable *Subcontractors* as to their locations.
 - .4 Provide cut-outs for raceways, sleeves, grommets and other manufactured accessories which are required for the work of this section and for work by others.
- .2 Conduct a pre-fabrication meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data for each type of *Product* and process proposed for use in the work of this section and incorporated into items of architectural woodwork.
- .3 Certificates:
 - .1 Fire retardant pressure treated lumber or panel materials and water resistant panel materials shall be accompanied by supplier's certificate of conformance with this specification.

Architectural Woodwork

- .2 Include manufacturer's written requirements for finishing treated material.
- .4 Shop drawings:
 - .1 Submit shop drawings for the work of this section complying with the North American Architectural Woodwork Standards 4.0 requirements.
 - .2 Submit engineered shop drawings for the following architectural woodwork assemblies:
 - .1 Metal support framing assemblies.
 - .2 Wall hung or suspended millwork.
 - .3 Indicate quality standards and grades.
 - .4 Include full scale drawings of exposed-to-view edge conditions.
 - .5 Include plans, sections and large scale details, and indicate components and methods of assembly, fastenings, and other fabrication information required for the work of this section. Indicate assembly joint lines.
 - .6 Include materials and their characteristics and finishes as applicable including the following:
 - .1 Panel core and material types, thicknesses, compliance with specified standards, special treatments.
 - .2 Adhesive types to be used and locations.
 - .3 Finishing requirements including North American Architectural Woodwork Standards 4.0 finish system number, sheen, and required application steps.
 - .7 Submit coordination drawings indicating locations of concealed grounds, cut-outs, plates, and other required fabrications.
 - .8 Show relation to adjoining construction, details of outside and inside corners and door openings.
- .5 Selection samples:
 - .1 Submit 3 sets of samples for initial selection purposes of actual veneers showing full range of grain variation, colour and matching, natural characteristics reflecting wood cut and species, manufacturing characteristics, and for each wood species specified. Submit samples as many times as required until approved by *Consultant*. First submission to include one set of samples per *Consultant* request plus one set lighter in tone and one set darker in tone.
 - .1 Solid wood with factory finish, and each type of edge trim: set of 3 pieces, 50 mm x 19 mm x 450 mm (2" x 3/4" x 18"), for each colour and finish and installed condition, finished on one side and one edge.
 - .2 Veneered panels, with each type of edge trim with factory finish: 3 finished samples, minimum 450 mm x 450 mm (18" x 18") or larger size for each finish and installed condition, four piece matched veneer cut and colour as specified to fully illustrate natural characteristics, manufacturing characteristics, colour and matching, and special characteristics.
 - .2 Casework hardware, one unit of each type and finish.
- .6 Verification samples:

Architectural Woodwork

- .1 Submit samples for purpose of verification of compliance with specified requirements.
- .2 Submit 3 sets of 200 mm x 200 mm (8" x 8") samples, or 200 mm (8") long as applicable, of each specified *Product*, material and finish, including but not limited to the following:
 - .1 Shop finished materials, showing each type of finish and colour.
 - .2 Samples of each specified *Product*, in each specified colour and finish.
 - .3 Engineered stone, in each specified colour and finish.
 - .4 Plastic laminates, in each specified colour and finish.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit maintenance and cleaning instructions for finishes requiring specific care, noting particularly those procedures or materials which will cause damage to finished surfaces to be included in maintenance manuals.
- .3 Maintenance materials:
 - .1 Deliver extra sets of hardware items for maintenance as follows:
 - .1 2% of each type actually installed, but not less than 2 sets.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 Manufacturers:
 - .1 Architectural woodwork shall be manufactured by a firm having 5 years' experience, minimum, on work of similar size and quality.
 - .2 Shall be a member in good standing of the Architectural Woodwork Institute or the Architectural Woodwork Manufacturers Association of Canada or the Woodwork Institute.
 - .2 Installers:
 - .1 Has successfully completed 2 architectural woodwork projects similar in scope, materials and design to this *Project* within the last 5 years.
- .2 Quality standard:
 - .1 Work shall be in accordance with the North American Architectural Woodwork Standards 4.0, Premium Grade, or the highest grade available for performance and appearance characteristics of materials in Sections 3 – 5 used that apply to *Product* fabrication and installation requirements governed by Sections 6 – 12.
- .3 Mock-ups:
 - .1 Veneer and solid types.
 - .2 Edge and joint types.
 - .3 Veneer panels, minimum showing specified veneer layout.

Architectural Woodwork

- .4 One wood frame corner mock-up, full size.
- .5 Moss wall: in accordance with Section 09 77 13.
- .6 One complete cabinet unit including drawers, doors and countertops or other millwork that demonstrate veneer paneling, solid wood, jointing, corner and edge detail construction in the work.
- .7 Architectural featured millwork as indicated on the drawings.
- .8 Mock-up may remain as part of final *Work* if accepted.

1.6 Delivery, Storage, and Handling

- .1 Protect architectural woodwork during transit, delivery, storage and handling to prevent damage, spoilage, and deterioration.
- .2 Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate architectural woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified under paragraph 1.7 Field Conditions.
- .3 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.

1.7 Field Conditions

- .1 Environmental conditions:
 - .1 During storage and installation: Obtain and comply with North American Architectural Woodwork Standards 4.0 for optimum temperature and relative humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained. Woodwork shall be acclimatized for a minimum of 72 hours prior to commencing woodwork installation.
 - .2 During finishing: Comply with Architectural Woodwork Standard's temperature and humidity requirements before, during, and after application of finishes.
 - .3 During service life of woodwork: Obtain and comply with woodwork manufacturer's advice for optimum temperature and humidity conditions.

1.8 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.

PART 2- PRODUCTS

2.1 Performance/Design Requirements

- .1 Casework integrity shall meet the minimum acceptance levels in accordance with SEFA 8-1999 as outlined in the North American Architectural Woodwork Standards 4.0 and additional or greater loading capacities as specified throughout the North American Architectural Woodwork Standards 4.0.

Architectural Woodwork

- .2 Maximum allowable adjustable shelf lengths shall comply with shelves assembly rules per the North American Architectural Woodwork Standards 4.0 based on shelf thickness indicated or scheduled.

2.2 Wood Materials

- .1 Lumber:
 - .1 Hardwood for concealed blocking and framing: Custom grade, any species that, when painted, will not show any defects.
 - .2 Moisture content: Provide kiln-dried (KD) lumber with moisture content range between 6% to 12% for interior architectural woodwork. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed 5% to 10%.
 - .1 WD-2; Solid hardwood for transparent finish.
 - .1 Species: to match existing Sapele.
 - .1 Substitutions: in accordance with Section 01 25 00.
 - .2 Cut: Rift.
 - .2 WD-3; Solid hardwood for opaque finish.
 - .1 Species: High Poplar.
 - .2 Cut: Plain.
- .2 Wood veneers:
 - .1 Allowable wood veneer face grade characteristics shall comply with North American Architectural Woodwork Standards 4.0 referenced grade and referenced standards.
 - .2 WD-1; Hardwood veneer; for transparent finish:
 - .1 Species: to match existing Sapele.
 - .1 Substitutions: in accordance with Section 01 25 00.
 - .2 Veneer thickness: Minimum 1.02 mm (0.040") thick after sanding.
 - .3 Veneer cut: Rift.
 - .4 Veneer leaf matching: Book.
 - .5 Veneer assembly matching:
 - .1 Balance and Centre.
 - .6 Veneer end matching:
 - .1 Architectural.
 - .3 Edgebanding:
 - .1 Inset solid wood edgebanding:
 - .1 Unless otherwise indicated, finish exposed panel edges with 6.4 mm (1/4") thick solid hardwood trim, veneer shall overlap full thickness of wood edge per North American Architectural Woodwork Standards 4.0 Figure RG-151.

Architectural Woodwork

- .2 Inset solid wood edging shall have similar moisture content as panel core, be glued securely, and calibrated with panel core thickness prior to be laminated with wood veneer on both faces.

2.3 Panel Materials

- .1 Panel material schedule; except where indicated otherwise:
 - .1 Thickness: 19 mm (3/4") minimum.
 - .2 Core panels:
 - .1 At veneered work: MDF, except at shelving use veneer core plywood.
 - .2 At plastic laminate: MDF.
 - .3 Plywood backing; countertops, backsplashes, and where indicated: Exterior grade plywood with no added urea-formaldehyde used in composition.
 - .3 Maximum moisture content at time of installation: 10% to 12%.
- .2 Plywood:
 - .1 Veneer core plywood non telegraphing grain: Sanded good one side or good two sides (when both sides exposed or to receive applied finish materials) plywood:
 - .1 Hardwood plywood: in accordance with ANSI/HPVA HP-1-2016.
 - .2 Softwood plywood: to Voluntary Product Standard: PS-1-09 Structural Plywood (with Typical APA Trademarks).
 - .3 WD-4; Medium density fibreboard (MDF):
 - .1 To ANSI A208.2-2022, 19mm (3/4") minimum thickness, 720 kg/m³ (45 lbs/ft³) minimum density and as follows:
 - .1 Grade:
 - .1 Grade 130.
 - .2 Formaldehyde emission: No added urea-formaldehyde used in composition.

2.4 Plastic and Composite Materials

- .1 PLAM-1; High pressure decorative laminate:
 - .1 General purpose grade: in accordance with ANSI/NEMA LD 3-2005, Horizontal General Purpose Grade (HGS).
 - .2 Colours: J0032 Bianco Kos, with coloured matched core.
 - .3 Acceptable manufacturer:
 - .1 Fenix 'NMT'.
 - .2 Substitutions: in accordance with Section 01 25 00.
- .2 SSM-1; Engineered stone; quartz-based fabricated stone surfacing:
 - .1 Composition: quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process, and as follows:
 - .1 Thickness: 25 mm (1").
 - .2 Finish: Suede.

Architectural Woodwork

- .3 Edge profile: Mitred edge.
- .4 Colour: Nolita.
- .5 *Acceptable Product*:
 - .1 Cosentino 'Silestone-Loft'.
 - .2 Substitutions: in accordance with Section 01 25 00.
- .2 Accessories:
 - .1 Joint adhesive: Manufacturer's standard adhesive to create inconspicuous, nonporous joints, with a chemical bond.
 - .2 Sealant: Mildew resistant sealant in accordance with Section 07 92 00.
 - .3 Sink/bowl mounting hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.

2.5 Fasteners and Adhesives

- .1 Fasteners shall comply with North American Architectural Woodwork Standards 4.0.
- .2 Concealed panel hanging strips: extruded aluminum interlocking strips. Strips and fasteners/anchors to be capable of supporting 2.5 times dead load of panels in both vertical and horizontal panel applications.
- .3 Adhesives: Shall be used for intended purpose and manufacturer materials applications and installation, applied in accordance with manufacturer's written requirements and shall comply with the "adhesive usage guidelines" recommendations of North American Architectural Woodwork Standards 4.0.

2.6 Hardware

- .1 Casework hardware; to be furnished and installed by the architectural woodwork manufacturer.
 - .1 Where casework hardware is not specified or indicated on drawings or scheduled, casework hardware shall comply with ANSI/BHMA Standards, latest edition, minimum grades, loading and other basic rules per the North American Architectural Woodwork Standards 4.0.
 - .2 Hinges:
 - .1 *Acceptable Product*:
 - .1 Blum 'Clip top'.
 - .2 Substitutions: in accordance with Section 01 25 00.
 - .3 Pulls; doors and drawers, except where otherwise indicated:
 - .1 *Acceptable Product*:
 - .1 Richelieu 'Modern Edge Pull – 9595, Stainless Steel'.
 - .2 Substitutions: in accordance with Section 01 25 00.

2.7 Finishes - Interior Architectural Woodwork

- .1 General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.

Architectural Woodwork

.2 Preparations for finishing:

- .1 Prior to finishing, exposed portions of woodwork shall have handling marks or effects of exposure to moisture removed with a thorough final sanding over surfaces of the exposed portions, using appropriate grit sandpaper, and shall be cleaned prior to applying sealer or finish. Sanding shall be completed just prior to stain or finishing application.
- .2 Concealed surfaces of woodwork that might be exposed to moisture, such as those adjacent to exterior concrete or masonry walls, shall be back-primed.
- .3 Comply with referenced quality standard in Part 1 for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

.3 Finish for veneer and solid wood, and MDF:

- .1 Comply with requirements indicated below for finish system, staining, and sheen.
 - .1 Sheen: Satin. Sheen range measurements in accordance with North American Architectural Woodwork Standards 4.0.
 - .2 Factory finish with transparent, Post Catalysed Lacquer in accordance with the North American Architectural Woodwork Standards 4.0, Section 5.
 - .1 Opaque finish:
 - .1 WD-3: To match PT-1.
 - .2 WD-4: Paint or pigmented stain colour to later selection by the *Consultant*.
 - .3 Paint finish, where indicated or scheduled: in accordance with Section 09 91 00.
 - .2 WD-1, WD-2; Transparent finish:
 - .1 Clear (natural).

2.8 Fabrication

- .1 Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises pre-cut, where possible, to receive hardware and other items of work.
- .2 Complete fabrication, assembly, finishing, hardware application, and other work before shipment to maximum extent possible. Trial fit in shop and disassemble components only as necessary for shipment and installation. Where necessary, provide ample allowance for scribing, trimming, and fitting. Reassemble with concealed fasteners.
- .3 Provide woodwork, solid tops and other indicated materials with pre-cut openings, where possible, for hardware, appliances, plumbing fixtures, electrical work, telephone cut-outs and similar items. Locate openings accurately and provide proper size and shape. Smooth edges of cut-outs and, where located in countertops, seal edges of cut-outs with a water-resistant coating.
- .4 Provide framing for architectural woodwork, complete with bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.
- .5 Reinforcing shown is minimum. Provide additional reinforcing as required to ensure a rigid assembly. Take responsibility for the stability of furniture and fitments.

Architectural Woodwork

- .6 Provide balancing sheets as required, and specified, complying with the North American Architectural Woodwork Standards 4.0.
- .7 Provide surface mount blocking and strapping necessary to support the work of this section. Such blocking shall not be exposed upon completion of work.
- .8 Prefinish work at the factory, except where specified or indicated otherwise.
- .9 Panel construction; solid edgebanded with overlaid veneer:
- .10 Solid wood edging: No end grain shall be visible; mitre external corners; house internal corners.

2.9 Fabrication – Engineered Stone

- .1 Fabricate components in shop to greatest extent practical to size and shape indicated, in accordance with reviewed shop drawings and manufacturer's written requirements.
- .2 Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 100 mm (4") wide solid surfacing material reinforcing strip under joints.
- .3 Provide holes and cut-outs as indicated or as required.
- .4 Rout and finish component edges to a smooth, uniform finish. Rout cut-outs then sand edges smooth. Repair or reject defective or inaccurate work.
- .5 Surfaces shall have a uniform finish.
- .6 Thermoforming: Comply with thermoforming data from manufacturer.
 - .1 Construct matching molds to form component shapes.
 - .2 Form pieces to shape prior to seaming and joining.
 - .3 Cut pieces larger than finished dimensions, sand edges, remove nicks and scratches.
 - .4 Heat entire component uniformly during forming.
 - .5 Prevent blistering, whitening or cracking of solid surfacing material during forming.

PART 3 - EXECUTION

3.1 Preparation

- .1 Condition woodwork to field conditions in installation areas before installing. Ensure that field conditions have been provided as requested and specified.
- .2 Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.
- .3 Provide grounds, nailers and other required fabrications which are to be built into other work when required.
- .4 Ensure that wall and ceiling variations are not in excess of 6.4 mm (1/4") in 3658 mm (144") and that floors are not in excess of 12.7 mm (1/2") in 3658 mm (144") of being plumb, level, flat, straight, square, of the correct size. Variations shall be corrected prior to installation of work of this section.
- .5 Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

Architectural Woodwork

3.2 Installation

- .1 Install woodwork to comply with North American Architectural Woodwork Standards 4.0 for same grade specified in Part 1 of this section for type of woodwork involved.
- .2 Install woodwork plumb, level, true, and straight with no distortions.
- .3 Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- .4 Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- .5 Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

3.3 Installation - Tolerances

- .1 Install to a tolerance of 3 mm in 2400 mm (1/8" in 8'-0") for plumb and level (including tops) and with no variations in flushness of adjoining surfaces unless otherwise acceptable in accordance with the North American Architectural Woodwork Standards 4.0.

3.4 Adjusting and Cleaning

- .1 Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork.
- .2 Clean, lubricate, and adjust hardware.
- .3 Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.5 Protection

- .1 Protect architectural woodwork during remainder of construction period to ensure that work will be without damage or deterioration at time of acceptance.
- .2 Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that woodwork is without damage or deterioration at time of *Substantial Performance of the Work*.

END OF SECTION

Joint Firestopping and Smoke Seals

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Materials installed in joints to restrict the spread of fire and smoke.
 - .1 Joints in or between fire-resistance-rated constructions.
- .2 Section excludes:
 - .1 Firestopping and smoke seals, for mechanical, electrical and communications penetrations of fire resistant assemblies, and firestopping and smoke seals within their respective assemblies. Refer to Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

1.2 Administrative Requirements

- .1 Coordination:
 - .1 Coordinate joint firestopping and smoke seal work with Section 01 33 00, paragraph 1.8 Project Firestopping Manual and Coordination.
 - .2 Coordinate with other sections to assure that pipes, conduit, cable, and other items that penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
 - .3 Schedule the *Work* to assure that penetrations and other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
- .2 Conduct a pre-installation meeting in accordance with Section 01 31 19.
 - .1 Representatives for mechanical and electrical work and independent inspection and testing company shall attend pre-installation meeting.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets: Submit data and installation instructions for *Products* providing descriptions sufficient for identification at the *Place of the Work*.
 - .1 Materials list of *Products* proposed for use in the work of this section; complying with listed systems designs.
 - .2 Listing agency's detailed drawing showing joint assemblies and firestopping materials, identified with listing agency's name and number or designation, fire rating achieved, and date of listing.
 - .3 Certificates:
 - .1 Submit the following certification documents with closeout submittals:
 - .1 Manufacturer's certification: Submit manufacturer's certification that installed firestopping and smoke seal *Products* are suitable for the use indicated and comply with specified requirements.

Joint Firestopping and Smoke Seals

- .2 Installation certification: Installer shall submit certification that all joint firestopping system installations are completed and that installations comply with listed systems designs.
- .4 Submit fire resistance rating test listings for firestopping and smoke seal systems.
- .3 Shop drawings:
 - .1 Submit drawings indicating fire resistance rated assembly number, required temperature, hose stream, and flame rating, material thicknesses, installation methods and materials of firestopping and smoke seals, primers, supports, damming materials as applicable, reinforcements, anchorages, fastenings and methods of installation for each condition to be encountered.
 - .2 Designate on shop drawings static and dynamic joint systems, relative positions, expansion and control joints in rated slabs and walls, and firestopping details.
 - .3 Engineered shop drawings; for engineering judgements:
 - .1 Where *Project* conditions require modification to an accredited third party testing agency's listed system design to address a particular firestopping condition that is not covered by a listed system, submit engineered shop drawings detailing the modifications to the listed system design as an engineering judgment or equivalent fire-resistance-rated assembly, for each *Project* location and condition.
 - .2 Submit the manufacturer's engineering judgment identification number and shop drawing details prepared by a professional engineer. The engineering judgment submittal shall include both *Project* name, *Project* location, and *Subcontractor's* name who will install firestop system as described in engineering judgement shop drawings.
 - .3 Provide complete details of specific application of listed system and its modifications upon which the engineered judgement is based upon.
 - .4 For perimeter fire barrier systems:
 - .1 Submit engineered shop drawings for engineering judgements covering perimeter fire barrier systems. Identify each cladding assembly type in contact with each perimeter fire barrier system.
 - .4 Manufacturers' instructions:
 - .1 Manufacturer of *Products* proposed for use in work of this section shall prepare firestopping manual scheduling products to be used for each assembly and installation required in the *Work*.
 - .1 Coordinate with project firestopping manual specified under Section 01 33 00.
 - .2 Manual shall include manufacturer's *Product* data sheets as specified under paragraph 1.3.2.
 - .3 Firestopping manual shall be submitted within 4 weeks of *Contract* award.

1.4 Quality Assurance

- .1 Qualifications:

Joint Firestopping and Smoke Seals

- .1 Installers: Shall have 5 years' experience, minimum, in application of *Products*, systems and assemblies specified and with approval, training and certification of *Product* manufacturers.
 - .1 Submit proof of manufacturer's installer certification for each installer of firestopping and smoke sealant systems.
 - .1 Manufacturer's willingness to sell its firestopping *Products* to the *Contractor* or to an installer engaged by the *Contractor* does not in itself confer qualification on the buyer.
- .2 Applicator shall designate a single individual as *Project* foreperson who shall be present at the *Place of the Work* at all times throughout the work of this section when the work of this section is being performed.

1.5 Delivery Storage, and Handling

- .1 Deliver materials to *Place of the Work* in manufacturer's unopened containers, containing classification label, with labels intact and legible at time of use.
- .2 Store materials in accordance with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.
- .3 Do not use damaged or adulterated materials and materials exceeding their expiry date.

1.6 Field Conditions

- .1 Comply with manufacturer's requirements relative to temperature and humidity conditions, before, during and after installation.

1.7 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranty:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 Duration: 5 years.

PART 2 - PRODUCTS

2.1 Manufacturers

- .1 General: Manufacturers of firestopping and smoke seal system *Products* and installation specialists for the work of this section are limited to applicable assemblies as required for the *Work* and having listing mark on packaging.
- .2 Subject to compliance with requirements, provide products by one of the following:
 - .1 3M Canada Inc.
 - .2 Hilti Canada Corp.
 - .3 Tremco Commercial Sealants & Waterproofing.

Joint Firestopping and Smoke Seals

2.2 Performance/Design Requirements

- .1 Firestop and smoke sealant systems shall consist of material, or combination of materials installed to retain integrity of fire-rated construction by effectively impeding spread of flame, smoke, and/or hot gasses through perimeter joint or gaps, construction joints, or at perimeter fire containment in or adjacent to fire-rated barriers.
- .2 Smoke sealants applied over firestopping materials or combination smoke seal/firestop seal material shall form air tight barriers to prevent passage of gas and smoke.
- .3 Fire-resistance rating of firestopping system shall be equivalent to rating of adjacent floor, wall or other fire separation assembly.
- .4 Firestopping system at fire rated assemblies with assembly STC rating requirements shall provide STC rating equal to STC rating of fire rated assembly.
- .5 Confirm locations of exposed/non-exposed firestopping/smoke seal surfaces with *Consultant* prior to application.
- .6 Provide movement capability at movement joints in accordance with design requirements for movement joint.
- .7 Head-of-wall joints; with dynamic designation:
 - .1 Joint assemblies shall permit vertical movement allowing wall to move independent of structure due to forces including, but not limited to, live loads, dead loads, thermal expansion/contraction, and wind sway. Such movement shall not damage the wall assembly or its fire protection components.
 - .1 Provide head-of-wall joints with dynamic designation.
- .8 Regulatory requirements:
 - .1 Joint firestop systems shall be listed in accordance with CAN/ULC-S115-11 and shall achieve required fire resistance rating in accordance with building code.
 - .2 Proposed firestopping and smoke seal materials and methods shall conform to applicable governing codes having local jurisdiction.

2.3 Materials

- .1 Single source responsibility for firestopping and smoke seal materials:
 - .1 Obtain firestopping and smoke seal materials from single manufacturer for each different *Product* required.
 - .2 Manufacturer shall instruct applicator in procedures for each material.
- .2 Firestopping and smoke seal systems shall conform to the following:
 - .1 VOC content not to exceed 250 gm/litre minus water.
 - .2 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gasses in compliance with requirements of CAN/ULC-S115-11 and not to exceed opening sizes for which they are intended.
 - .3 Provide firestopping materials and systems with fire-resistance rating not less than the fire-resistance rating of applicable adjacent assembly.
 - .4 Listed in accordance with CAN/ULC-S115-11.

Joint Firestopping and Smoke Seals

- .5 Use only joint firestop systems that have been tested by an accredited third party testing agency for specific fire-rated construction conditions conforming to construction assembly type, joint type and fire-rating requirements for each separate instance.
 - .1 Where there is no specific third party tested and classified firestop system for a particular firestop configuration, submit engineered shop drawings.
- .6 For joints in fire-separations, provide listed systems designs for the joint firestop and smoke seal systems as required by building code to maintain the integrity of the fire separations.
- .7 *Products* shall be compatible with abutting dissimilar membranes, architectural coatings, finishes at floors, walls and ceilings. Check with requirements of *Contract Documents* and manufacturer of selected materials being installed.
- .3 Smoke sealants for overhead and vertical joints shall be non-sagging; sealants for floors shall be self-levelling.
- .4 Smoke seal sealant colour at exposed locations: Grey. (Red will not be accepted)

PART 3 - EXECUTION

3.1 Preparation

- .1 Examine sizes, anticipated movement and conditions to establish correct thickness and installation of back-up materials.
- .2 Prepare surfaces in accordance with manufacturer's written specifications and to requirements of listed system designs.

3.2 Installation

- .1 Install joint firestopping and smoke seal systems in accordance with manufacturer's written requirements and in compliance with listed system designs. Products and installation requirements must comply with listed system designs.
- .2 For materials that will remain exposed after completing the *Work*, finish to achieve smooth, uniform surfaces. Tool or trowel exposed surfaces.
- .3 Notify *Consultant* when random completed installations are ready for review, as directed by *Consultant*, prior to concealing or enclosing firestopping and as applicable, smoke seals.
- .4 Protect materials from damage on surfaces subjected to traffic.

3.3 Identification and Documentation

- .1 Provide documentation for each joint firestop system application addressed. This documentation is to identify each joint location on the entire Project.
- .2 Documentation for installed joint firestop systems is to include:
 - .1 Sequential location number.
 - .2 Project name.
 - .3 Date of installation.
 - .4 Detailed description of joint firestop system location.

Joint Firestopping and Smoke Seals

- .5 Listed firestop system design number or engineered judgment number.
- .6 Type of joint.
- .7 Width of joint.
- .8 Overall length of joint.
- .9 Number of sides addressed.
- .10 Hourly rating of firestop joint system to be achieved.
- .11 Installers name.

3.4 Field Quality Control

- .1 Conduct quality control to be in accordance with Section 01 45 00.
 - .1 Field tests and inspections:
 - .1 Examine completed firestop joint installations to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspections are completed.
 - .2 Inspection consultant to review installation of the work of this section and to perform random tests to verify its completion in accordance with the requirements of the *Contract Documents*.
 - .3 Give at least 48 hours notice before operations commence, and arrange for a pre-job conference with *Contractor*, installer, independent inspection and testing company, manufacturer, and *Consultant* present.
 - .4 Independent inspection and testing company shall examine installed firestopping in accordance with ASTM E2174-20a and ASTM E2393-20a. Independent inspection and testing company shall examine firestopping and shall determine, in general, that firestopping has been installed in accordance with requirements of the *Contract Documents* and in compliance with each listed firestop system design.
 - .5 Representatives of the manufacturer(s) shall have access to the *Work*. *Contractor* shall provide assistance and facilities for such access in order that the manufacturer(s) representative(s) may properly perform its function.
 - .2 Manufacturer's field review to be in accordance with Section 01 45 00.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Joint sealants – interior locations.
- .2 Section excludes:
 - .1 Roofing system sealants.
 - .2 Tiling control joint sealants.
 - .3 Glazing system assembly sealants.
 - .4 Mechanical and electrical sealants.
 - .5 Acoustic sealants.

1.2 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
 - .2 Submit manufacturer's and *Product* name for each sealant which will be used in the *Work* prior to commencing the *Work*.
- .3 Samples:
 - .1 Submit "wet sample" sealant colour samples for each sealant *Product* and colour.

1.3 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
 - .1 Include manufacturer's warranties.
- .2 Maintenance instructions:
 - .1 Submit maintenance instructions for all items for incorporation into the operation and maintenance manuals.

1.4 Quality Assurance

- .1 Qualifications:
 - .1 *Subcontractor*.
 - .1 Shall have 5 years' experience, minimum, in application of *Products*, systems and assemblies specified.

1.5 Field Conditions

- .1 Conform to sealant manufacturer's specifications and recommendations.
- .2 Do not proceed with installation of joint sealants under the following conditions:

Joint Sealants

- .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or are below 5° C (40° F).
- .2 When joint substrates are wet.
- .3 Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .4 Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranty:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 Duration: 2 years.
 - .3 Materials warranty for a duration of 5 years.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Interior sealants shall have a VOC limit of 50 g/L maximum, unless otherwise specified, and comply with South Coast Air Quality Management District (SCAQMD) Rule 1168, Adhesive and Sealant Applications.
- .2 Joint sealants:
 - .1 Shall perform as air tight and water-tight joints.
 - .2 Defects shall include, but are not limited to:
 - .1 Staining from abutting materials or filler.
 - .2 Migrating, bleeding into, or staining abutting materials.
 - .3 Unsightly surface deformation.
 - .4 Excessive colour change, chalking, or dust pick-up.
 - .5 Failing adhesively or cohesively where maximum elongation is less than 25% of designed width of exposed joints.
 - .6 Hardening to more than 25% over specified hardness.

2.2 Sealants

- .1 General:
 - .1 Colours: Sealant colours shall match colours of adjacent materials, as selected and approved by *Consultant*.
 - .1 Colours: shall be selected from manufacturer's full range of colours.
 - .2 In accordance with ASTM C920-14 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C920-14 classifications for type, grade, class, and uses.
 - .3 For sealants to be applied to porous substrates:

Joint Sealants

- .1 Provide products that have undergone testing in accordance with ASTM C1248-22 and have not stained porous joint substrates indicated for *Work*.
- .4 Sealant supplied shall not exude any material(s) which travel into adjacent materials, or travel onto surfaces of adjacent materials; causing damage, or attracting soiling, which becomes apparent during the service life of the building.
- .2 Interior general sealants:
 - .1 VOC limit: Maximum 50 g/L, unless otherwise indicated.
 - .2 Interior sealant; at joints with painted gypsum board: one-component paintable acrylic in accordance with ASTM C834-10 Type OP; or polyurethane in accordance with ASTM C920-14 Type S, Grade NS, Class 35.
 - .1 Acceptable *Products*:
 - .1 Acrylic sealants:
 - .1 Master Builders Solutions Canada 'MasterSeal NP 520'
 - .2 Tremco, Inc. 'Tremflex 834'.
 - .2 Polyurethane sealants:
 - .1 Sika 'Sikaflex 1A'.
 - .3 Substitutions: in accordance with Section 01 25 00.
 - .3 Interior sealant; at movement joints in vertical surfaces: one-component polyurethane sealant in accordance with the following: ASTM C920-14, Type M or S, Grade NS, Class 25.
 - .1 Acceptable *Products*:
 - .1 Master Builders Solutions Canada 'MasterSeal NP1'.
 - .2 Sika 'Sikaflex 15LM'.
 - .3 Tremco, Inc. 'Dymonic 100'.
 - .4 Substitutions: in accordance with Section 01 25 00.
 - .4 Interior sealant; at vertical and trafficable movement joints: one-component low modulus silicone sealant in accordance with the following: ASTM C920-11, Type S, Grade NS, Class 100/50.
 - .1 Acceptable *Products*:
 - .1 DOWSIL '790'.
 - .2 Momentive 'Silpruf LM SCS2700'.
 - .3 Sika 'Sikasil WS-290'.
 - .4 Tremco, Inc. 'Spectrem 1'.
 - .5 Interior sealant, mildew resistant one part silicone sealant in accordance with the following: ASTM C920-14, Type S, Grade NS, Class 25.
 - .1 Acceptable *Products*:
 - .1 DOWSIL '786'.
 - .2 Momentive 'Sanitary SCS1700 Sealant'.

Joint Sealants

- .3 Sika 'Sikasil GP'.
- .4 Tremco, Inc. 'Tremsil 200'.

2.3 Accessories

- .1 General: Provide joint sealants, primers, backings, and fillers that are compatible with one another and with joint substrates and other sealants or joint fillers specified and approved for applications indicated under joint sealant scheduled and under conditions of service and application as demonstrated by joint sealant manufacturer based on proven test results and field experience. When incompatible, inform *Consultant* and change to compatible type acceptable to *Consultant*.
- .2 Cylindrical sealant backings: Provide joint backings that meet ASTM C1330-02, Type O (open-cell polyurethane), or Type B (non-absorbent bi-cellular backing materials with surface skin), sized 25 percent or greater than joint opening with proper density to control sealant depth and profile. Follow joint sealant manufacturer's recommendations with backing selections for optimum joint sealant performance, in accordance with the following schedule:
 - .1 Use open cell foam with non-absorbing closed cell skin (Sof-Rod) for vertical joints; round shape for open joints and triangular shape for angular joints.
 - .2 Use closed cell foam for horizontal joints.
- .3 Bond-breaker tape: Polyethylene tape or other approved plastic tape as recommended by joint sealant manufacturer to prevent 3-sided joint adhesion to rigid, inflexible joint fillers or joint surfaces at back of joint where such adhesion would restrict proper sealant movement or result in sealant failure.
- .4 Masking tape: Non-staining, non-absorbent and compatible with joint sealants and adjacent surfaces.
- .5 Sealant primers: Use primers only as recommended by sealant manufacturer where required to enhance adhesion of sealant to specific joint substrates indicated and as determined for use from pre-construction mock-up testing. Select primers in consultation with sealant manufacturer and manufacturer of substrate material which do not have a detrimental effect on sealant adhesion or in-service performance.
- .6 Cleaners for nonporous surfaces:
 - .1 Provide non-staining, chemical cleaners of type which are acceptable to manufacturer of sealant and sealant backing material, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
 - .2 Provide cleaner conditioner required for glass and glazed surfaces as recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 Manufacturer's Recommendations

- .1 Unless specified otherwise herein, comply with the recommendations and directions of the manufacturer whose materials are being used in the work of this section.

Joint Sealants

3.2 Preparation

- .1 Protect adjacent work areas and finished surfaces from damage during joint sealant installation.
- .2 Clean and prepare joint surfaces and substrates of substance that could impair the bond of joint sealants immediately before installing joint sealants.
- .3 Provide a dry, dust-free and cleaned substrate for optimum results.
- .4 Clean porous joint surfaces by using heavy-duty brushing, light abrasive, mechanical abrading or combination of these methods to produce a clean, sound surface for optimum bond with joint sealants per manufacturer's recommendations.
- .5 Clean non-porous surfaces using the two-cloth wipe method as referenced in ASTM C1193-16(2023) and outlined by joint sealant manufacturer's written requirements.
- .6 Prepare rusting or scaling surfaces using abrasive cleaning methods as recommended by joint sealant manufacturer prior to joint sealant installation. Remove and neutralize efflorescence, mould, mildew and algae prior to joint sealant installation.
- .7 Prepare finish-coated surfaces per joint sealant manufacturer's specific recommendations.
- .8 Test materials for indications of staining or poor adhesion before any sealing is commenced. Submit reports in writing to *Consultant* of results.

3.3 Masking

- .1 Where necessary to prevent contamination or marring surfaces of adjacent materials, mask areas adjacent to joints with masking tape prior to priming or sealing application. Remove tape immediately after joint has been completed and an initial set achieved.

3.4 Installation

- .1 Install in accordance with joint sealant manufacturer's installation written requirements for products, primers and applications indicated unless more stringent project-specific instructions or requirements apply.
- .2 Apply joint sealants for continuous waterproof sealant joint protection. Lap vertical joints over horizontal joints as recommended by sealant manufacturer. Comply with installation recommendations in ASTM C1193-16(2023) for use of joint sealants as applicable to each specific sealant installation.
- .3 Install sealant primers only when recommended by sealant manufacturer and demonstrated at pre-construction tests after joint surface preparation has been completed and when surfaces are verified as clean and dry. Allow any primer installation to completely dry or cure prior to installation of backing or joint sealants. Primer is mandatory for gun applied sealants.
- .4 Install joint sealants using proven techniques that comply with the following and in proper sequence with installation of primers and backings.
 - .1 Using proper joint sealant dispensing equipment, place sealants by pushing sealant beads into opening to fully wet-out joint sealant substrates. Fill sealant joint opening to full and proper configuration.

Joint Sealants

- .2 Provide uniform cross-sectional shapes and depths in relation to joint width for optimum sealant movement capability per joint sealant manufacturer's written requirements.
- .5 Joint sealant tooling is required for non-sag joint sealant installations. Immediately after placing fresh sealants and before skinning or curing begins, tool sealants using metal spatulas designed for this purpose in accordance with manufacturer's recommendations. Provide a smooth, uniform sealant finish, eliminating air pockets and ensuring good contact for optimum sealant adhesion within each side of the joint opening.
 - .1 Provide concave joint configuration as indicated per figure 5-A in ASTM C1193-16(2023) unless otherwise indicated.
 - .2 Use tooling agents that are approved in writing by sealant manufacturer and that do not discolour sealants or adjacent surfaces.
 - .3 Remove excess sealant from surfaces adjacent to joint openings using metal spatula, promptly cleaning any sealant residue from adjacent finished surfaces. Remove masking after joint sealant is installed.
- .6 Allow single-component sealants to fully cure before adhesion testing is performed as recommended by joint sealant manufacturer as outlined in Field Quality Control paragraphs in Section 07 92 00.
- .7 Match approved sealant mock-up for colour, finish and overall aesthetics. Remove, refinish or re-install work not in compliance with the *Contract Documents*.
- .8 When surfaces of adjacent materials are to be painted, perform sealant work before these surfaces are painted.
- .9 Check form release agent used on concrete for compatibility with primer and sealant. If they are incompatible inform *Consultant* and change primer and sealant to compatible type, or clean concrete to sealant manufacturer's acceptance.
- .10 Install joint backing material, filler strips, gaskets, bond breakers and similar type material of comparable performance characteristics. Install bond breaker tape or packing over asphalt impregnated fibre board as recommended by sealant manufacturer.
- .11 Where joints are 12.7 mm (1/2") or deeper, insert backing material in continuous uniform compression with setback from finished face of adjoining materials equal to required depth of sealant (width/depth ratio) as specified herein.
- .12 On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.
- .13 Install bond breaker tape in bottom of joints in lieu of sealant backing where proper depth cannot be obtained when backing is installed.
- .14 Maintain correct sealant depth. Sealant depth shall be 1/2 the width of the joint, maximum depth shall be 12.7 mm (1/2"), minimum depth shall be 6 mm (1/4"). Comply with manufacturer's written recommendations.
- .15 Fillet bead sealant joints to be sized to provide proper contact area with substrates, in accordance with manufacturer's written recommendations.
- .16 Apply sealants using pressure-operated guns fitted with suitable nozzles in accordance with manufacturer's directions. Apply sealants in such manner as to ensure good adhesion to sides of joints and to completely fill voids in joints.

Joint Sealants

- .17 Apply sealants so that surfaces of joints are smooth, full bead, free from ridges, wrinkles, sags, air pockets and embedded impurities. Tool sealant surfaces to produce a smooth surface.
- .18 Install sealant with exterior face of sealant set back 10 mm (3/8") from face of adjacent materials at building movement joints, unless otherwise indicated.
- .19 Do not apply sealants to areas where installation of paints, coatings or flooring is in progress. Apply sealants after such work is complete and fully cured.

3.5 Interior Sealant Schedule

- .1 Include in work of this section sealants to seal open joints in surfaces exposed to view, and to make building weather-tight and air-tight, as applicable, as indicated, and as otherwise specified, except where specified under the work of other sections.
- .2 Install sealant to:
 - .1 Movement and control joints on exposed insitu concrete walls.
 - .2 Interior control and expansion joints in floor and wall surfaces.
 - .3 Raked out joints at junctions of masonry with concrete walls and columns, and at intersection of masonry walls and partitions where joint reinforcement is installed.
 - .4 Perimeters of exterior and interior door and window frames.
 - .5 Joints at tops of non-load bearing masonry walls at the underside of insitu concrete.
 - .6 Exposed interior control joints in gypsum board.
 - .7 Millwork junctions with walls.
- .3 Mildew resistant sealant at wet areas:
 - .1 Counter/wall junctions at countertops.

3.6 Field Quality Control

- .1 Conduct quality control in accordance with Section 01 45 00.

3.7 Adjusting and Cleaning

- .1 Remove droppings and clean off excess sealant or sealant residue adjacent to sealant joint installations as the work progresses by methods approved by joint sealant manufacturer before material achieves initial set.
- .2 Do not damage adjacent surfaces with harmful removal techniques and protect finished surfaces beyond those that have been masked.
- .3 Remove and replace damaged joint sealants.
- .4 Remove temporary coverings and masking protection from adjacent work areas upon completion.

3.8 Protection

- .1 Protect installed sealants during and after final curing from damage resulting during construction.

Joint Sealants

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Hollow metal doors and panels (steel doors).
 - .2 Metal frames (steel frames).
 - .3 Metal frames (steel frames for screens, sidelights, window assemblies).

1.2 Administrative Requirements

- .1 Coordination:
 - .1 Cooperate fully with finish hardware distributor's representative during preparation of shop drawings and execution of shop fabrication.
 - .2 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.
- .2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Submit copy of NAAMM-HMMA 840-17 standard.
- .3 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .4 Shop drawings:
 - .1 Include details of each door and frame type, finish hardware types and locations, frame profiles, door and frame elevations, mitre details, glazing preparation details and anchor details and locations.
 - .2 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in door schedule.
 - .3 Electrified hardware requirements and preparations shall be clearly indicated on shop drawings.

1.4 Quality Assurance

- .1 Qualifications:
 - .1 Manufacturers:
 - .1 Provide doors and frames manufactured by a firm specializing in the design and production of hollow metal steel doors and frames.
 - .2 Manufacturer shall be a member in good standing of the Canadian Steel Door Manufacturers Association (CSDMA).
- .2 Mock-up:
 - .1 Provide mock-up of door and frame assembly for each door type.

Steel Doors and Frames

- .2 Mock-up may be incorporated in the completed work upon acceptance of *Consultant*.

1.5 Delivery, Storage, and Handling

- .1 Inspect materials thoroughly upon receipt and report immediately discrepancies, deficiencies and damages, in writing, to *Supplier*.
- .2 Note damages incurred during shipment on carriers' bill of lading and report immediately, in writing, to *Supplier*.
- .3 Store materials properly on planks, out of water and covered to protect from damage from adverse weather conditions. Remove wet packaging immediately.
- .4 Remove wrappings or coverings from doors upon receipt at the *Place of the Work*, and store in a vertical position, spaced with blocking to permit air circulation between them.

1.6 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranties:
 - .1 System:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 The warranty is a total system warranty, and includes hardware, sealants, hanging and fitting, and finishing.
 - .3 Duration: 2 years.
 - .2 Glass and glazing: in accordance with Section 08 80 00.

PART 2 - PRODUCTS

2.1 Manufacturers

- .1 All Steel Doors 2000 Ltd.
- .2 Artek Door (1985) Ltd.
- .3 Daybar Industries Ltd.
- .4 Fleming-Baron Door Products.
- .5 Trillium Steel Doors Limited.

2.2 Performance/Design Requirements

- .1 Fire rating requirements:
 - .1 Fire rated labelled doors and frames: tested in accordance with CAN/ULC-S104-10 and listed by a nationally recognized agency having a factory inspection service and shall be constructed as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
 - .2 Install fire labelled steel door and frame products in accordance with NFPA 80-2010, except where indicated otherwise.
- .2 Doors and frames shall function as intended, including but not limited to:
 - .1 Be in true alignment.

Steel Doors and Frames

- .2 Operate and swing freely, smoothly, and easily.
- .3 Remain stationary at any point.
- .4 Close evenly and tightly against stops without binding.
- .5 Latch positively when doors are closed with moderate force.

2.3 Materials

- .1 Steel:
 - .1 Fabricated from tensioned levelled steel in accordance with ASTM A924/A924M-22a, galvanized in accordance with ASTM A653/A653M-13, Commercial Steel CS, Type B.
 - .2 Steel shall be free of scale, pitting, coil breaks, surface blemishes, buckles, waves, and other defects.
 - .3 Minimum sheet thickness; uncoated steel sheet: in accordance with Appendix 1 of ANSI/NAAMM HMMA 861-14 "Guide Specifications for Commercial Hollow Metal Doors and Frames".
 - .4 Finish: Minimum Galvanneal coating designation ZF120 (A40).
- .2 Door core materials:
 - .1 Honeycomb: Structural small cell 25 mm (1") maximum kraft paper 'honeycomb'. Weight: 36.3 kg (80 lb) per ream (minimum). Density: 16.5 kg/m³ (1.03 pcf) minimum, sanded to required thickness.
- .3 Adhesives:
 - .1 Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive.
 - .2 Lock seam doors: fire resistant, resin reinforced polychloroprene, high viscosity sealant-adhesive.
- .4 Primer: rust inhibitive for touch-up.
- .5 Finishing hardware: in accordance with Section 08 71 00.
- .6 Miscellaneous:
 - .1 Door silencers: single stud rubber or neoprene type.

2.4 Fabrication - General

- .1 Fabricate steel doors, frames, transoms, sidelights and borrowed lights as applicable, to the design and dimensions indicated. Take field measurements where coordination with adjoining work is necessary.
- .2 Fabricate steel doors and frames to be rigid, neat in appearance and free from defects, warp, wave or buckle with all corners square unless otherwise indicated.
- .3 Operating clearances:
 - .1 Provide clearance at floor with allowance made for indicated finish flooring materials.
 - .2 Clearances for Fire-Rated Doors: As required by NFPA 80-2010.

Steel Doors and Frames

- .3 Clearances for Non-Fire-Rated Doors: Not more than 3 mm (1/8") at jambs and heads, except not more than 6 mm (1/4") between pairs of doors. Not more than 19 mm (3/4") at bottom.
- .4 Drill and tap or reinforce for mortised or surface mounted hardware in accordance with accepted hardware schedule, ANSI A115, NFPA 80-2013, or manufacturers recommendations.
- .5 Countersink exposed fasteners unless otherwise shown. Use flat or oval head screws.
- .6 Reinforce components to resist stresses imposed by hardware in use.
- .7 Allow for anticipated expansion and contraction of frames and supports.
- .8 Fit elements at intersections and joints accurately together, in true planes, and plumb and level.
- .9 Weld continuously at joints exposed to view or at joints through which air or water could penetrate from the exterior of building to the interior.
- .10 Perform welding in accordance with CSA W59-18.
- .11 Mortise, reinforce, drill and tap to receive hardware and security devices using templates provided by respective *Supplier*.
- .12 Touch up finish damaged during fabrication.
- .13 Prepare doors or frames to receive seals where seals are indicated.

2.5 Fabrication - Steel Doors and Panels

- .1 Fabricate steel doors and panels to a thickness of 45 mm (1-3/4"), unless indicated otherwise.
- .2 Interior and non-insulated doors and panels:
 - .1 Face sheets fabricated from 1.06 mm (0.042") (18 gauge) steel.
 - .2 Honeycomb core.
 - .3 Longitudinal edges mechanically interlocked.
 - .1 Tack welded at top and bottom of door, 150 mm (6") on centre, and above and below each edge cutout, filled and ground smooth with no visible seams.
- .3 Fabricate of composite metal face construction with each face formed from flush sheet steel without visible seams, free of scale, pitting, coil brakes, buckles and waves.
- .4 Formed edges shall be true and straight with minimum radius for the thickness of steel used.
- .5 Lock and hinge edges shall be bevelled 3 mm in 50 mm (1/8" in 2") unless hardware or door swing dictates otherwise.
- .6 Top and bottom of doors shall be provided with inverted, recessed, 1.34 mm (0.053") (16 gauge) steel end channels, welded to each face sheet at 50 mm (2") on centre maximum.
- .7 Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.
- .8 Blank, reinforce, drill and tap doors for mortised, templated hardware. Locate hardware to manufacturer's standard unless indicated otherwise.

Steel Doors and Frames

- .9 Holes 12.7 mm (1/2") and larger shall be factory prepared.
- .10 Glazing:
 - .1 For glazing materials up to and including 8 mm (5/16") thick, doors shall be provided with 0.81 mm (0.032") (20 gauge) steel glazing trim and snap-in glazing stops.
 - .2 For glazing materials greater than 8 mm (5/16") thick, doors shall receive 0.81 mm (0.032") (20 gauge) steel trim and screw fixed glazing stops. Screws shall be #6 x 32 mm (1-1/4") oval head Tek™ (self-drilling) type at 305 mm (12") on centre maximum.
 - .3 Glazing trim and stops shall be accurately fitted (within 0.39 mm (0.015") tolerance), butted at corners, with removable glazing stops located on the 'push' side of the door.
- .11 Fabricate closing stiles of paired doors as indicated or scheduled.

2.6 Fabrication - Steel Frames

- .1 General: Applicable to frames, transom panel frames, sidelights, and window assemblies.
- .2 Interior and non-thermally broken frames; welded:
 - .1 Fabricated from:
 - .1 1.34 mm (0.053") (16 gauge) steel.
 - .2 Supplied set-up and welded (SUW).
- .3 Factory assembled frame product shall be square, free of defects, warps or buckles.
- .4 Set-up and welded corner joints (SUW):
 - .1 Profile welded—punch mitred, continuously welded on inside of the profile faces, rabbets, returns and soffit intersections, with exposed faces filled and ground to a smooth, uniform seamless surface, as defined in the CSDMA - "Recommended Specifications for Commercial Steel Door and Frame Products".
- .5 Set-up and welded joints at mullions, sills and center rails:
 - .1 Coped accurately, butted and tightly fitted.
 - .2 At intersecting flush profile faces, securely weld, fill and grind to flush, smooth, uniform, seamless surface.
 - .3 At intersecting recessed profile faces, securely weld to concealed reinforcements, with exposed hairline face seams.
 - .4 At other intersecting profile elements make exposed face seams to hairline tolerance.
- .6 Where required due to site access, when required for co-ordination or installation, or shipping limitations, frame product shall be fabricated in sections for splicing in the field.
 - .1 Field spliced jambs, heads and sills shall be provided with 1.34 mm (0.053") (16 gauge) steel splice plates securely welded into one section, extending 100 mm (4") minimum each side of splice joint.

Steel Doors and Frames

- .2 Field splices at closed sections (mullions or center rails) shall be 1.34 mm (0.053") (16 gauge) steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100 mm (4") minimum into closed sections when assembled.
- .3 Field splice joints shall be welded, filled and ground to present a smooth uniform surface by the installation company responsible for installation after assembly.
- .7 On factory assembled frame product, provide 2 temporary steel shipping bars welded to the base of the jambs or mullions to maintain alignment during shipping and handling. Remove shipping bars prior to anchoring of frames to floor.
- .8 Each door opening shall be prepared for single stud door silencers. Silencers shall be shipped loose for installation by installer, after finish painting.
 - .1 Single interior doors: 3 at strike jamb.
 - .2 Pair of interior doors: 2 at header.
 - .3 Weather-stripped doors: None required.
 - .4 Sound, light, or smoke sealed doors: None required.
- .9 Prior to shipment, mark each frame with an identification number as shown on the approved submittal drawings.
- .10 Provide mullions and transom bars of closed construction type. For fixed condition, attach members to frame with butt-welded joints. For removable condition, attach members with removable mullion anchors.
- .11 Conceal fastenings unless otherwise indicated.
- .12 Anchor frames to floor by 1.34 mm (0.053") (16 gauge) thick angle clips, welded to frame and provide with 2 holes for floor anchorage.
- .13 Grind welded corners to a flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- .14 Protect strike and hinge reinforcements using guard boxes welded to frames at masonry construction.
- .15 Reinforce head of frames wider than 1220 mm (48").
- .16 Brace frame units to prevent distortion in shipment and protect finish.

2.7 Hardware Reinforcements and Preparations

- .1 Door and frame product shall be blanked, reinforced, drilled and tapped at the factory for fully templated mortise hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
- .2 Door and frame products shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
- .3 Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware are required frame product shall be reinforced only, with drilling and tapping done by field installation.

Steel Doors and Frames

- .4 Templated holes 12.7 mm (1/2") diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by installation on site. Templated holes less than 12.7 mm (1/2") diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
- .5 Hinge reinforcements shall be 3.12 mm (0.123") (10 gauge) steel minimum, high frequency type shall be provided.
- .6 Frames shall be prepared for 114 mm (4.5") standard weight hinges minimum unless otherwise indicated.
- .7 Doors and frames in excess of 2450 mm (96") rabbet height shall be prepared for 114 mm (4.5") heavy weight 4.6 mm (0.180") hinges minimum.
- .8 Lock, strike and flush bolt reinforcements shall be 1.34 mm (0.053") (16 gauge) steel minimum, with extruded tapped holes that provide equivalent number of threads as 2.36 mm (0.093") (12 gauge).
- .9 Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 1.06 mm (0.042") (18 gauge) steel minimum.
- .10 Reinforcements are not required for surface applied hardware supplied with thru-bolts and spacers or sex-bolts.
- .11 Provide hardware mortises on perimeter frame members to be grouted in masonry or concrete partitions with 0.66 mm (0.026") (22 gauge) steel grout guards.
- .12 Electrified hardware:
 - .1 Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and inter-connected with CSA approved 12.7 mm (1/2") diameter conduit and connectors.
 - .2 Refer to electrical documents for general electrical rough-in details. At door locations indicated in electrical documents as requiring rough-in only of electrical (ie. where no electrically or electronically operated hardware is specified in the hardware schedule), provide enclosures, boxes, and conduit to permit future installation of devices without removal of grout, demounting of frames, or installation of exposed conduits.
 - .3 Frames:
 - .1 Frames with electrified devices shall include electrical connection boxes sized to accommodate devices specified in Section 08 71 00.
 - .2 Frame electrical connection boxes shall be positioned flush to edge of frame face return. Clearance shall be maintained to allow wall material to be consistently applied for length of frame member. Frame connection boxes shall be welded in place and positioned to allow necessary clearance for electrical trade to install conduit and connection components, with conduit layout in a manner that takes conduit up to ceiling in an uninterrupted configuration and to accommodate wire installation.
 - .4 Doors:

Steel Doors and Frames

- .1 Doors with electrified devices shall be manufactured to include wire raceway in door panel to accommodate electrified devices, such as electric hinge, power transfer units, electrified locks, electrified door closures and electrified exit devices. Construction of raceways shall provide a continuous conduit or channel between entry and exit points to accommodate wire installation after door manufacture.
- .2 Doors with electrified locks may require extended space to accommodate plug-type connection components or wire collection space. Coordinate with work of Section 08 71 00 and obtain hardware templates for electrified hardware clearly indicated on reviewed shop drawings and prior to door manufacture.

2.8 Frame Anchorage

- .1 Frame products shall be provided with anchorage appropriate to floor, wall and frame construction.
- .2 Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb.
- .3 Frame products for installation in new masonry walls shall be provided with steel adjustable wall anchors of the T-strap, stirrup or wire, 1.34 mm (0.053") (16 gauge) minimum or 3.96 mm (0.156") diameter wire. Straps shall be not less than 50 mm (2") x 254 mm (10") in size, corrugated and/or perforated.
- .4 Frame products installed in steel stud and drywall partitions shall be provided with 0.81 mm (0.032") (20 gauge) steel snap-in or "Z" stud type anchors.
- .5 Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4 mm (1/4") diameter, located not more than 150 mm (6") from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb. Each preparation shall be provided with 1.34 mm (0.053") (16 gauge) anchor bolt guides.
- .6 Anchor bolts and expansion shell anchors for the above preparations shall be provided by the installation company.
- .7 Where frame product is installed prior to construction of the adjacent wall, each jamb shall be provided with 1.34 mm (0.053") (16 gauge) steel floor anchors. Each anchor shall be provided with 2 holes for mounting to the floor and shall be securely welded to the inside of the jamb profile.
- .8 On sidelights or windows exceeding 3 m (9'-10") in width, installed in stud partitions, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 2.36 mm (0.093") (12 gauge) steel formed channels, mounting angles and adjusting brackets, with mounting angles welded to the inside of frame head. Formed channels, adjusting brackets and fasteners shall be shipped loose. Channels shall be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on site, by contractor responsible for installation.

2.9 Sizes and Tolerances

- .1 Widths of door openings shall be measured from inside of frame jamb rabbet with a tolerance of ± 1.6 mm (+0.063").

Steel Doors and Frames

- .2 Heights of door openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame with a tolerance of ± 1.2 mm (± 0.047 ").
- .3 Unless finishing hardware dictates otherwise, doors shall be sized so as to fit the above openings and allow a 3 mm ($1/8$ ") clearance at jambs and head. A clearance of 19 mm ($3/4$ ") between the bottom of the door and the finished floor (exclusive of floor coverings) shall be provided. Tolerances on door sizes shall be ± 1.2 mm (± 0.047 ").
- .4 Manufacturing tolerances on formed frame profiles shall be ± 0.8 mm (± 0.031 ") for faces, door stop heights and jamb depths. Tolerances for throat openings and door rabbets shall be ± 1.6 mm (± 0.063 ") and ± 0.4 mm (± 0.016 ") respectively. Hardware cut-out dimensions shall be as per template dimensions, ± 0.4 mm (± 0.015 ").

2.10 Hardware Locations

- .1 Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified in paragraph 2.9 of this section.
- .2 Top of upper hinge preparation for 114.3 mm (4.5") hinges shall be located 180 mm (7.5") down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3 mm (4.5") hinges shall be located 310 mm (12.625") from finished floor as defined in paragraph 2.9 of this section. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts.
- .3 Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033 mm (40-5/16") from finished floor. Strikes for deadlocks shall be centered at 1220 mm (48") from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer's templates.
- .4 Push and/or pulls on doors shall be centered 1070 mm (42") from finished floor.
- .5 Preparations not noted above shall be as per hardware manufacturer's templates.
- .6 Hardware preparation tolerances shall comply with the ANSI A115 standards.

PART 3 - EXECUTION

3.1 Examination

- .1 Provide necessary grounds, bracing and strapping for fitting and adequate for securing of the work.
- .2 Cooperate with work of other sections to ensure fastenings set by others are provided and located, their work is installed to their specifications and that those responsible for back priming are notified in sufficient time for them to schedule work.

3.2 Installation - Steel Doors and Frames

- .1 Set frame product plumb, square, aligned, without twist at correct elevation in accordance with NAAMM-HMMA 840-1708 11 13.
- .2 Fire labelled product shall be installed in accordance with NFPA 80-2010.
- .3 Frame product installation tolerances:
 - .1 Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be ± 1.6 mm ($\pm 1/16$ ").

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- .2 Squareness tolerance, measured through a line 90° from one jamb at the upper corner of the product, to the opposite jamb, shall be ± 1.6 mm ($\pm 1/16$ ").
- .3 Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be ± 1.6 mm ($\pm 1/16$ ").
- .4 Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be ± 1.6 mm ($\pm 1/16$ ").
- .4 Brace frame product rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install temporary wood spreaders at mid-point of frame rabbet height to maintain frame widths. Remove wood spreaders after product has been built-in.
- .5 Provide vertical support at center of head for openings exceeding 1250 mm (48") in width.
- .6 Secure anchorages and connections to adjacent construction.
- .7 Adjust operable parts for correct clearances and function.
- .8 Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.
- .9 Remove grout or other bonding material from products immediately following installation.
- .10 Provide appropriate anchorage for floor and wall construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite the strike jamb. On each jamb, install 2 anchors for openings up to and including 1525 mm (60") high and install 1 anchor for each additional height of 760 mm (30") of height or fraction thereof, except as indicated below. Frames placed in previously placed concrete, masonry or structural steel shall be provided with anchors located not more than 150 mm (6") from top and bottom of each jamb, and intermediate anchors at 660 mm (26") on centre maximum.
- .11 Secure frames set in previously constructed concrete or masonry openings by countersunk expansion bolts at same centres as for adjustable Tee wall anchors. Reinforce frame at fastening location to prevent indentation of frame by fastening device.
- .12 Fill and grind smooth "punch and dimpled" frame installations.
- .13 Prior to site touch-up, exposed surfaces of galvanized steel to be finished shall be cleaned to remove foreign matter. Refer to paint manufacturers recommendations for additional information and requirements of Section 09 91 00.
- .14 Touch-up exposed field welds shall be finished to present a smooth uniform surface and with a rust inhibitive primer.
- .15 Touch-up exposed surfaces that have been scratched or otherwise marred during shipment, installation, and handling shall be with a rust inhibitive primer.
- .16 Finish paint in accordance with Section 09 91 00.
- .17 Install door silencers.
- .18 Properly fasten units and secure in place with concealed fixings wherever possible. Include grounds and furring where required.
- .19 Make allowance for deflection to ensure structural loads are not transmitted to frames.
- .20 Adjust operable parts for correct clearances and function.

Steel Doors and Frames

3.3 Installation - Finishing Hardware

- .1 Install finishing hardware in accordance with ANSI A115.1G-1994, manufacturers' templates and instructions, and Section 08 71 00.

3.4 Adjusting and Cleaning

- .1 Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.
- .2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by *Supplier's* requirements.
- .3 Adjust doors equipped with closers to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location, and traffic.
- .4 Clean hardware after installation in accordance with *Supplier's* requirements.

END OF SECTION

Flush Wood Doors

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Solid core doors with wood veneer.
 - .2 Factory finishing wood doors.

1.2 Administrative Requirements

- .1 Coordination:
 - .1 Coordinate installation of doors with installation of frames specified in other Sections and hardware specified in Section 08 71 00.
 - .2 Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Submit shop drawings for the work of this section complying with the North American Architectural Woodwork Standards 4.0 requirements.
 - .2 Indicate door location using numbering system per door schedule, size, and hand of each door, elevation of each door type; undercuts, bevelling, construction type core and edge construction not covered in product data; and special blocking requirements.
 - .3 Indicate dimensions and locations of factory machining criteria for hardware, extent of hardware blocking.
 - .4 Indicate dimensions and locations of cut-outs including trim for openings.
 - .5 Indicate door face finish requirements including veneer matching.
 - .6 Indicate doors to be factory finished and finish requirements.
 - .7 Indicate electrified hardware requirements and preparations.
- .4 Selection samples:
 - .1 Submit 3 sets of samples for initial selection purposes of actual veneers showing full range of grain variation, colour and matching, natural characteristics reflecting wood cut and species, manufacturing characteristics for each wood species specified. Submit samples as many times as required until approved by *Consultant*. First submission to include one set of samples per *Consultant* request plus one set lighter in tone and one set darker in tone.
- .5 Verification samples:

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- .1 Submit cut-away sample of each type of door, to show stile and rail construction, core, cross banding, door face finish and edges.

1.4 Quality Assurance

- .1 Qualifications:
 - .1 Manufacturer shall be a member in good standing of the Architectural Woodwork Institute or the Architectural Woodwork Manufacturers Association of Canada or the Woodwork Institute.
- .2 Quality standard:
 - .1 Work shall be in accordance with the North American Architectural Woodwork Standards 4.0, Premium Grade, or the highest grade available for performance and appearance characteristics of materials in Sections 3 – 5 used that apply to *Product* fabrication and installation requirements governed by Sections 6 – 12.

1.5 Delivery, Storage, and Handling

- .1 Doors shall be marked with door numbers used on shop drawings in the top hinge cavity created by the machining for hinges.
- .2 Identify doors with labels. Package with resilient packaging.
- .3 Store doors flat at the *Place of the Work* in piles with bottom face on bottom of pile. Protect from moisture by placing water resistant material under skids supporting piles. Cover top of piles and provide air at sides of piles.
- .4 Deliver the wood doors only after the building is closed and dry and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period. Do not receive the doors in a damp area. Do not drag the doors on the ground, floor or across one another.

1.6 Field Conditions

- .1 Environmental conditions:
 - .1 During storage and installation: Obtain and comply with wood door manufacturer's instructions for optimum temperature and relative humidity conditions for wood doors during its storage and installation. Do not install wood doors until these conditions have been attained.
 - .2 During finishing: Comply with wood door manufacturer's temperature and humidity requirements before, during, and after application of finishes.
 - .3 During service life of woodwork: Obtain and comply with wood door manufacturer's advice for optimum temperature and humidity conditions.

1.7 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranties:
 - .1 System:
 - .1 Labour, materials, and workmanship for work of this section.

Flush Wood Doors

- .2 The warranty is a total system warranty, and includes hardware, sealants, hanging and fitting, and finishing.
- .3 Repair or replace wood doors that fail or are defective within the specified warranty period. The warranty includes re-installation of hardware, re-hanging, and finishing
- .4 Duration: 2 years.
- .2 Glass and glazing: in accordance with Section 08 80 00.

PART 2- PRODUCTS

2.1 Manufacturers

- .1 Baillargeon by Masonite Architectural.
- .2 Lambton Doors.
- .3 Masonite Architectural.
- .4 Substitutions: in accordance with Section 01 25 00.

2.2 Performance/Design Requirements

- .1 Flush wood doors shall meet the minimum acceptance levels in accordance with the North American Architectural Woodwork Standards 4.0.
 - .1 Be in true alignment.
 - .2 Operate and swing freely, smoothly, and easily.
 - .3 Remain stationary at any point.
 - .4 Close evenly and tightly against stops without binding.
 - .5 Latch positively when doors are closed with moderate force.
 - .6 No delamination.
 - .7 No telegraphing of core construction in face panels exceeding 0.254 mm (0.01") in a 75 mm (3") span, and warp exceeding 3 mm (1/8") in a 1066 mm (42") x 2133 mm (84") section.

2.3 General

- .1 Single-source manufacturing and fabrication responsibility: Engage a qualified Manufacturer to assume undivided responsibility for wood doors specified in this section, including fabrication and finishing except where site finishing is specified.

2.4 Door Construction

- .1 Door construction, industry abbreviations and types to North American Architectural Woodwork Standards 4.0.
- .2 Performance duty level:
 - .1 Doors shall meet the requirements of ANSI/WDMA I.S. 1A-13 for Extra Heavy Duty Performance Level unless otherwise indicated or scheduled.
- .3 Solid particleboard core, veneer faced, non fire rated wood door construction:

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- .1 Type PC-5, particle board core to ANSI A208.1-2009 LD-2 (529 kg/m³ - 529 kg/m³ (28 lbs/ft³-33 lbs/ft³) density).
- .4 Bonding:
 - .1 Bond stiles and rails to core; abrasive sand core assembly to achieve uniform thickness prior to lamination of door faces.
- .5 Panel edge types:
 - .1 Wood veneer faced doors for transparent finish:
 - .1 For vertical edges (stiles) and exposed horizontal edges (rails). (Exposed horizontal edges are those edges that can be viewed from floors above.):
 - .1 Solid wood edgeband to match face veneer, face and cross bands show.
 - .2 Impact resistant vinyl edgeband (vertical edges/stiles only), face and crossbands are covered:
 - .1 Thickness: minimum 3 mm (1/8").
 - .2 Hardness: minimum 65 in accordance with ASTM D2240-15(2021).
 - .3 Tensile strength: minimum 24.8 MPa (3590 psi) in accordance with ASTM D638-22.
 - .4 Colour and finish to match wood door finish.
- .6 Blocking:
 - .1 Provide hardware blocking for doors as follows:
 - .1 Non-rated doors: Structural composite lumber for hardware blocking.
 - .2 HB-1, minimum 125 mm (5") wide, full door width, top-rail blocking for closure devices or flush bolts or for sliding door hardware.
 - .3 HB-2, minimum 125 mm (5") wide, full door width, bottom-rail blocking for doors with protection plates, concealed door seals, automatic bottoms, pivots or floor bolts.
 - .4 HB-4, minimum 125 mm (5") wide x 250 mm (10") high blocking for doors with mortise locks and pockets.
 - .5 HB-5, minimum 125 mm (5") wide x 250 mm (10") high blocking for hinges.
 - .6 HB-6, minimum 125 mm (5") wide, full door width, mid-rail blocking for fire exit devices.
 - .7 HB-7, minimum 125 mm (5") wide, full door height, for doors with continuous type hinges.
- .7 Thickness:
 - .1 45 mm (1-3/4") minimum unless otherwise indicated or scheduled.

2.5 Veneer Faced Doors For Transparent Finish

- .1 Veneer face grade: Allowable wood veneer face grade characteristics shall comply with North American Architectural Woodwork Standards 4.0 referenced grade and referenced standards.
 - .1 A.

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- .2 Veneer thickness: Minimum 1.02 mm (0.040") thick after sanding.
- .3 WD-1; Veneer species:
 - .1 Sapele to match existing door panel.
 - .2 Substitutions: accordance with Section 01 25 00.
- .4 Veneer cut: Plain.
- .5 Veneer leaf matching: Book.
- .6 Veneer assembly matching:
 - .1 Balance.
- .7 Doors in pairs or sets:
 - .1 For openings with more than one door, including doors with mullions, door faces shall be matched as follows:
 - .1 Pair matched.
- .8 Transom and side panels:
 - .1 Fabricate matching panels with same construction, exposed surfaces, and finish specified for associated doors.
 - .2 Matching requirements: to match existing.

2.6 Accessories

- .1 Wood glass stops: Solid hardwood, species to match face finish, and referenced quality standard.
- .2 Finishing hardware: in accordance with Section 08 71 00.

2.7 Fabrication

- .1 Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - .1 Clearances: Refer to Part 3 for clearance tolerances.
 - .2 Fit doors for automatic door bottoms.
 - .3 Bevel non-fire-rated doors 3-1/2 degrees (1/8 inch in 2 inches) at lock and hinge edges.
- .2 Fabricate doors with hardware blocking as specified in Part 2 of this Section.
- .3 Factory machine doors for finish hardware that is not surface applied. Do not machine for surface hardware. Locate hardware to comply with Door and Hardware Institute (DHI) "Recommended Locations for Architectural Hardware for Flush Wood Doors (latest edition). Comply with final reviewed hardware schedules, door and frame shop drawings and hardware templates.

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- .4 Electrified hardware: Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware supplier, doors with electrified devices shall be manufactured to include wire raceway in door panel to accommodate electrified devices, such as electric hinge, power transfer units, electrified locks, electrified door closures and electrified exit devices. Construction of raceways shall provide a continuous conduit or channel between entry and exit points to accommodate wire installation after door manufacture.
- .5 Factory cut and trim openings.
- .6 Transom and side panels:
 - .1 Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

2.8 Factory Finishing

- .1 Finish work in factory in accordance with North American Architectural Woodwork Standards 4.0 and referenced quality standard.
- .2 Prior to finishing, handling marks or effects of exposure to moisture removed with a thorough final sanding over surfaces of the exposed portions, using appropriate grit sandpaper, and shall be cleaned prior to applying sealer or finish. Sanding shall be completed just prior to stain or finishing application.
- .3 Comply with requirements indicated below for finish system, staining, and sheen.
 - .1 Sheen range measurements in accordance with North American Architectural Woodwork Standards 4.0:
 - .1 Satin.
 - .2 Factory finish with transparent, Post Catalysed Lacquer in accordance with the North American Architectural Woodwork Standards 4.0.
 - .1 Transparent finish:
 - .1 Clear (natural).
- .4 Seal top and bottom door edges.

PART 3 - EXECUTION

3.1 Examination

- .1 Provide necessary grounds, bracing and strapping for fitting and adequate for securing of the work.

3.2 Installation - General

- .1 Execute installation and assembly at the *Place of the Work* using skilled forces under supervision of a competent joinery foreperson.
- .2 Install work plumb, level and straight, and fasten it securely to backing to support itself and anticipated superimposed loads.
- .3 Build into construction as indicated, or specified in other sections of this specification, or both.

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- .4 Adequately fasten units and secure in place with concealed fixings wherever possible. Include grounds and furring where required.

3.3 Installation - Doors

- .1 Align and fit doors in frames with uniform clearances as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - .1 Clearances:
 - .1 Provide clearances as follows except where more stringent clearance is required or indicated.
 - .2 Provide 3.18 mm (1/8") maximum clearance between door and frame at heads, jambs, and between pairs of doors.
 - .3 Provide minimum 6 mm (1/4") clearance from bottom of door and top of floor finish and maximum clearance of 9.5 mm (3/8").
 - .2 Seal top and bottom edges of wood doors. Re-seal field cuts in accordance with manufacturer's written requirements.
 - .3 Pilot drill screw and bolt holes.

3.4 Installation - Finishing Hardware

- .1 Install finishing hardware in accordance with Section 08 71 00.

3.5 Adjusting and Cleaning

- .1 Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.
- .2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by *Supplier's* requirements.
- .3 Ensure that doors equipped with closers operate to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location and traffic.
- .4 Clean hardware after installation in accordance with *Supplier's* requirements.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

- .1 Supply and off-load to place in a clean, dry, and secure room at the *Place of the Work*, which has been designated for storage of all finish hardware specified including necessary fastening devices.
- .2 Supply all finish hardware required and not supplied under other Sections.
- .3 Check and verify hardware information on door and frame shop drawings, prior to fabrication.
- .4 Packaging, labelling, provision of installation instructions, templates, fixings and similar items, and delivery to the *Work* site.
- .5 Give assistance at the *Place of the Work* to organize hardware storeroom and supply qualified staff to correctly categorize, mark, and arrange each item in groups to enable efficient dispensing in specified hardware groups for each door to installation trades.
- .6 Provide qualified staff at the *Place of the Work* promptly to assist installation trades subsequent to being requested and to ensure that hardware is being correctly installed.
- .7 Upon completion of installation of hardware, hardware *Supplier* shall arrange and conduct, in company of *Consultant* and *Contractor*, inspections to verify that all hardware is installed and functioning satisfactorily, and where necessary shall recommend adjustments of such items as closer arms, valves, door holders and latch and locksets. Report comments in writing to *Consultant* and *Contractor*.
- .8 Supply temporary locking cylinders and keys for construction purposes. Locks used for *Contractor* security shall be keyed as required to conform to building operations' security requirements.

1.2 Administrative Requirements

.1 Coordination:

- .1 Coordinate work of this section to ensure information and material is promptly provided, to ensure orderly and expeditious progress of the *Work*, and to comply with schedule for completion.
- .2 Within 3 weeks of *Contract* Award, submit confirmed orders to manufacturers/*Suppliers* to *Consultant*.
- .3 Assist *Contractor* to organize hardware storeroom and supply qualified staff to correctly categorize, mark, and arrange each item in groups to enable efficient dispensing in specified hardware groups for each door to installation trades.
- .4 Coordinate the work of this section to ensure supplied hardware can function as required and can be installed within the particular details of the door and frame assemblies. Hardware that cannot be installed or will not function as intended will be replaced at no cost to the *Owner*.

.2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

Finish Hardware

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Schedules and samples:
 - .1 Prepare and submit for review, a finish hardware schedule with technical product data sheets for use in the *Work*. List type, selected manufacturer's name and number, location, mounting heights and finish of hardware, and complete cross reference to door schedule.
 - .2 The indication or omission of a hardware component on the hardware schedule does not remove the responsibility of this section to ensure that all hardware can be installed and will function as intended.
 - .3 Submit samples of complete line of hardware and finishes. Identify samples indicating hardware item numbers used in the Finish Hardware Schedule, manufacturer's numbers, names, types, finishes, sizes and indication of door location(s). Approved samples will be retained for comparisons and returned upon completion of the *Work*.
 - .4 Prepare and submit for review, a keying schedule recognizing *Owner* requirements which shall be determined after award of *Contract*.
- .4 Templates:
 - .1 Submit for distribution, 3 copies of templates, template information, installation instructions and details necessary to enable preparation for, and installation of finish hardware in accordance with Door Hardware Institute recommended procedures. Submit templates arranged and marked coincident with specified hardware designations.
 - .2 Submit promptly when requested, the foregoing information in 3-ring plastic hard-covered binders suitably identified.
 - .3 In lieu of 1.3.4.1 arrange for the issue by each hardware manufacturer, the manufacturer's standard book of template drawings, at the option of door and frame manufacturers.
- .5 Jigs:
 - .1 Submit template jigs for each component to be recessed to enable installation trades to prepare doors to preclude misalignment and improper fit.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Instruct the *Owner's* designated representative in proper care and preventative maintenance of hardware to assure longevity of operation.
 - .2 Submit maintenance data for cleaning and maintenance of finish hardware.

Finish Hardware

- .3 Submit to building maintenance staff prior to date of *Substantial Performance of the Work*, two sets of wrenches for door closers, locksets and fire exit hardware.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 *Supplier*:
 - .1 Shall have 5 years' experience, minimum, in *Products*, systems and assemblies specified and with approval of *Product* manufacturers.
 - .2 Finish Hardware Supplier's project manager shall be directed involved in the day to day management of the project and shall be an accredited Architectural Hardware Consultant (AHC).

1.6 Delivery, Storage, and Handling

- .1 Package each item of hardware individually, complete with trim and necessary fastenings, and accessories, including wrenches, keys, and other appurtenances required to ensure correct installation. Mark each item as to contents and appropriate use in specified groups.
- .2 All items of hardware subject to handling when installed shall be submitted with an easily removable covering to protect against scratches, abrasions, coating with dissimilar finish materials on adjacent surfaces, and tarnishing.

1.7 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .1 Extended warranty:
 - .1 Manufacturer's standard extended warranties.
 - .2 Labour, materials, and workmanship for work of this section.
 - .1 Duration: 2 years.
 - .3 Keypad locks, floor/wall stops, and other hardware items:
 - .1 Duration: 1 year.
 - .4 Overhead stops:
 - .1 Duration: 2 years.
 - .5 Exit devices:
 - .1 Duration: 5 years.
 - .6 Door closers - mechanical:
 - .1 Duration: 10 years.
 - .7 Mortise hinges and locks:
 - .1 Duration: Lifetime.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Comply with codes and requirements of governing authorities, and as specified.
- .2 Provide hardware items with characteristics to meet specified fire ratings, and conform to exit requirements of governing authorities.

2.2 Materials

- .1 Finish hardware: in accordance with Finish Hardware Schedule.

PART 3 - EXECUTION

3.1 Examination

- .1 Before furnishing any hardware, carefully check *Contract Documents*, verify door swings, door and frame materials and operating conditions, and assure that hardware will fit work to be attached.
- .2 Check shop drawings and frame and door lists affecting hardware type and installation, and verify to correctness thereof, or advise of required revisions. Check that doors, frames and panels requiring additional support are reinforced.
- .3 Point out special requirements to installer. Make final adjustment of hardware, in particular closer arms, valves and locksets, to work properly.

3.2 Installation

- .1 Install in accordance with manufacturer's written installation requirements. Refer also to installation requirements indicated, and specified in other sections of specifications.
- .2 Accurately locate and adjust hardware to meet manufacturer's written requirements. Use special tools and jigs as recommended.
- .3 Locate door stops to contact doors 75 mm (3") from latch edge.
- .4 Refer to Section 08 14 00 with respect to factory preparation for hardware for wood doors. Install wood doors and applicable hardware, including hinges.
- .5 Take delivery of finishing hardware and install, except hardware specified as part of work of another section. Check each item as received.
- .6 Set, fit and adjust hardware according to manufacturer's directions, at heights later directed by *Consultant*. Hardware shall operate freely. Protect installed hardware from damage and paint spotting.
- .7 Sound and weather seals:
 - .1 Install seals to continuously seal entire perimeter of doors. Secure in place with non-ferrous screws, in accurate alignment.
 - .2 Maintain integrity of seal at head of doors fitted with closers. Adapt seals as required to achieve specified performance.
- .8 Pre-drill kickplates and doors prior to installation of kickplates. Apply with water-resistant adhesive and countersunk stainless steel screws.

Finish Hardware

- .9 Set thresholds on two continuous beads of polyurethane caulking fastened with a minimum of 4 countersunk screws.
- .10 At wood doors, use screw attachment for exit devices and closers except as follows:
 - .1 Use through-bolt attachment for exit devices and closers at mineral core doors.

3.3 Electrified Hardware

- .1 Install electronic components, security components such as magnetic locks, sentronic hold open devices door status switches, card readers, processors, transformers, and other electric devices.
- .2 Power wiring will be supplied and installed by Electrical Divisions 26, 27, and 28 including conduit, boxes and other electrical appurtenances, including connections and terminations. Be responsible for ensuring that all wiring work is done in accordance with the *Suppliers* wiring diagrams and directions.
- .3 Arrange for testing and commissioning of system by the distributor of the system. Submit a copy of reports to the *Consultant*.

3.4 Keying

- .1 Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- .2 Submit Construction Master Keying (CMK) and Grand Master Keying (GMK) upon completion of the work of this section.

3.5 Field Quality Control

- .1 Field tests and inspections:
 - .1 Inspect the installation of finish hardware on an agreed frequency.
 - .2 Advise in writing of work being performed that will prejudice the installation or correct operation of items of hardware.
 - .3 Ensure items have been installed complete with required trim and accessories, and fastenings are adequately secured and approved. Ensure closer arms, valves, holder devices, locksets and latchsets are correctly adjusted.
 - .4 Inspections shall be performed by Finish Hardware Supplier's project manager involved in the day to day management of the project and shall be an accredited Architectural Hardware Consultant (AHC).

3.6 Adjusting and Cleaning

- .1 Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.
- .2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by *Supplier's* requirements.
- .3 Ensure that doors equipped with closers operate to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location and traffic.

Finish Hardware

- .4 Clean hardware after installation in accordance with *Supplier's* requirements.

END OF SECTION

Glass and Glazing

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Glass and glazing.

1.2 Administrative Requirements

- .1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Show details of each type of glazing system in conjunction with the framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material, glazing thickness, bite on the glass and glass edge clearance.
 - .2 Indicate analysis of glass including maximum deflection and allowable stresses from imposed dead/live loads and thermal loads.
- .4 Samples:
 - .1 Submit 305 mm (12") square samples of each type of glass indicated except for clear monolithic glass products, and 305 mm (12") long samples of each color required, except black, for each type of sealant or gasket exposed to view.
 - .1 Submit 3 control samples for each glass type showing maximum range of visible difference between units for the *Project*.
 - .2 Submit samples of glass showing each type of shape and finish of glass edge for exposed glass edges.
- .5 Test and evaluation reports:
 - .1 Obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials including insulating units.
- .6 Manufacturer reports:
 - .1 Submit glass fabricator's product information and structural calculations indicating compliance with glazing standards established by the Glass Association of North America (GANA). Submittal to include thermal stress and structural load analysis of the proposed glass types, configuration and sizes.
- .7 Submit sample glazing warranty.
- .8 Submit letter from insulating glass unit fabricator that insulating glass units supplied will bear the certification mark of IGMAC or IGCC/IGMA.CAN/CGSB 12.8-97

Glass and Glazing

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit maintenance and cleaning instructions for glass and glazing for incorporation into the operating and maintenance manuals.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 Manufacturers: Fabrication processes, including tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994.
 - .2 Installers / applicators / erectors:
 - .1 *Subcontractor:*
 - .1 Shall be thoroughly trained and experienced in skills required.
 - .2 Shall be completely familiar with referenced standards and requirements of the work of this section.
 - .3 Shall personally direct installation performed under this section.
 - .2 Foreperson experience: Shall have 10 years' experience, minimum, as glazing mechanic.
 - .3 Glazing mechanic experience: Shall have 3 years' experience, minimum, as glazers.

1.6 Delivery, Storage, and Handling

- .1 Protect glass from edge damage, dust, and contaminants during handling and storage. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.
- .2 Storage and protection: Protect glazing materials according to manufacturer's written requirements and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

1.7 Field Conditions

- .1 Ambient Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation or other causes.
- .2 Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 4.4°C.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 General:

Glass and Glazing

- .1 Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section.
 - .1 GANA Glazing Manual.
 - .2 GANA Engineering Standards Manual.
 - .3 GANA Laminated Glazing Reference Manual.
 - .4 GANA Sealant Manual.
- .2 Glass strength:
 - .1 Design glass in conformance with the building code and the following requirements:
 - .1 Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed the following:
 - .1 8 breaks per 1000 for glass installed vertically less than 15 degrees from the vertical plane and under wind action.
 - .2 Provide annealed, heat strengthened, and tempered lights where required by the building code, and where required for the various solar exposures on the building.
 - .3 Glass thicknesses and glass types specified, indicated, or scheduled in the *Contract Documents* are minimums required. Modify glass thickness as required to satisfy design and building code requirements, and requirements of authorities having jurisdiction, and any such modifications shall be clearly indicated on shop drawings.
- .3 Thermal and optical performance: Provide glass products with performance properties specified or published by glass manufacturer where not specified. Performance properties to be manufacturer's published data as determined according to the following procedures:
 - .1 Centre of glass U-Value: National Fenestration Rating Council (NFRC) 100 methodology using Flixo Pro (version 8.0 or later) or LBNL WINDOW 7 computer program.
 - .2 Centre of glass solar heat gain coefficient: NFRC 200 methodology using LBNL-35298 WINDOW 5.2 computer program.
 - .3 Visible light transmittance: NFRC 200 methodology.
 - .4 Solar optical properties: NFRC 300 or LBNL Optics.
- .4 Provide glass *Products* of uniform appearance, reflectivity, hue, shade, visible light transmittance, and colour when viewed from distance of 3 m (10 ft) to 30 m (100 ft) perpendicular to the glass or from 45 degree angle to the glass.
- .5 Protect laminated glass interlayer from damage or discolouration resulting from contact with deleterious and incompatible sealants, substances, and materials. Comply with manufacturer's recommended installation requirements.

2.2 Glass Manufacturers

- .1 Subject to compliance with the requirements of the *Contract Documents*, provide primary glass by one of the following float glass manufacturers:
 - .1 Cardinal Glass Industries.

Glass and Glazing

- .2 Guardian Industries, LLC.
- .3 Pilkington North America.
- .4 Vitro Architectural Glass.

2.3 Glass Materials

- .1 General:
 - .1 Single source responsibility: Provide materials from a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source and manufacturing plant for each type and class required.
- .2 Annealed (float) glass:
 - .1 Clear, annealed glass, 6 mm (1/4") thick minimum, in accordance with CAN/CGSB 12.3-M91, Glazing Quality.
- .3 Heat treated (tempered or heat strengthened) float glass:
 - .1 In accordance with CAN/CGSB 12.1-M90.
 - .2 Minimum thickness: 6 mm (1/4").
 - .3 Fabrication process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - .4 For uncoated glass, comply with requirements for Condition A in accordance with ASTM C1048-18.
 - .5 For coated vision glass, comply with requirements for Condition C (other coated glass) in accordance with ASTM C1048-18.
 - .6 Heat strengthened glass shall have surface compression of 24-52 MPa (3,500-7,500 psi).

2.4 Glazing Materials (Non-Fire Rated)

- .1 Glazing materials; general: Select glazing sealants, tapes, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
- .2 Glazing gaskets: Moulded or extruded gaskets of profile and hardness required to maintain watertight seal, made from the following:
 - .1 Preformed silicone to ASTM C1115-17(2022).
- .3 Setting blocks: Moulded or extruded material with Shore, Type A Durometer hardness of 85, plus or minus 5, made from the following:
 - .1 Preformed silicone to ASTM C1115-17(2022).
- .4 Spacers: Moulded or extruded blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated made from the following:
 - .1 Preformed silicone to ASTM C1115-17(2022).

Glass and Glazing

- .5 Edge blocks: Moulded or extruded material of hardness needed to limit glass lateral movement (side walking) made from the following:
 - .1 Preformed silicone to ASTM C1115-17(2022).
- .6 Cleaners, primers and sealers: Type recommended by sealant or gasket manufacturer.
- .7 Polyurethane foam glazing tape:
 - .1 High density, closed-cell, flexible, non-extruding tape, adhesive backed one side only; recommended by manufacturer for exterior applications with nominal pressure in glazing channel.
 - .2 Acceptable *Products*: As recommended by manufacturer suitable for conditions of application and use.
- .8 Silicone glazing (Weatherseal) sealant:
 - .1 Non-staining, low dirt pick-up, medium-modulus, neutral-curing silicone sealant; complying with ASTM C920-11, Type M or S, Grade NS, Class 50.
 - .2 SWRI Validation.
 - .3 Colour: to later selection by *Consultant* from full range.

2.5 Fabrication of Glazing Units

- .1 Fabricate glazing units in sizes required to fit openings, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - .1 Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
- .2 Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- .3 Grind smooth and chamfer, and polish exposed glass edges and corners, unless otherwise indicated.

PART 3 - EXECUTION

3.1 Examination

- .1 Examine framing, glazing channels, and stops, with glazing installer present, for compliance with the following:
 - .1 Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - .2 Inspect butt and mitre joints in framing. Seal joints found to be open with a compatible sealant prior to glazing.
 - .3 Glazing pockets and surfaces are free of dust, construction debris, and contaminants.
 - .4 Presence and functioning of weep systems.
 - .5 Minimum required face and edge clearances as per FGIA and GANA standards.
 - .6 Effective sealing between joints of glass-framing members.

Glass and Glazing

- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- .1 Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- .2 Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.
- .3 Clean contact surfaces with solvent and apply primers to surfaces to receive tapes and sealants in accordance with the manufacturer's requirements. Ensure surfaces are free of moisture and frost.

3.3 Glazing - General

- .1 Comply with combined written requirements of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- .2 Adjust glazing channel dimensions as required by conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- .3 Protect glass edges from damage during handling and installation. Remove damaged glass from *Project* site and legally dispose of off *Project* site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- .4 Clean glazing rebate surfaces of traces of dirt, dust, or other contaminants.
- .5 Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- .6 Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- .7 Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- .8 Provide spacers for glass lites where length plus width is greater than 1270 mm (50").
 - .1 Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - .2 Provide 3.2 mm (1/8") minimum bite of spacers on glass and use thickness equal to sealant width.
- .9 Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel.
- .10 Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- .11 Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- .12 Glaze hollow metal doors and frames specified under work of Section 08 11 13 using tape glazing installation.

Glass and Glazing

3.4 Tape Glazing

- .1 Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- .2 Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- .3 Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- .4 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- .5 Do not remove release paper from tape until right before each glazing unit is installed.
- .6 Centre glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centres of openings.

3.5 Gasket Glazing (Dry)

- .1 Allow gaskets to relax and cut compression gaskets to lengths recommended by gasket manufacturer to fit openings to suit frame dimensions.
- .2 Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- .3 Installation with drive-in wedge gaskets: Centre glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centres of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- .4 Installation with Pressure-Glazing Stops: Centre glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- .5 Install gaskets so they protrude past face of glazing stops.

3.6 Sealant Glazing (Wet)

- .1 Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- .2 Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- .3 Tool exposed surfaces of sealants to provide a substantial wash away from glass.

Glass and Glazing

3.7 Field Quality Control

- .1 Conduct quality control in accordance with Section 01 45 00.

3.8 Adjusting and Cleaning

- .1 Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.
- .2 Final cleaning of glass in accordance with Section 01 78 00.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Translucent film; applied to interior glazing; FILM-1.

1.2 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Samples:
 - .1 Submit 3 - 200 mm x 200 mm (8" x 8") samples of each specified film type, pattern and colour.

1.3 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit maintenance and cleaning instructions for incorporation into operating and maintenance manuals.
 - .2 Instruct *Owner's* representative on proper care and maintenance for work of this section.

1.4 Quality Assurance

- .1 Qualifications:
 - .1 *Subcontractor*. Shall have 5 years' experience, minimum, in application of *Products* specified.

1.5 Delivery, Storage, and Handling

- .1 Package materials and identify on attached labels the manufacturer, contents and material specification number.

1.6 Field Conditions

- .1 Conform to manufacturer's written documented temperatures, relative humidity, and substrate moisture content and temperature for application of materials of this section.

1.7 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Applied film shall function as intended, and exhibit none of the following:

Applied Films

- .1 Bubbling.
- .2 Cracking.
- .3 Crazing.
- .4 Delamination.
- .5 Discolouration.
- .6 Peeling.

2.2 Materials

- .1 FILM-1; Applied films; translucent:
 - .1 Acceptable *Product*:
 - .1 3M 'Fasara Milky White, SH2MAML'.
 - .2 Substitutions: in accordance with Section 01 25 00.

PART 3- EXECUTION

3.1 Examination

- .1 Examine glass surfaces to receive film and verify that they are free from defects and imperfections which will affect the final appearance of installed film. Correct such deficiencies before starting film application.

3.2 Preparation

- .1 Prepare surfaces for film application in accordance with film manufacturer's written requirements.
- .2 Window and window framing will be cleaned thoroughly with a neutral cleaning solution. Surface of glass shall be bladed with industrial razor to ensure the removal of any foreign contaminants in accordance with film manufacturer's instructions.
- .3 Towelling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

3.3 Installation

- .1 Applied film; interior application:
 - .1 Apply film to indicated surface of glazing units in accordance with film manufacturer's written requirements, applied plumb, true and level over clean glazing, without air bubbles, wrinkles, blisters, and other defects.
 - .2 After installation, applied film shall be flat with no obvious concentrations of moisture, free of creases, free of tears, with no moisture dimples when viewed under normal conditions.
 - .3 Film edges shall be cut neatly and square at a uniform distance of 1.5 mm (1/16") to 0.79 mm (1/32") from frame.

3.4 Adjusting and Cleaning

- .1 Clean film and glass surfaces so they are free of foreign matter using cleaners recommended by film manufacturer.

3.5 Protection

- .1 Comply with manufacturer's written requirements respecting protection.

END OF SECTION

Metal Supports for Gypsum Board

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Metal support systems for interior gypsum board partitions, interior ceilings, and interior assemblies as indicated.

1.2 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the *Work* of this section, including additional data as may be required to demonstrate compliance with the *Contract Documents*.

1.3 Quality Assurance

- .1 Qualifications:
 - .1 Installers / applicators / erectors:
 - .1 *Subcontractor*. Shall have 5 years' experience, minimum, in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

PART 2 - PRODUCTS

2.1 Materials - General

- .1 For sheet metal *Products*: Sheet metal thickness indicated herein pertains to the minimum base steel thickness exclusive of coating.
- .2 Protective coatings for metal supports and framing:
 - .1 Minimum corrosion protection: Z120 (G40) ASTM A653/A653M-13.
- .3 Sheet metal screws shall have a minimum coating thickness of 0.008 mm (0.0003") of zinc. Other coatings providing equal or better corrosion protection may be used, subject to acceptance of *Consultant*.
- .4 Screws:
 - .1 Steel screws shall be equal to or exceed minimum diameter indicated on shop drawings.
 - .2 Penetration beyond joined materials shall be not less than 3 exposed threads.
 - .3 Thread types and drilling capability shall conform to manufacturer's recommendations.

2.2 Partition Support Materials

- .1 Interior non-loadbearing channel stud framing: to ASTM C645-18; roll formed from 0.455 mm (0.0179") minimum thickness unless otherwise indicated or as recommended by gypsum board manufacturer, galvanized steel sheet. Provide service holes starting at 450 mm (18") from bottom, then 914 mm (36") on centre to top of studs.

Metal Supports for Gypsum Board

- .1 Steel studs at door jambs and where indicated: 1.720 mm (0.0677") minimum thickness.
- .2 Steel studs; at backer plate locations: 0.836 mm (0.0329") minimum thickness.
- .3 Steel studs at abuse resistant gypsum board locations: 0.836 mm (0.0329") minimum thickness.
- .2 Interior floor and ceiling tracks (runners): to ASTM C645-18; in widths to suit stud sizes.
 - .1 Metal thickness: to match studs.
 - .2 For openings wider than 914 mm (36"), provide 0.836 mm (0.0329") minimum thickness for header.
- .3 Interior floor and ceiling track (runner) fasteners:
 - .1 To concrete and masonry: Use stub nails or power-driven fasteners.
 - .1 Power actuated fastening systems are not permitted.
 - .2 To suspended acoustic ceiling tile grid: Manufactured to fit applicable ceiling grid profile; CGC 'Partition Clip'.
- .4 Bracing channels: Minimum 19 mm x 10 mm x 1.087 mm (3/4" x 3/8" x 0.0428") cold rolled galvanized steel.

2.3 Ceiling Support Materials and Systems

- .1 General: Size ceiling support components to comply with ASTM C754-20 unless otherwise indicated.
- .2 Main runners: Steel channels, hot or cold rolled; Z180 (G60) galvanized.
- .3 Hanger wire: in accordance with ASTM A641/A641M-19, soft, Class 1 galvanized, minimum 4.064 mm (0.160", 8 AWG).
- .4 Hanger rods and flats: Mild steel with zinc coating, galvanized for exterior applications.
 - .1 General: Size devices for 5 times load imposed by completed system as determined in accordance with ASTM E488/E488M-22.
 - .2 Screws, clips, bolts, concrete inserts or other devices for ceiling hangers whose suitability for use intended has been proven through standard construction practices or by certified test data.
 - .3 Hangers: Comply with ASTM C754-20 for maximum ceiling area and loads to be supported.
 - .4 Interior concrete ceiling anchors:
 - .1 Acceptable Products:
 - .1 ITW Ramset/Red Head 'Dynabolt Sleeve Anchor TW-1614' or 'Redi-Drive Tie Drive' or 'Redi-Drive' with angle clip.
 - .2 ITW Ramset/Red Head 'Trubolt' or 'Dynabolt' anchors complete with galvanized angle clip.
 - .3 Hilti 'Kwik-Bolt 3' and 'HHDCA 1/4 Ceiling Hangers'.

Metal Supports for Gypsum Board

- .5 Fasteners exposed to weather, condensation, and corrosion: Zinc-plated or stainless steel fasteners in applicable product lines specified in preceding paragraphs.
- .5 Tie wire: 1.19 mm (0.047", 18 AWG) minimum zinc coated, soft-annealed wire, to ASTM A641/A641M-19.
- .6 Furring anchorages: 1.62 mm (0.0637", 16 AWG) galvanized wire ties, manufacturer's standard wire type clips, bolts, nails or screws as recommended by furring manufacturer and complying with ASTM C754-20.
- .7 Runner (carry) channels: 1.367 mm (0.0538") thick cold rolled steel, primer painted or zinc coated for interior locations, to ASTM C754-20, with minimum 228 MPa yield strength:
 - .1 38 mm x 12.7 mm (1-1/2" x 1/2") where supported at centres of 914 mm (36") maximum.
 - .2 38 mm x 19 mm (1-1/2" x 3/4") where supported at centres of 1220 mm (48") maximum.

2.4 Furring

- .1 Furring channels: 0.455 mm (0.0179") minimum typical thickness, cold rolled steel, wiped coated, nominal size of 22 mm (7/8") depth x 35 mm (1-3/8") face, hat type with knurled face.
- .2 Z-furring members: Galvanized steel z-shaped furring members; ASTM A653/A653M-13, G60, 0.836 mm (0.0329") minimum thickness of base metal, of depth indicated, designed for mechanical attachment of insulation boards or blankets.
- .3 Fasteners for furring members: Type and size recommended by furring manufacturer for substrate and application indicated, load rating and spacing to support materials carried by assembly with factor of safety of 3x per fastener manufacturer data sheets.

2.5 Accessories

- .1 Backer plates:
 - .1 Metal backer plates: Steel, galvanized; minimum 150 mm (6") wide x 0.836 mm (0.0329") minimum x length and width to suit size of items to be attached; fastened to studs for attachment of surface mounted fittings and accessories.
 - .2 Plywood backer plates: Softwood plywood; 19 mm (3/4") minimum x length and width to suit size of items to be attached; fastened to studs for attachment of surface mounted fittings and accessories.
 - .3 Dimensional wood blocking in accordance with Section 06 10 53 Rough Carpentry.
 - .4 Elimination of backer plates or direct attachment of accessories or equipment to studs will not be permitted.

PART 3 - EXECUTION

3.1 Installation General

- .1 Comply with ASTM C754-20 and manufacturer's requirements, except as modified herein. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated.

Metal Supports for Gypsum Board

- .2 Provide and install studs, framing, shimming, and furring to provide proper support for gypsum board to achieve the following installation tolerances:
 - .1 Do not exceed 3 mm (1/8") in 3 m (10') variation from plumb, level, and plane.
 - .2 Do not exceed 10 mm (3/8") from drawings locations.
 - .3 Do not exceed 1.5 mm (1/16") variation between planes of abutting edges or ends.
 - .4 Install each framing member so fastening surfaces vary not more than 3.2 mm (1/8") from the plane formed by faces of adjacent framing.
 - .5 In double stud walls, do not bridge across studs on opposite sides of wall with gypsum board or metal cross bracing.
- .3 Give complete cooperation and direction to trades erecting framing and furring over which this work is applied. Coordinate finished joint location with framing.
- .4 Coordinate installation and cooperate with mechanical and electrical work to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with the partitions, ceiling and soffit systems.
 - .1 Where the presence of suspended ductwork or other mechanical or electrical services or devices above ceiling framing conflicts with ceiling framing suspension points from structure above, provide bridging framing below conflicting work as required to support ceiling framing on specified intervals.
 - .2 Do not suspend ceiling framing from mechanical or electrical suspension systems unless agreement is obtained in writing from engineer for *Subcontractor* installing such framing that additional imposed loads are acceptable; obtain *Consultant's* acceptance before proceeding.
- .5 Provide clearances between work of this section and structural elements to prevent transference of structural loads.
- .6 Do not bridge building expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members or as indicated.
- .7 Size framing systems according to manufacturer's engineered load tables, to meet allowable deflection without permanent deformation.
 - .1 Maximum allowable deflection: L/240.

3.2 Blocking

- .1 Attach to framing adequate backer plates to support the load of, and to withstand the withdrawal and shear forces imposed by, items installed upon the work of this section.

3.3 Furring - General

- .1 Furring indicated in *Contract Documents* is schematic. Do not regard as exact or complete. Provide all necessary framing and furring to support gypsum board in accordance with manufacturers' specifications.
- .2 Shim furring as required to achieve required installation tolerances.
- .3 Leave finished work rigid, secure, square, level, plumb, curved to detailed radius and erected to maintain finish gypsum board line dimensions and contours. Make allowance for thermal movement.
- .4 Thermally separate metal studs from exterior concrete or masonry.

Metal Supports for Gypsum Board

3.4 Suspended and Furred Ceilings

- .1 Arrange hangers for suspended gypsum board ceilings to provide support independent of walls, columns, pipes, ducts; erect plumb, and securely anchored to structural frame, or embed in concrete slabs.
- .2 Keep lateral braces at hangers back 450 mm (18") minimum unless otherwise noted.
- .3 Space hangers at 914 mm (36") on centre maximum along runner channels, and not more than 150 mm (6") from ends.
- .4 Space runner channels at 1220 mm (48") on centre, maximum, and not more than 150 mm (6") from boundary walls, interruptions of continuity, and changes in direction. Run channels transversely to structural framing members.
- .5 Where splices are necessary, lap members at least 200 mm (8") and wire each end with 2 loops. Avoid clustering or lining up of splices.
- .6 Attach to rod hangers by bending hanger sharply under bottom flange of runner, and securely wiring in place with saddle tie.
- .7 Erect cross furring channels transversely across runner channels at 400 mm (16") on centre maximum, 305 mm (12") on centre at fire rated assemblies, at not more than 150 mm (6") from boundary wall openings, interruptions in ceiling continuity, and changes in direction.
- .8 Secure furring channels to each support with purpose-made slips or wire tie. Splice joints by lapping channels and tying together.
- .9 Level cross furring channels to maximum tolerance of 3 mm in 3 m (1/8" in 10 ft).

3.5 Wall Furring

- .1 Install steel furring for braced walls, free standing walls, walls that are furred out as indicated.
- .2 Frame openings and around built-in equipment, cabinets, access panels, on 4 sides, with channels. Extend furring into reveals. Check clearances with equipment suppliers.
- .3 Provide bulkheads and boxed-in duct shafts, for beams, columns, pipes and around exposed services where indicated. Install 19 mm (3/4") channels at corners and at 305 mm (12") on centre.

3.6 Metal Stud Partition Framing

- .1 Provide partition tracks (runners) at floor and underside of structural assembly and as follows:
 - .1 Align accurately and lay out according to partition layout.
 - .2 Secure runners to concrete, access flooring and to concrete slabs, as applicable, with screwed or shot fasteners located 50 mm (2") from each end and spaced at maximum 610 mm (24") on centre.
 - .3 At partition corners, extend one runner to end of corner and butt other runner to it, allowing necessary clearance for gypsum board thickness. Runners should not be mitred.
- .2 Unless otherwise indicated, place interior studs vertically at centres as follows:

Metal Supports for Gypsum Board

- .1 Provide studs at 400 mm (16") on centre, and as specially spaced in accordance with details indicated.
- .2 Provide studs not more than 50 mm (2") from abutting walls, openings and each side of corners.
- .3 Provide freedom for 19 mm (3/4") deflection under beams, structural slabs and the like to avoid transmission of structural loads to studs, or install 50 mm (2") leg ceiling tracks.
- .3 Install studs in tracks at floor and ceiling.
- .4 Where horizontal runs of service lines are scheduled to be installed, arrange with applicable trades and install studs simultaneously with services.
- .5 At openings in stud walls, erect track at head and sills to accommodate intermediate studs. At each end of track, cut out flanges, turn up web, and fasten to studs. Install intermediate studs above and below openings in same manner and spacing as wall studs. Install double studs at each jamb, and double tracks at head of door openings.
- .6 At partitions requiring fire rating, erect in accordance with requirements of listing.
- .7 Size studs, connections, and runners to carry loads according to stud manufacturer's load tables, at 24 kg/m² (5 lb/ft²) live load to meet maximum allowable deflection limits. Where depth of stud is indicated, size metal thickness to meet allowable deflection limits.
- .8 Provide three studs at corner and intermediate intersections of partitions.
- .9 Coordinate work with others installing horizontal runs of service lines so that work is done simultaneously. Where standard holes are too small for installed services, notch studs, and splice notched flanges with splice pieces 305 mm (12") longer than notches, each fastened with 2 screws.
- .10 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .11 Coordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other sections.
- .12 Unless otherwise indicated, partitions, together with gypsum board facings, shall extend above ceilings to underside of structure above.
- .13 Chase walls:
 - .1 Provide chase walls consisting of two parallel steel stud partitions.
 - .2 Provide cross bracing consisting of metal furring, located at quarter points on each pair of studs. Attach cross bracing to studs with metal screws.
- .14 Lateral support bracing channels:
 - .1 Stiffen partitions over 3 m (10') in vertical span, at mid-height to maximum vertical spacing of 2440 mm (8') on centre, with at least one 19 mm (3/4") horizontal bracing channel, extending full length of partition, overlapping at least two stud spaces at ends of bracing channels.
 - .2 Stiffen partitions at not more than 150 mm (6") from the top and bottom of openings and across two full stud spaces at each side of openings with horizontal bracing channel.

Metal Supports for Gypsum Board

- .15 Install steel stud reinforcement 1.720 mm (0.0677") at door frames and brace above ceiling. Secure to top and bottom structure with angle brackets and anchors.

3.7 Control Joints

- .1 Control joints: in accordance with Section 09 29 00.

3.8 Concrete Anchors

- .1 Provide anchors and anchorage points in reinforced concrete floor slab underside in accordance with gypsum board manufacturer's suspension requirements. Drill holes with carbide-tipped drill bits conforming to ANSI B212.15-1994 (R2000).
- .2 Provide anchors; minimum installation depth, and method of expansion as recommended by the anchor manufacturer.

END OF SECTION

Gypsum Board

PART 1- GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Gypsum board; standard, paper-faced.
 - .2 Gypsum board; abuse resistant.
 - .3 Gypsum board accessories and miscellaneous related materials.

1.2 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.

1.3 Quality Assurance

- .1 Qualifications:
 - .1 *Subcontractor*: Shall have 10 years' experience, minimum, in successful installation of work of type and quality indicated and specified.

1.4 Field Conditions

- .1 Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum boards.
- .2 Install paper-faced gypsum panels after installation areas are enclosed and conditioned.
- .3 Panels that are wet, moisture damaged, or mould damaged shall not be installed.
 - .1 Indications that panels are wet or moisture damaged include, but are not limited to, discolouration, sagging, or irregular shape.
 - .2 Indications that panels are mould damaged include, but are not limited to, fuzzy or splotchy surface contamination and discolouration.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Single source responsibility: Obtain gypsum and cement board products from a single manufacturer.
- .2 Paper-faced gypsum board: in accordance with ASTM C1396/C1396M-17.
- .3 Glass scrim gypsum board: in accordance with ASTM C1658/C1658M-13.

2.2 Gypsum Board Panels

- .1 Gypsum board; standard, paper faced:
 - .1 Acceptable *Products*:

Gypsum Board

- .1 CertainTeed 'Type X'.
- .2 CGC 'SHEETROCK Brand Firecode X'.
- .3 Georgia-Pacific 'ToughRock Fireguard X Gypsum Board'.
- .4 PABCO Gypsum 'QuietRock ES'.
- .2 Gypsum board; abuse resistant:
 - .1 Mould and moisture resistant: in accordance with ASTM D3273-21, with a panel score of 10.
 - .2 Abuse resistance performance:
 - .1 Surface abrasion surface damage: in accordance with ASTM D4977/D4977M-20, Level 3.
 - .2 Surface indentation surface damage: in accordance with ASTM D5420-21, Level 1.
 - .3 Soft-body impact penetration: in accordance with ASTM E695-22, Level 2.
 - .4 Hard Body Impact resistance: in accordance with ASTM C1629/C1629M-23, App.1, Level 1.
 - .3 Paper faced:
 - .1 Acceptable *Products*:
 - .1 CertainTeed 'Air-Renew Extreme Abuse Resistant' Gypsum Board.
 - .2 CertainTeed 'Extreme Abuse' Gypsum Board.
 - .3 CGC 'Sheetrock Brand Panels Mold Tough AR Firecode X'.
 - .4 Glass mat faced:
 - .1 Acceptable *Products*:
 - .1 CGC 'Sheetrock Brand Glass-Mat Panels Mold Tough AR Firecode X'.
 - .2 Substitution: in accordance with Section 01 25 00.

2.3 Attachment Materials

- .1 Screws; for gypsum board: bugle head, fine thread, self-tapping, Type W or S or S-12 point to suit framing type and metal gauge, with corrosion resistant finish in accordance with ASTM C1002-07/ASTM C954-11.
 - .1 Screw sizing:
 - .1 #6 x 25 mm (1") for single thickness board fastening.
 - .2 #6 x 32 mm (1-1/4") for single thickness 15.9 mm (5/8") board fastening.
 - .3 #7 x 41 mm (1 5/8") for double thickness board fastening.
 - .2 Tie wire: 1.6 mm (0.063") diameter galvanized soft annealed steel wire.

2.4 Accessories

- .1 Accessories: in accordance with ASTM C1047-19 unless otherwise indicated, maximum length pieces per location. Flanges shall be free from dirt, grease, or other material that adversely affects the bond of joint treatment or decoration.

Gypsum Board

.2 Trims:

- .1 Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.

- .1 Shapes:

- .1 Corner bead.

- .1 Mechanically fastened corner beads at impact resistant gypsum walls.

- .2 "L" or "LC" beads.

- .3 Reveal trims.

- .4 Control joints, certified by manufacturer for use at fire resistance rated assemblies as required.

.3 Aluminum trims: extruded accessories of profiles and dimensions as indicated.

- .1 Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.

- .2 Shapes:

- .1 Z reveal.

- .2 Reveals and moldings at round columns.

- .3 Acceptable manufacturers:

- .1 Fry Reglet.

- .2 Gordon Interior Specialties.

.4 Aluminum gypsum board trim:

- .1 Extruded alloy 6063-T5 to ANSI H35.1/H35.1M-2017 consisting of fin, tapered, grooved, and prepunched for screw attachment and bonding agent.

- .1 Acceptable manufacturers:

- .1 Fry Reglet.

- .2 Gordon, Inc.

- .3 Softforms.

2.5 Related Support Assemblies and Backer Plates

- .1 Dimensional wood blocking at interior assemblies: in accordance with Section 06 10 53.
- .2 Metal support systems and backer plates at interior assemblies: in accordance with Section 09 22 00.

2.6 Joint Treatment Materials

- .1 General: Comply with ASTM C475/C475M-17(2022).
- .2 Joint tape: in accordance with manufacturer's written requirements.
- .3 Joint compound for interior gypsum board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - .1 Prefilling: Use setting-type compound as recommended by panel board manufacturer.

Gypsum Board

- .2 Embedding and first coat: Use setting-type or taping compound as recommended by panel board and trim accessory manufacturers.
- .3 Fill and finish coats: Use sanding type setting-type or taping compound as recommended by panel board manufacturer.

2.7 Acoustic Wall Assembly Materials

- .1 Acoustic sealant; concealed locations: to meet material requirements as listed in Part 9 of ASTM C919-22, including ASTM C834-10 or ASTM C920-14:
 - .1 Acceptable *Products*:
 - .1 Hilti Canada Corp 'CS-S SA Light'.
 - .2 Owens Corning 'QuietZone Acoustic Sealant'.
 - .3 Pecora 'BA-98'.
 - .4 Pecora 'AC-20'.
 - .5 Tremco 'Tremflex 834'.
 - .6 Substitutions: in accordance with Section 01 25 00.
 - .2 Acoustic sealant; exposed locations, acrylic:
 - .1 Acrylic/latex acoustic sealant, Type S, Grade NS, Class 12.5 to ASTM C920-14, maximum VOC content 60 g/L, non-hardening or ASTM C834-10, Type OP, Grade -18° C.
 - .2 For exposed sealants use paintable sealant products, do use non-skinning type products where they are exposed to view or where sealant products may deteriorate (stain or bleed into) into painted surfaces.
 - .3 Acceptable *Products*:
 - .1 Hilti Canada Corp 'CS-S SA Light'.
 - .2 Master Builders Solutions Canada 'MasterSeal NP 520'.
 - .3 Owens Corning 'QuietZone Acoustic Sealant'.
 - .4 Pecora 'AC20'.
 - .5 Tremco 'Tremflex 834'.
 - .3 Smoke and acoustic sealant; concealed and exposed locations, non-fire-rated acoustic assemblies:
 - .1 Acrylic smoke and acoustic sealant, in accordance with ASTM C834-10 maximum VOC content 60 g/L, paintable, Flame Spread Value of maximum 25 to CAN/ULC-S102-10.
 - .2 Sealant shall not deteriorate (stain or bleed into) painted surfaces.
 - .3 Acceptable *Products*:
 - .1 Hilti Canada Corp 'CS-S SA Light'.
 - .2 Tremco 'Tremstop Smoke & Sound Sealant'.
 - .3 Substitutions: in accordance with Section 01 25 00.

Gypsum Board

- .4 Acoustic sealant for plenum locations: Smoke-seal sealant with flame-spread not more than 25 and smoke developed classification not more than 50 to CAN/ULC-S102-10, in accordance with Section 07 84 00.
- .5 Acoustic compound: premixed perlite plaster.
- .6 INS-7; Acoustic (sound attenuation) insulation:
 - .1 Mineral-fibre sound attenuation batts: in accordance with CAN/ULC S702-14, Type 1, fire resistant and non-combustible to CAN/ULC-S114-05, high density for sag-free, tight fitting installation.
 - .1 Density: minimum 40 kg/m³ (2.5 lbs/ft³).
 - .2 Acceptable *Products*:
 - .1 Johns Manville 'MinWool Sound Attenuation Fire Batts'.
 - .2 Owens-Corning 'Thermafiber SAFB'.
 - .3 Rockwool 'AFB'.
 - .2 Fasteners: use mechanical fasteners where required to secure insulation into position in accordance with insulation manufacturer.

2.8 Access Doors

- .1 Access doors: Coordinate with Mechanical and Electrical Specifications.
 - .1 Acceptable *Product*:
 - .1 Bauco Products Incorporated (APS - Access Panel Solutions) 'Bauco Plus II' access panels.
 - .2 Substitutions: in accordance with Section 01 25 00.

PART 3 - EXECUTION

3.1 Installation

- .1 General:
 - .1 Comply with ASTM C840-18b, GA 216-21, GA 600-21, and manufacturer's written requirements, except as otherwise indicated.
 - .2 Do not bridge building expansion joints with support system.
 - .3 Frame both sides of joints with furring and other supports as indicated.
- .2 Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1.6 mm (1/16") open space between boards. Do not force into place.
- .3 Cover both faces of stud partition framing with gypsum board in concealed spaces (above ceiling, and the like) unless otherwise indicated, except in chase walls which are properly braced internally.
- .4 Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cut-outs.
- .5 Apply components of fire-rated assemblies in conformance with indicated designs.
- .6 Do not apply gypsum board in close proximity to hot pipes or heating ducts.

Gypsum Board

- .7 Install materials with the minimum number of joints. Tightly butt joints, without force, and neatly align them.
- .8 Frame openings on every side. Provide clearances with services.
- .9 Work shall include bulkheads over doors, frames, screens, and changes in ceiling levels, pipe space and as indicated.
- .10 Provide clearances between work of this section and structural elements to prevent transference of structural loads in accordance with Section 09 22 00.
- .11 Tolerances:
 - .1 Do not exceed 3 mm (1/8") in 3 m (10') variation from plumb, level, and plane in exposed surfaces, except at end joint between gypsum board panels.
 - .2 Do not exceed 10 mm (3/8") from indicated location.
 - .3 Do not exceed 1.5 mm (1/16") variation between planes of abutting edges or ends.
 - .4 Surface flatness shall not exceed 1.5 mm (1/16") within 305 mm (12") straight edge. For non-tapered-edge end joints between boards, measure flatness tolerance with end of straight end at centreline of joint.

3.2 Accessories

- .1 At external corners install corner trim secured to framing at 230 mm (9-1/16") on centre on both flanges with screw fasteners or clinch tool.
- .2 Secure casing trim at board edges where exposed to view, where board butts against other materials with no trim to conceal junction, at perimeter of ceiling surfaces at tops of partitions where they stop against continuous ceiling surfaces, and where indicated.
- .3 Erect accessories straight, plumb or level, rigid and at proper plane.
- .4 Use full length pieces.
- .5 Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners, free from rough edges. Secure in accordance with manufacturer's specifications unless otherwise required.
- .6 Installation tolerances:
 - .1 Alignment with board panels shall not exceed tolerances specified above.
 - .2 End joints shall be flush aligned to maximum offset of 0.5 mm (0.020").

3.3 Board Application - General

- .1 Before installation of board commences, ensure that internal services have been installed, tested, and approved; conduits, pipes, cables, and outlets are plugged, capped, or covered; and that fastenings and supports installed by others are in place.
- .2 Extend board into door, window, and other openings, reveals, behind fitments, and other applied items and on metal stud partitions to structure above unless indicated otherwise.
- .3 Apply board with long dimension perpendicular to supports, unless otherwise indicated.
- .4 Locate joints on opposite sides of partitions on different studs, and at least 305 mm (12") from opening jambs.

Gypsum Board

- .5 Install board to minimize joints, and align end joints to be the least objectionable (where they are unavoidable), according to the indicated lighting design. Locate joints in ceilings where least prominently discerned, and never line them up with opening edges.
- .6 Form smooth joints at ends and at field cut edges of board panels.
- .7 Fasten board to metal support members by metal gypsum board screws, 9.5 mm (0.374") minimum to, and 12.7 mm (1/2") maximum from, centre of joints.
 - .1 Space screws:
 - .1 At fire rated board as per fire-rated assembly.
 - .2 At typical board walls at 400 mm (16") on centre at edges and field unless otherwise required.
 - .3 At typical board ceilings at 305 mm (12") on centre at edges and field unless otherwise required.
- .8 Offset gypsum board joints 150 mm (6") minimum from corners of openings.
- .9 Locate gypsum panel product joints so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.
- .10 Replace damaged or weathered sheathing boards.

3.4 Abuse Resistant Board Application

- .1 Install abuse resistance gypsum board in accordance with gypsum board manufacturer's written requirements.
- .2 Where both abuse resistant gypsum panels and plain gypsum board are used together on the same surface plane adjacent to one another, a smooth transition between the two types of boards is required. Finish the work in a manner such that the transition provides an inconspicuous joint when viewed by a person at normal viewing angles while standing in front of the boards from a distance of not less than 1000 mm (39").

3.5 Acoustic Wall Assemblies

- .1 Acoustical sealant and plaster:
 - .1 Apply acoustical sealant to seal gaps in accordance with ASTM C919-22 and in accordance with the STC rated assembly.
 - .2 Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919-22 and with manufacturer's written requirements for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - .3 Clean substrate, remove debris and deleterious substances.
 - .4 Apply sealant to close voids; no leaks around track and gypsum board.
- .2 Sound attenuation insulation:
 - .1 Install sound attenuation insulation to fill cavity unless otherwise indicated.

Gypsum Board

- .2 Trim insulation to provide close-fit contact to framing assemblies and fill the partition cavity or acoustic insulation assemblies to thicknesses specified or indicated.
- .3 Maintain air space between backs of sound attenuation insulation and back of opposite partition face layer, as applicable.
- .4 Cut insulation to provide close-fit contact around electrical boxes, pipes, and other obstructions and penetrations through and within acoustic assemblies.
- .5 Extend acoustic partition assemblies to underside of structure. Incorporate approved provision to prevent transmittance of structural deflection to partition assembly.
- .6 Staple sound attenuation insulation where required by manufacturer's installation requirements.
- .7 Where studs are not faced with gypsum board on both sides, mechanically fasten wire mesh to non-faced side of stud to retain insulation.
- .8 Mechanically attach sound attenuation insulation in wall assemblies where cavity of wall assembly is greater than 150 mm (6").
- .9 Secure insulation in such a manner that it will not sag or settle away from required locations.
- .3 Sound flanking paths:
 - .1 Where sound rated partition walls intersect non rated gypsum board partition walls, extend sound rated construction to completely close sound flanking paths through non rated construction.
 - .2 Seal joints between face layers at vertical interior angles of intersecting partitions.

3.6 Finishing

- .1 Provide levels of gypsum board finish for locations as follows, in accordance with GA 214-21.
 - .1 Level 1: Ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
 - .2 Level 2: Gypsum board substrate at applied hard surfaces, except remove tool marks and ridges.
 - .3 Level 3: Skimming of existing drywall at new commercial grade vinyl wallcovering.
 - .4 Level 4: Exposed gypsum board surfaces, except where another finish level is indicated.
- .2 Interior gypsum board:
 - .1 Prefill:
 - .1 Use setting-type joint compound. Mix joint compound according to manufacturer's written requirements.
 - .2 Fill joints between boards flush to top of eased or beveled edge.
 - .3 Fill joints of gypsum board above suspended ceilings in fire rated partitions.
 - .4 Wipe off excess compound and allow compound to harden.

Gypsum Board

- .5 Prefill joint gaps not greater than 3.2 mm (1/8") with either ready-mix or setting type joint compound; prefill joint gaps greater than 3.2 mm (1/8") with setting-type joint compound.
- .2 Taping (Level 1):
 - .1 Butter taping compound into inside corners and joints.
 - .2 Centre tape over joints and press down into fresh compound.
 - .3 Remove excess compound.
 - .4 Tape joints of gypsum board above suspended ceilings.
- .3 First coat (Level 2):
 - .1 Use taping or all-purpose drying-type compound.
 - .2 Immediately after bedding tape, apply skim coat of compound and allow to dry completely in accordance with manufacturer's written requirements.
 - .3 Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.
 - .4 Cover fastener heads and accessories with 1 coat of joint compound.
- .4 Second coat (Level 3): After first coat treatment is dried, apply second coat of compound over tape and trim, feathering compound 50 mm (2") beyond edge of first coat.
 - .1 Cover fastener heads and accessories with total of 2 separate coats of joint compound.
- .5 Third coat (Level 4):
 - .1 After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 50 mm (2") beyond edge of second coat.
 - .2 Allow third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.
 - .3 Finished joints will be accepted with a camber not greater than 1 mm (1/32") and shall be seamless, plumb, true and flush and with square, neat corners.
 - .4 Cover fastener heads and accessories with total of 3 separate coats of joint compound.
- .3 Joint compound:
 - .1 Apply finish coat of compound feathering 75 to 100 mm (3" to 4") beyond tape edges.
 - .2 Feather coats onto adjoining surfaces so that camber is maximum 0.79 mm (1/32").
- .4 Trim:
 - .1 Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by trim manufacturer.
 - .2 Install metal corner beads at external corners.

Gypsum Board

- .3 Install metal casing bead trim whenever edge of gypsum base would otherwise be exposed or semi exposed, and where gypsum base terminates against dissimilar material.
- .4 Erect beads plumb or level, with minimum joints.
- .5 Control joints:
 - .1 Provide control joints set in board facing. Support control joints with studs or furring channels on both sides of joint.
 - .2 Provide control joints in required locations
 - .1 Review control joint locations with *Consultant* prior to installation.
 - .3 Install control joints where a partition, wall, or ceiling traverses a construction joint (expansion, seismic or building control element) in the building structure.
 - .4 Install control joints where a wall or partition runs in an uninterrupted straight plane exceeding 9100 mm (30 linear feet).
 - .5 Install control joints in interior ceilings:
 - .1 With perimeter relief:
 - .1 Linear dimensions between control joints shall not exceed 15000 mm (50 ft) and total area between control joints shall not exceed 230 m² (2500 ft²).
 - .2 Without perimeter relief:
 - .1 Linear dimensions between control joints shall not exceed 9100 mm (30 ft) and total area between control joints shall not exceed 84 m² (900 ft²).
 - .6 Install control joints where ceiling framing members change direction.
 - .7 Where a control joint occurs in an acoustical or fire-rated system, provide blocking behind the control joint by using a backing material such as 16 mm (5/8") Type X gypsum panel products, mineral fibre, or other tested equivalent. Construct through-wall control joints at fire-rated assemblies in accordance with assembly listing requirements.
 - .8 Line up control joints with joints in other construction or with centre lines of mullions, columns, piers, or similar building elements, where accepted by *Consultant*.
 - .9 Install control joints straight and true.
 - .10 Ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners. If control joints are not used, additional reinforcement is required at corners to distribute concentrated stresses.
 - .11 Locate board joints so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.

3.7 Access Doors

- .1 Install access doors to mechanical and electrical fixtures specified in respective sections of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

Gypsum Board

- .2 Install access panels in locations to be determined by coordination with trades installing mechanical, electrical and other building services and consultation with *Consultant*.
- .3 Rigidly secure frames to furring or framing systems.

3.8 Adjusting and Cleaning

- .1 Clean up and remove surplus materials and rubbish resulting from the work of this section upon completion.
- .2 Clean off beads, casings, joint compound droppings and the like, leave the work of this section ready for painting trades.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Interior hard surface tiling.
 - .2 Mortar bed for tiling.
 - .3 Thin-set mortar for tiling.
 - .4 Levelling underlayment.
 - .5 Sheet uncoupling membrane.
 - .6 Trim accessories.

1.2 References

- .1 Definitions:
 - .1 Large format tile: Tiles with dimension measured along any edge 380 mm (15") and greater.

1.3 Administrative Requirements

- .1 Conduct a pre-installation meeting in accordance with Section 01 31 19.
- .2 Sequencing and scheduling:
 - .1 Coordinate installation of tile work with related work.
 - .2 Proceed with tile work only after curbs, vents, drains, piping, and other projections through substrate have been installed and when substrate construction and framing of openings have been completed.

1.4 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
 - .2 Submit manufacturer's installation requirements for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Indicate location and sizes of control joints.
- .4 Samples:
 - .1 Submit 3 -full size samples of each type of tile specified.
 - .2 Submit 3 - 305 mm (12") long samples trim accessory.
 - .3 Submit 3 - 305 mm (12") long samples of control joint sealant.
- .5 Test and evaluation reports:
 - .1 Submit moisture, alkalinity, and mortar bond test results.

Tiling

.6 Tiling system manufacturer's system warranty and design criteria:

- .1 Submit tiling system manufacturer's warranty specimen and warranty design criteria prior to the commencement of work of this section.

1.5 Closeout Submittals

.1 Submit closeout submittals in accordance with Section 01 78 00.

.2 Operation and maintenance data:

- .1 Submit manufacturer's operation and maintenance requirements for inclusion in the operation and maintenance manuals.

.3 Maintenance materials:

- .1 Provide minimum 5% of each type and colour of tile required for the *Work* for maintenance use.
- .2 Maintenance material to be of same production run as installed material.

1.6 Quality Assurance

.1 Qualifications:

.1 *Subcontractor*:

- .1 Has adequate plant, equipment, and skilled workers to perform the work expeditiously.
- .2 Has successfully completed installations similar to that specified during a period of at least the immediate past 5 years.
- .3 Shall be a member company in good standing of the Terrazzo, Tile and Marble Association of Canada and have been a member for at least the past 5 years.

.2 Mock-ups:

- .1 Grouted mock-up: 1220 mm x 1220 mm (48" x 48") sample panels of each tile type and colour, texture, size, and pattern of tile and grout.

1.7 Field Conditions

.1 Ambient conditions:

- .1 Execute work of this section while ambient temperature and humidity within safe working temperatures in accordance with manufacturer's installation requirements for a period of 72 hours before, during and following installation. Avoid concentrated or irregular heating during curing period.

1.8 Warranty

.1 Warrant work of this section in accordance with Section 01 78 36.

.2 Extended warranty:

.1 System:

- .1 Labour, materials, and workmanship for work of this section.
- .2 Duration: 2 years.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Terrazzo, Tile and Marble Association of Canada ("TTMAC") Specification Guide 09 30 00 Tile Installation Manual TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual.
- .1 Slip resistance: Floors shall have a wet Dynamic Coefficient of Friction (DCOF) of 0.42 or greater in accordance with ANSI A326.3.
- .2 Tiling systems shall exhibit none of the following once installed:
 - .1 Waterproofing under tile assemblies that fails to remain watertight.
 - .2 Staining or discolouration of tile due to mortar or grout.
 - .3 Delaminating of tile.
 - .4 Cracked or chipped tiles.
 - .5 Cracked grout.

2.2 General

- .1 Tile products shall be from same production run, dye lot, calibre, and batch number. If shading variation is evident, notify *Consultant* prior to installation.

2.3 Tile Products

- .1 Porcelain tiles :
 - .1 CT-F1; Floor tile:
 - .1 Acceptable *Product*: Stone Tile 'Sensi'.
 - .1 Size: 400 mm x 800 mm x 10 mm (16" x 32" x 0.40").
 - .2 Finish: Matte.
 - .3 Colour: to later selection by *Consultant* from manufacturer's full range.
 - .2 Substitutions: in accordance with Section 01 25 00.
 - .2 CT-B1; Tile base:
 - .1 To match CT-F1 with micro bevel edge and matching grout colour.
 - .2 Size: 100 mm high x 800 mm long (4" x 32").

2.4 Mortar Materials

- .1 Unless otherwise specified, select from the following thin-set mortar:
 - .1 Latex modified Portland cement thin set mortar gauged:
 - .1 ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
 - .2 White colour for translucent tile applications.
 - .3 Acceptable *Products*:
 - .1 Ardex 'X77 Microtec Fiber Reinforced Mortar' with Ardex 'E90 Mortar Admix'.

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- .2 Custom Building Products 'ProLite'.
- .3 Flextile '51' mixed with Flextile '44'.
- .4 Mapei 'KERALASTIC' mixed with 'KERABOND'.
- .5 Profix '6500' liquid latex mixed with '8500' thin set mortar.
- .6 Promo Adhesives Inc. 'Pro Bond Plus' with 'Pro Bond Plus Additive'.
- .7 TEC 'Superflex Ultra-Premium Thin Set'.
- .2 Enriched, modified, Portland cement thin set mortar, single component, with integral polymer:
 - .1 ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
 - .2 White colour for translucent tile applications.
 - .3 Acceptable *Products*:
 - .1 Ardex 'X 5 Flexible Tile & Stone Mortar'.
 - .2 Custom Building Products 'Versabond LFT'.
 - .3 Flextile '52'.
 - .4 Laticrete '254 Platinum Multipurpose Thin-Set Mortar'.
 - .5 Mapei 'Ultraflex 3' or 'Ultraflex RS'.
 - .6 Profix 'Megaflex' thin set mortar.
 - .7 Promo Adhesives Inc. 'Pro HPX'.
 - .8 TEC 'Ultimate Large Tile Mortar'.
- .2 Special mortar and setting materials:
 - .1 Mortar for large format tiles meeting definition under paragraph 1.2.1.1:
 - .1 Enriched, modified, fast-set Portland cement medium bed mortar high-hydration, low residual moisture behind the tile formula.
 - .2 ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
 - .3 Substrate primer: in accordance with manufacturer's installation requirements.
 - .4 White colour for translucent tile applications and light coloured stones.
 - .5 Acceptable *Products*:
 - .1 Ardex 'S 28 Microtec Rapid Hardening and Rapid Drying Semi-Pourable Natural Stone Floor Tile'.
 - .2 Custom Building Products: 'MegaLite'.
 - .3 Flextile '58XT'.
 - .4 Mapei 'Granirapid'.
 - .5 Laticrete '4-XLT Rapid'.
 - .6 Profix 'Flex GT-30'.
 - .7 Profix 'Optiflex' Full-Contact Mortar.

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- .8 Promo Adhesives Inc. 'Pro Quick SF' with 'Pro Quick Plus Additive'.
- .9 TEC 'Fast Set Ultimate Large Tile Mortar'.
- .10 TEC 'Fast Set 3N1 Performance Mortar'.
- .2 Latex-Portland cement mortar for thick beds, levelling beds and scratch coats:
 - .1 ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
 - .2 Acceptable *Products*:
 - .1 Ardex 'A 38 Rapid Hardening and Drying Cement for Floor Screeds in Internal or External Locations'.
 - .2 Custom Building Products 'SpeedSlope'.
 - .3 Custom Building Products 'Thick Bed Bedding Mortar'.
 - .4 Flextile '4:1 Dry Pack Mortar mixed with Flextile '44'.
 - .5 Laticrete '226 Thick Bed Mortar' gauged with Laticrete '3701 Mortar Admix'.
 - .6 Mapei 'Ultraflex LFT'.
 - .7 Profix 'GT 30' medium bed mortar.
 - .8 Promo Adhesives Inc. 'Pro P-151 SF'.
 - .9 TEC 'Floor Mud'.
- .3 Mortar beds, levelling coats:
 - .1 Materials:
 - .1 Water: clean and free of chemicals detrimental to mortar and grout mixes.
 - .2 Sand: to ASTM C144-18, passing 16 mesh.
 - .3 Cement: to CSA A3002-13, Type U.
 - .4 Latex: Formulated for use with Portland cement mortars.
 - .5 Cleavage membrane: 0.10 mm (4 mil) thick polyethylene film to CAN/CGSB 51.34-M86.
 - .6 Reinforcing mesh: 51 mm x 51 mm (2" x 2") mesh size, fabricated from 1.6 mm (0.06") thick galvanized steel wire; welded fabric design.
 - .2 Mixes:
 - .1 Scratch coat (by volume): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability.
 - .2 Slurry bond coat: Mix Portland cement and water to a creamy paste consistency. Include latex additive where required by TTMAC detail.
 - .3 Mortar bed for walls (by volume): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability.

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- .4 Levelling coat (by volume): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability.
- .5 Mortar bed for floors (by performance): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability that will allow compaction during tamping of the mortar bed, and achieve minimum compressive strength of 15 MPa after 28 days.
- .4 Levelling underlayment:
 - .1 Cement-based, quick-setting, self-levelling, self-drying underlayment for installations from featheredge to minimum 32 mm (1") thick in single application.
 - .2 Primer: Type as recommended by levelling underlayment manufacturer to suit substrate.
 - .3 Acceptable *Products*:
 - .1 Ardex 'Liquid BackerBoard Self-Levelling Underlayment'.
 - .2 Ardex 'TL 1000'.
 - .3 Custom Building Products 'TechLevel 100'.
 - .4 Flextile '5900 Flex-Flo Plus Self-Levelling Underlayment'.
 - .5 Laticrete 'Supercap SC500'.
 - .6 Mapei 'Ultraplan 1 Plus'.
 - .7 Promo Adhesives Inc. 'Pro Plan'.
 - .8 TEC 'Contractor Grade Self Levelling'.
 - .9 TEC 'Levelset 200'.

2.5 Grout Materials

- .1 Latex-Portland cement grout and Portland cement grout:
 - .1 Sanded (for joints between 3.2 mm (1/8") and 12.7 mm (1/2") and for floor tiling) and unsanded (for joints greater than 1.5 mm (1/16") less than 3.2 mm (1/8") and for wall, ceiling tiling:
 - .2 ANSI A118.6 (ANSI A108/A118/A136.1-20) or ANSI A118.7 (ANSI A108/A118/A136.1-20)
 - .3 Acceptable *Products*:
 - .1 Ardex 'FG-C Microtec (unsanded)', 'FL Rapid Set, Flexible Sanded'.
 - .2 Custom Building Products: 'Polyblend Non-Sanded Grout', 'Polyblend Sanded Grout'.
 - .3 Flextile '500 Polymer Modified Non-Sanded', '600 Polymer Modified Sanded Grout'.

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- .4 Laticrete 'Tri-Poly Fortified Sanded Grout (1500 Series), Laticrete 'Tri-Poly Fortified Unsanded Grout (1600 Series)' gauged with Laticrete '1776 Admix Plus'.
- .5 Mapei 'Keracolor S' Sanded Grout, Mapei 'Keracolor U' Unsanded Grout'.
- .6 Profix 'Poly 500 Sanded Grout', Profix 'Poly 600 Unsanded Grout'.
- .7 Promo Adhesives Inc. 'Pro Grout Sanded', Promo Adhesives Inc. 'Pro Grout Un-Sanded'.
- .8 TEC 'AccuColor Premium Sanded Grout', TEC 'AccuColour Premium Unsanded Grout'.
- .2 Grout colours to later selection by *Consultant* from manufacturer's full range.
- .3 Grout sealer: as recommended by grout manufacturer.

2.6 Sheet Uncoupling Membrane Materials

- .1 Review floor assembly design (live load deflection) with *Consultant* and uncoupling membrane manufacturer's representative. Confirm uncoupling membrane manufacturer's recommended product to *Consultant* in writing, on uncoupling membrane manufacturer's company letterhead prior to commencing the installation.
- .2 Uncoupling membrane:
 - .1 Mortar; for setting tile: Compatible product as recommended by sheet uncoupling membrane manufacturer.
 - .2 Acceptable *Products*:
 - .1 Ardex 'UI 720' Flexbone'.
 - .2 Ardex 'UI 740 Flexbone'.
 - .3 Custom Building Products: 'Redgard Uncoupling Mat'.
 - .4 Flextile 'FlexMat'.
 - .5 Mapei 'Mapeguard UM'.
 - .6 Schluter 'Ditra'.
 - .7 Schluter 'Ditra XL'.
- .3 Accessories:
 - .1 Mortar; for setting tile: Compatible product as recommended by sheet uncoupling membrane manufacturer.

2.7 Accessories and Related Materials

- .1 TR-1; Trim accessories:
 - .1 Profile height: to suit material thickness.
 - .2 Finish: Brushed stainless steel.
 - .3 Acceptable *Products*:
 - .1 Schluter Systems 'SCHIENE'.
 - .2 Substitutions: in accordance with Section 01 25 00.

Tiling

- .2 Joint sealants: mildew resistant sealant in accordance with Section 07 92 00.
- .3 Control joint sealant:
 - .1 One-component, neutral cure, exterior grade silicone sealant.
 - .2 Tensile strength (ASTM C794-18): Minimum 1.5 MPa (225 psi).
 - .3 Hardness (ASTM D751-06(2011); Shore A): Minimum 15.
 - .4 Weather resistance (QUV Weather-ometer): No change after 10,000 hours.
 - .5 Acceptable *Products*:
 - .1 Ardex 'SX'.
 - .2 Flextile 'Tile & Grout Caulk'.
 - .3 Laticrete 'Latasil Tile and Stone Sealant'.
 - .4 Mapei 'Mapesil T'.
 - .5 Profix 'Poly 400 Flexible Caulking'.
 - .6 TEC 'Accucolour 100% Silicone Sealant'.

PART 3 - EXECUTION

3.1 Examination

- .1 Ensure compatibility of *Products* supplied under this section, and which bear contact with substrate.
- .2 Before work of this section commences, examine the areas to be covered and report any flaw or adverse conditions in writing to the *Contractor* and the *Consultant*. Do not proceed with work until surfaces and conditions comply with the requirements indicated in the manufacturer's requirements and in ANSI A108.5 (ANSI A108/A118/A136.1-20) specification.
- .3 Miscalibrated tiles, tiles with chipped corners, tiles with holes, will not be accepted for installation.
- .4 Inspect tiles for colour variation. Tiles presenting noticeable variations shall be carefully selected, set aside and used in areas where they fit in the pattern homogeneously. Provide for appropriate lighting equipment in addition to existing lighting in the immediate area where the installation is being performed so that any shade differences which are normally very slight can be identified easily.

3.2 Preparation

- .1 Completely remove contaminants and deleterious substances and debris which may prevent, reduce, and affect adhesion or performance or may act as bond breaker.
- .2 Wire brush steel substrates to remove deleterious substances and rust, to promote full adhesion to steel.
- .3 Roughen surfaces with previously painted glossy finishes by sandpaper or other abrasive medium, and completely remove finishes which are not compatible with products specified under this section.
- .4 Prime gypsum, wood or porous concrete with primer, brush or roller applied at full strength in accordance with mortar manufacturer's recommendations.

Tiling

.5 Floor surfaces:

- .1 Prepare concrete to receive levelling underlayment in accordance with International Concrete Repair Institute (ICRI) designation CSP-3.
- .2 Concrete shall be minimum of 90 days old.
- .6 Concrete shall be dry with maximum allowable moisture in accordance with product manufacturer's written requirements for products to be installed directly over concrete.

3.3 Mixing

- .1 Mix mortars, additives and grouts in accordance with manufacturer's written requirements.

3.4 Levelling Underlayment Installation

- .1 Install levelling underlayment to tile flooring assemblies utilizing large format tile, except for large format tile installations over mortar bed sloped to drain.
- .2 Mix and apply primer to prepared subfloor. Allow to dry prior to installation of levelling material.
- .3 Mix and apply levelling material in accordance with manufacturer's written requirements to produce a smooth, flat surface.
 - .1 Apply levelling underlayment to provide substrate surface flatness tolerances to achieve $F_F 60$ in accordance with ASTM E1155-14 or 3 mm (1/8") with a 3000 mm (10'-0") straightedge.
- .4 Allow to set prior to installation of tile.

3.5 Sheet Uncoupling Membrane Installation

- .1 Levelling and sloping of substrates shall be completed prior to installation of uncoupling membranes.
- .2 Remove dust, dirt, oil, grease, paint, laitance, efflorescence, curing compounds, sealers, water repellents and other deleterious materials that prevent bond. Metal plumbing pipe penetrations and fixtures must be clean of oil, grease, rust and other potential bond breakers.
- .3 Install uncoupling membrane system to comply with manufacturer's written requirements.

3.6 Installation - General

- .1 Install *Products* in accordance with manufacturer's specifications and as indicated herein, in accordance with TTMAC Specification Guide 09 30 00 Tile Installation Manual TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual, and in accordance with ANSI A108.5 (ANSI A108/A118/A136.1-20) except where specified otherwise.

3.7 Thin-Set Method

- .1 Make joints even, straight, plumb and of uniform width.
- .2 Provide mortar beds and levelling coats in accordance with TTMAC details.
- .3 Provide uniform positive slope to floor drains, to minimum allowable slope of 20 mm/m (1/4 inch/ft).

Tiling

- .4 At floor drains in mortar bed: Provide minimum setting bed of 10 mm (3/8"), sloped to drain at 20 mm/m (1/4 inch/ft).
- .5 Provide edge protection at tile edges and corners, unless otherwise indicated, using maximum length pieces.
- .6 Provide edge protection and transition strips at tile transitions, unless otherwise indicated, using maximum length pieces.
- .7 Review locations of tile accessories with *Consultant* prior to setting tile and comply with directions of *Consultant*.
- .8 Apply sealant at interface with frames at openings. Apply sealant in accordance with Section 07 92 00 and manufacturer's requirements.
 - .1 Sealant colour to later selection by *Consultant*.
- .9 Install flooring to entire area indicated or scheduled. Unless otherwise indicated, include coverplates occurring within finished floor areas. Maintain overall uniform continuity of colour and pattern with pieces of flooring installed on cover plates. Tightly butt edges to perimeter of floor around cover plates and to cover plates. Do not install flooring to floor drains occurring within finished floor areas.

3.8 Tile Setting

- .1 Lay out tile work as indicated on drawings, and where lay-out is not indicated, lay-out tiles so tiles less than 1/2 the least dimension do not occur and with minimum amount of cutting.
- .2 Using a damp towel, wipe off the back side of tile to remove any dust or other residue that may be left over from the manufacturing process.
- .3 Place as much tile as possible in one operation before setting bed reaches initial set. Clean back and remove bed when it has set before tile is laid.
- .4 Prime materials and by methods specified by manufacturer of bond coat.
- .5 Except where tiles have setting tabs, and except for expansion, control and isolation joints, maintain joint widths as selected by *Consultant*.
- .6 Back up tile coves, curbs and other shaped pieces solid with mortar. Rigidly set, reinforce or otherwise make firm and secure such pieces.
- .7 Beat tiles in thoroughly and sufficiently to cause mortar ribs or notches to come together into a continuous void free bed and allow the mortar to flow up partially into the joint space to maximum of 1/3 the thickness of the tile. Sound floor tiles by tapping and reset tiles with voids in setting bed.
- .8 Tile shall contact setting materials for minimum of 95% coverage unless otherwise indicated.
- .9 Obtain 100% mortar coverage with applicable requirements for back buttering of tile in referenced TTMAC and ANSI A108/A118/A136.1-20 series of tile installation standards for the following:
 - .1 Tile installed with chemical resistant mortars and grouts.
 - .2 Tile having any dimension 300 mm (12") or larger in any direction.
 - .3 Tile with raised or textured backs.
 - .4 Tile installation rated for Heavy or Extra Heavy Duty.

Tiling

- .5 Porcelain tiles with more than 20% of the tile backs covered with firing release dust back buttered so that 100% of the back is covered with mortar rated for C627, Extra Heavy Duty rating.
- .10 Remove any excess setting material from the joint area so that 2/3 of the depth of the tile is available for grouting.
- .11 Remove smudges or smears of setting material from the tile surface with a damp sponge or cloth immediately after final adjustment and beat-in while the mortar is fresh.
- .12 Do necessary cutting and drilling of fixtures, fittings, and built-in or penetrating units without marring the tile. Replace cracked or damaged tile.
- .13 Form external angles with round edge tile extending over edge of square edge adjacent tile. Internal angles shall be formed square, carrying 1 flat tile past edge of other.
- .14 Extend tile into recesses at windows, doors, or other openings.
- .15 Extend tiles 100 mm (4") behind mirrors, and fully behind cabinets, cupboards and other fixed objects at walls.
- .16 Cut tiles to conform to irregularities in wall lines and vertical planes along outer edges. Smooth cut edges with carborundum block or by other means to provide clean straight edge.
- .17 Install tiles to provide even distribution of shading, colour, and characteristics.

3.9 Control Joints

- .1 Install control joints and expansion joints in tile work in accordance with TTMAC Detail 301MJ-2019-2021 in floors and walls and at perimeters of floors, around columns and where tile abuts other hard materials and as indicated.
 - .1 Review locations with *Consultant* prior to setting tile and comply with instruction given by *Consultant*.
- .2 Carry substrate control and movements joints through to tile work.
- .3 Cut tiles on both sides along the edges of control joints.
- .4 Sealant control joints: Raking out joints to full depth of tile and cleaning joints for application of sealant in accordance with Section 07 92 00.

3.10 Trim Accessories Installation.

- .1 Install trims in accordance with manufacturer's written requirements.
- .2 Install in continuous lengths.
- .3 Scribe and fit to obstructions.
- .4 Mitre corners.
- .5 Tile shall be installed flush with top surface of trim accessory with tolerance of 1 mm (1/32") lower than the top surface of trim accessory. The trim accessory shall not be higher than the tiled surface. A joint of 3 mm (1/8") shall be left between the tile and the profile to be filled with grout.

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3.11 Grouting

- .1 Install grout to comply with ANSI A118.4 (ANSI A108/A118/A136.1-20) unless otherwise specified and in accordance with manufacturer's written requirements.
- .2 Allow tile installation to cure a minimum of 24 hours prior to grouting.
- .3 Grout joints shall be free of dirt, debris, water or tile spacers and face of tiles are clean.
- .4 Apply a coat of grout release and achieve 100% surface covered of tile following grout release manufacturer's written requirements.
- .5 Pack joints full and free of voids/pits.
- .6 Allow grout joints to become firm. Inspect joint for pinholes/voids and repair them with freshly mixed grout. Within 24 hours, check for remaining haze and remove it with warm soapy water and a nylon scrubbing pad, using a circular motion, to lightly scrub surfaces and dissolve haze/film.
- .1 Grout joint width to be 3 mm (1/8") unless otherwise indicated.
- .2 Use caution when using sanded grouts to prevent scratching of tile or other material surfaces.
- .3 Do not cover, bridge or fill any expansion joints in tile with grout.

3.12 Tile Installation Tolerances

- .1 Maximum allowable lippage:
 - .1 Tile up to 152 mm x 152 mm (6" x 6") in size: 1 mm (0.040").
 - .2 Tile greater than 152 mm x 152 mm (6" x 6") in size: 2 mm (0.080").
- .2 Finish planes shall be straight and plumb to within 6 mm in 3 m (1/4" in 10 feet).

3.13 Field Quality Control

- .1 Conduct quality control in accordance with Section 01 45 00.

3.14 Adjusting and Cleaning

- .1 Clean installed tile surfaces after grouting has cured.
- .2 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.

3.15 Protection

- .1 Protect work of this section against damage by work of other sections for a minimum of 72 hours after application of grouting by prohibiting passage of traffic over tile. Do not immerse in water and protect tilework from freezing for at least 28 days after installation.
- .2 Protect floors from impact and vibration for a minimum of 48 hours after installation.
- .3 Install floor protection in areas where other work, repairs and installation of equipment, and foot traffic will occur.
- .4 Where latex or polymer additives are used in mortar materials, materials shall be cured a minimum of 14 days before exposure to moisture and before water immersion and longer as included in mortar manufacturer's written requirements.

END OF SECTION

Acoustical Tile Ceiling Systems

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Acoustical tile ceiling systems; ACT-1.

1.2 Administrative Requirements

- .1 Coordination:
 - .1 Cooperate with mechanical and electrical *Subcontractors*.
 - .2 Coordinate layout and installation of acoustic ceiling units and suspension systems components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, partition system, fire suppression system components and other work required to be incorporated in or coordinated with the ceiling system.
- .2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Submit manufacturer's standard details.
 - .2 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, and acoustical unit support at ceiling fixture.
 - .3 Submit reflected ceiling plans for special grid patterns as indicated.
- .4 Samples:
 - .1 Submit sample of each component of ceiling system. Samples shall fully represent materials to be supplied in colour, texture, finish and construction.
 - .2 Submit samples, load test data and design tables for each type of insert to be used in the *Work* for hanger supports.
- .5 Certificates:
 - .1 Submit certificate of compliance stating that the suspension system provided, including materials and installation, comply with the requirements of the *Contract Documents*.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Maintenance data:

Acoustical Tile Ceiling Systems

- .1 Submit maintenance and cleaning instructions for acoustical ceiling systems for incorporation into the maintenance manuals.
- .3 Maintenance materials:
 - .1 Deliver for maintenance use, 2% of each type and colour of suspension components and acoustical tiles used in the *Work*, and as follows:
 - .1 Provide 15 m² (161 ft²) of each type for future offices.
 - .2 Pack panels in suitable containers, clearly dated and identified as to type and location of installation in the *Work*, and store where directed by *Owner*.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 Installers / applicators / erectors:
 - .1 Installers: Shall have 5 years' experience, minimum, in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .2 Mock-ups:
 - .1 Construct in locations acceptable to *Consultant* a typical sample ceiling installation 10 m² (108 ft²) in area. Modify sample as directed and as required to obtain approval. Upon acceptance retain sample as standard of quality for acoustical ceiling.
 - .2 Do not begin fabrication and erection of remainder of ceiling system until sample installation has been reviewed and accepted. Accepted sample may become a part of the final *Work*, subject of approval of *Consultant*.

1.6 Delivery, Storage, and Handling

- .1 Ship exposed members and mouldings in rigid crates to avoid damage. Bent or deformed material shall be rejected. Baked enamelled members shall be suitably wrapped and protected against damage.
- .2 Deliver acoustical ceiling units to the *Place of the Work* in original, unopened packages and store in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- .3 Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.
- .4 Handle acoustical ceiling units carefully to avoid chipping edges or damaging units.

1.7 Field Conditions

- .1 Commence installation after building is enclosed with windows and exterior doors in place and glazed, and roof watertight.
- .2 Interior temperature of building to range from 15°C to 30°C and relative humidity of not more than 70% before and during installation. Maintain uniform temperatures for 72 hours prior to commencement of the work of this section and maintain temperature until completion of the work of this section.

Acoustical Tile Ceiling Systems

1.8 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranties:
 - .1 System:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 Duration: 2 years.
 - .2 Manufacturer's *Product* warranty for the following:
 - .1 Acoustical tiles:
 - .1 Duration: 30 years.
 - .2 Suspension systems:
 - .1 Duration: 10 years.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Design suspension systems for a maximum mid-span deflection not exceeding $L/360$ in accordance with ASTM C635/C635M-22 deflection test.
- .2 Design suspension system to support safely, and without distortion, the superimposed loads of:
 - .1 Air supply diffusers and return grilles.
 - .2 Lighting fixtures.

2.2 General

- .1 Single source responsibility: Obtain each type of acoustical ceiling unit and suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the *Work*. Products installed as part of the work of this section shall be from same production run.

2.3 Acoustical Tiles

- .1 ACT-1; Lay-in acoustical tiles:
 - .1 Classification: Type XII, Form 2, Pattern E in accordance with ASTM E1264-23.
 - .2 Size: 610 mm x 1220 mm x 25.4 mm (24" x 48" x 1").
 - .3 NRC: 0.95.
 - .4 Material: Fibreglass.
 - .5 Surface texture: Fine texture.
 - .6 Edge: Square lay-in.
 - .7 Colour: White.
 - .8 Flame spread:
 - .1 Maximum values in accordance with CAN/ULC-S102-10:

Acoustical Tile Ceiling Systems

- .1 Flame Spread Value (FSV): 25.
- .2 Smoke Developed Value (SDV): 50.
- .9 Acceptable *Products*:
 - .1 Armstrong 'Optima'.
 - .2 Substitutions: in accordance with Section 01 25 00.

2.4 Metal Suspension Systems

- .1 Hanger anchorage devices: Screws, clips, bolts, concrete inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3 x calculated load supported except size direct pull-out concrete inserts for 5 x calculated loads.
- .2 Concrete hanger anchors; post installed: Steel eye bolts and nuts to suit ceiling hangers with capability to sustain, without failure, a load equal to 4 times that imposed by ceiling construction, as determined by testing per ASTM E488/E488M-22, conducted by a qualified independent testing laboratory.
 - .1 Dynabolt Sleeve Anchor 'TW-1614' or Rendi-Tie-Drive 'TD4-112' tie wire anchor by ITW Ramset/Red Head.
 - .2 Kwik-Bolt III 'HHDCA 1/4' tie wire anchor by Hilti Corporation.
 - .3 Fasteners exposed to weather, condensation, and corrosion: Zinc-plated or stainless steel fasteners in applicable product lines specified in preceding paragraphs.
- .3 Hangers and tie wire: Galvanized wire, recommended by manufacturer of suspension system, minimum 2.66 mm (0.1") (12 gauge).
- .4 Suspension system accessories:
 - .1 Splices, clips, and perimeter moulding, of manufacturer's standard type to suit the applicable conditions unless special conditions and access area are shown or specified.
 - .2 Angle wall mouldings; hemmed with prefinished exposed flanges:
 - .1 For 24 mm (15/16") grid applications; angle moulding with exposed bottom flange of 22 mm (7/8").
 - .1 Armstrong '7803'.
 - .2 CertainTeed 'WA15-15'.
 - .3 CGC 'M7'.
- .5 Standard suspension system, non fire-rated:
 - .1 Intermediate heavy duty in accordance with ASTM C635/C635M-17, 24 mm (15/16") interlocking tee system, designed to support acoustical panels in patterns indicated with deflection of main tees less than L/360, consisting of main tees and cross tees. The system shall provide lock joint intersections of cross and main tees.
 - .2 Acceptable *Products*:

Acoustical Tile Ceiling Systems

- .1 Armstrong 'Prelude XL 15/16" Exposed Tee Systems'.
- .2 CertainTeed '15/16" Classic Stab System'.
- .3 CGC 'DX'.

2.5 Miscellaneous Materials

- .1 Acoustical sealant: Non-drying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable sealant complying with requirements specified in Section 07 92 00.

2.6 Metal Finish

- .1 Metal exposed in finished work shall have a pre-coated baked enamel finish in non-yellowing colour. Submit paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of exposed metal components in the ceiling assemblies.
 - .1 Colour: Blizzard White.

PART 3 - EXECUTION

3.1 Installation - General

- .1 Install ceiling panels and metal suspension system in accordance with manufacturer's directions. Where manufacturer's directions are at variance with *Contract Documents*, notify *Consultant* before proceeding with installation.
- .2 Do not commence installation until work above suspended ceiling has been completed, inspected and accepted.

3.2 Installation - Suspension System

- .1 Install suspension system rigid, secure, square, level and plumb, framed and erected to maintain dimensions and contours indicated, and in accordance with ASTM C636/C636M-19, Cisca installation standards and any other applicable national or local code requirements. Make allowance for thermal and structural movement.
- .2 Attach hangers to structure with inserts and hanger supports. Do not use powder activated fasteners.
- .3 Support hangers for suspended ceiling grid independent of walls, columns, pipes and ducts.
- .4 Space hangers for ceilings at maximum 1220 mm (48") on centre in both directions. Provide additional hangers as required to comply with manufacturer's written installation requirements.
- .5 Locate hangers at not more than 150 mm (6") from ends of main tee members.
- .6 Install exposed tee members to pattern indicated. Securely attach hangers to main tee members.
- .7 Exposed tees shall be as long as possible to minimize joints. Make joints square, tight, flush and reinforce with splines. Distribute joints to prevent clustering in one area.
- .8 Space tee bars to suit ceiling panels and as detailed, and to accommodate lighting fixtures, diffusers and return grilles.

Acoustical Tile Ceiling Systems

- .9 Cooperate in the installation of ceiling systems, making adjustments where required to ensure that the lighting fixtures, supply diffusers, exhaust grilles and other built-in items properly fit into ceiling module and finish flush with rest of ceiling.
- .10 Restrict creep inside module panels so that strips are centred on module lines.
- .11 Install edge moulding as detailed where ceiling abuts vertical surfaces. Lap corners, use maximum lengths to minimize joints. Make joints square, tight and flush.
 - .1 Screw attach mouldings to substrates at intervals not more than 400 mm (16") on centre and not more than 210 mm (8") from ends, levelling with suspension system. Lap corners accurately and connect securely.

3.3 Installation - Tiles

- .1 Take precautions during installation to ensure tile edges are not chipped or otherwise damaged.
- .2 Minimize field cutting. Rectify cut tile edges of tile to match factory cut edge profile and colour.
- .3 Install acoustical tiles to form horizontal and level ceiling with parts flush and joints butted tightly to hairline appearance.
- .4 Distribute variations in colour and texture of panels to obtain a uniform appearance.

3.4 Installation - Tolerances

- .1 Allowable tolerances: in accordance with ASTM C636/C636M-19.
- .2 Install suspension systems level to tolerance of 1:1200.
- .3 Install edge mouldings level to tolerance of 3 mm in 3660 mm (1/8" in 12'-0").

3.5 Field Quality Control

- .1 Conduct quality control in accordance with Section 01 45 00.

3.6 Adjusting and Cleaning

- .1 Replace uneven, defective or damaged materials and finishes, eliminate waves, remove soiled or stained areas.
- .2 Clean dirty and discoloured surfaces of acoustical units and suspension system according to manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Linoleum sheet flooring; RFL-1.

1.2 Administrative Requirements

- .1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Show sheet flooring roll and width layout as related to *Consultant's* floor pattern including borders and accents including where flooring materials meet other floor materials.
 - .2 Show locations of seams, floor drains, floor plates, and where flooring meets other flooring.
- .4 Samples:
 - .1 Selection samples:
 - .1 Submit manufacturer's range of pattern and colours available for *Consultant's* selection.
 - .2 Samples for verification:
 - .1 Flooring: In manufacturer's standard size, but not less than 150 mm (6") x 230 mm (6" x 9") sections of each different colour and pattern of floor covering required.
 - .2 Heat-welding bead: Manufacturer's standard-size samples, but not less than 230 mm (9") long, of each colour required.
 - .3 Transition trim: Manufacturer's standard size samples, but not less than 100 mm (4") long, of each colour required.
 - .4 Seam samples: For each floor covering product, colour, pattern, and seam required, installer shall provide a 150 mm x 230 mm (6" x 9") sample directly applied to a rigid backing material with the seam running lengthwise and in the center of the sample.
- .5 Test and evaluation reports:
 - .1 Submit adhesive bond test results.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.

Linoleum Flooring

.2 Operation and maintenance data:

- .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

.3 Maintenance materials:

- .1 Submit 2% of each colour in full running length, pattern and type flooring material required for this project for maintenance use, and as follows:
 - .1 Provide 15 m² (161 ft²) of each type for future offices.
- .2 Maintenance materials to be same production run as installed materials.
- .3 Suitably package for protection and storage, each identified with name of manufacturer and flooring material.
- .4 Tag and store where directed by *Owner*.

1.5 Quality Assurance

.1 Qualifications:

- .1 Installers:
 - .1 Shall have 5 years' experience, minimum, in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

.2 Mock-ups:

- .1 Prior to commencing flooring installation for this section, prepare full room mock-up (room size at least 10 m² (100 ft²) in area) for acceptance by the *Consultant*.
- .2 Mock-up shall include flooring showing edge treatment and relationships to adjoining surfaces.
- .3 Location of installation shall be determined by *Consultant*.
- .4 Do not proceed with flooring specified in this section until mock-up has been accepted by *Contractor* and *Consultant*.

1.6 Delivery, Storage, and Handling

- .1 Package flooring materials and identify contents of each package.
- .2 Store materials for a minimum of 24 hours immediately before installation to comply with temperatures specified under Field Conditions.
- .3 Store flooring rolls on end.

1.7 Field Conditions

.1 Ambient conditions:

- .1 Install materials of this section only when surfaces and air temperatures have been maintained between 18.4°C and 29.4°C for 48 hours preceding installation, and will be so maintained during installation and for 48 hours thereafter. Maintain a minimum temperature of 13°C after above period. Relative humidity shall be 50 +/- 10%.

Linoleum Flooring

- .2 Ensure that adequate ventilation is provided during installation and curing of materials of this section.
- .3 In areas that are exposed to intense or direct sunlight, *Products* shall be protected during the conditioning, installation, and adhesive curing periods, by covering the light source.
- .4 Allow products to acclimatize in installation area for a minimum 24 hour prior to installation.

1.8 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranty:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 Duration: 2 years.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Slip resistance: Floors shall have a wet Dynamic Coefficient of Friction (DCOF) of 0.42 or greater in accordance with ANSI A326.3.
- .2 Linoleum sheet flooring shall not:
 - .1 Become stained or discoloured due to slab markings.
 - .2 Delaminate from substrates.
 - .3 Have welded seams which separate.

2.2 General

- .1 Single source responsibility: Obtain each *Product* from a single source with resources to provide products of consistent quality in appearance and physical properties, same production run. Products installed as part of the work of this section shall be from same production run.

2.3 Linoleum

- .1 RFL-1; Linoleum sheet flooring:
 - .1 In accordance with ASTM F2034-18, Type 1, colours and pattern detail shall be dispersed throughout the thickness of the wear layer.
 - .2 Thickness: 2.5 mm (1/10").
 - .3 Acceptable *Products*:
 - .1 Forbo 'Marmoleum Solid'.
 - .1 Pattern: 'Piano'.
 - .2 Colour: Warm Grey.
 - .2 Substitutions: in accordance with Section 01 25 00.

Linoleum Flooring

2.4 Miscellaneous Materials

- .1 Seam construction:
 - .1 Hot welded joints, provide welding rod matched to floor pattern/colour selected.
 - .2 Colours: To later selected by *Consultant* from full colour range.
- .2 Primers and adhesives:
 - .1 Types designed for wet areas as recommended by resilient flooring manufacturer compatible with materials and to suit substrate types and to comply with warranty requirements.
- .3 Patching and levelling compound:
 - .1 Trowel applied Portland cement based, moisture, mildew, and alkali-resistant.
 - .2 Minimum compressive strength after 28 days shall be minimum 3,500 psi when tested in accordance with ASTM C109/C109M-21.
 - .3 Gypsum based compounds are not acceptable.
 - .4 Acceptable manufacturers:
 - .1 Ardex.
 - .2 Mapei.
 - .3 Substitutions: in accordance with Section 01 25 00.
 - .5 Acceptable *Product*: type as recommended by flooring manufacturer for substrate conditions.
- .4 Cleaning solution:
 - .1 Acceptable *Products*: type as recommended by flooring manufacturer.
- .5 Floor transition strips:
 - .1 Profile height: to suit material thickness.
 - .2 Finish: Brushed stainless steel.
 - .3 Acceptable *Products*:
 - .1 Schluter Systems 'SCHIENE'.
 - .2 Substitutions: in accordance with Section 01 25 00.
- .6 Sealant: Mildew resistant sealant in accordance with Section 07 92 00.

PART 3 - EXECUTION

3.1 Examination

- .1 Verify that field conditions have been provided as requested and specified.
- .2 Verify that substrates have been provided as specified without holes, protrusions, cracks greater than 1.6 mm (0.06") wide, unfilled control joints, depressions greater than 3 mm (1/8") deep, or other major defects.
- .3 Substrates shall be firm, structurally sound, sufficiently porous, and dry.
- .4 Examine substrate to ensure clean lines, correct level and freedom from cracks, ridges, dusting, scaling and carbonation.

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- .5 Examine floors in advance of application of flooring to ensure that floors are protected against entry of water and moisture.
- .6 Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- .7 Failure to call attention to defects or imperfections will be construed as acceptance and approval of the substrate. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.
- .8 Defective work resulting from application to unsatisfactory surfaces will be considered the responsibility of those performing the work of this section.

3.2 Preparation

- .1 Comply with recommendations of ASTM F710-22.
- .2 Substrates shall be free of wax, oil, silicone, soap, grease, dust, solvents, sealers, curing compounds, hardeners, alkaline salts, excessive carbonation or laitance, mould, mildew, paints, varnish, asphalt, residual adhesives, adhesive removers, or other contaminants or deleterious material that may inhibit bond strength or act as a bond breaker. Remove such contaminants and deleterious material using mechanical methods recommended by manufacturer. Do not use chemical abatement methods.
- .3 Concrete substrates that are loose, sandy, scaly, or have a white powdery surface are not acceptable. Substrates shall be mechanically prepared.
- .4 Flooring substrates shall be smooth and level within a tolerance of 3 mm (1/8") in a 3 m (10'-0") radius.
- .5 Fill surface cracks, holes, score marks, depressions, and grooves, and repair surface spalls with Portland cement patching or levelling compound.
- .6 Expansion joints, isolation joints, and other movement joints in substrates shall not be filled with patching or levelling compound.
- .7 Remove bumps, high spots, peaks and ridges to produce a uniform and smooth substrate.
- .8 Prepare substrates so that installation of flooring shall not show telegraphing of substrate.
- .9 Remove chalking and dusting and loose material from concrete surfaces with wire brushed or by scraping.
- .10 Sweep and vacuum clean substrates minimum 24 hours prior to alkalinity, moisture, and adhesion testing. Do not use sweeping compounds.
- .11 Notify *Consultant* of any substrate or levelling compound defects or installation conditions that may result in unsatisfactory performance.
- .12 Prepared concrete substrate shall have a finish equivalent to a magnesium trowel finish. Shiny, slick, non-porous, or overly porous substrates are not acceptable and shall require additional preparation prior to installation of flooring products. Prepared concrete substrates shall have a Concrete Surface Profile #3 to #5 in accordance with International Concrete Repair Institute (ICRI).
 - .1 Substrate to be approved in writing by flooring manufacturer prior to application of flooring.
 - .2 Submit written report to *Consultant* following procedures for manufacturer's field review in accordance with Section 01 45 00.

Linoleum Flooring

.13 Adhesion bond testing:

- .1 Test substrates in accordance with paragraph 3.7 Field Quality Control after mechanically preparing subfloor or applying patching and levelling compounds.
 - .2 Proceed with installation only after substrates pass testing. Document tests performed and submit in writing to *Consultant*.
- .14 Do not install floor coverings until they are same temperature as space where they are to be installed.
- .1 Move floor coverings and installation materials to acclimatize in spaces where they will be installed at least 48 hours in advance of installation.
- .15 Where flooring adjoins thicker floor materials, apply levelling screed, feather out to make up difference in level between materials to achieve flush floor finish between adjacent flooring materials unless otherwise indicated.
- .16 Spray paints, permanent markers and other indelible ink markers shall not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and permanently stain the flooring material. If such contaminants are present on the substrate they shall be mechanically removed prior to the installation of the flooring material.

3.3 Sheet Flooring Installation

- .1 Before commencing installation, verify product type, size, thickness, and colour. Do not install flooring with visual imperfections, colour variations or apparent defects.
- .2 Install rolls and cuts in sequence by roll number and cuts from each individual roll in consecutive order. Do not reverse sheets for seaming.
- .3 Unroll material in the same direction and follow the flooring manufacture's numbered sequence/layout diagram.
 - .1 Lay flooring with joints parallel to building lines to produce symmetrical pattern and minimum joints.
 - .2 Place seams in inconspicuous and low-traffic areas, at least 150 mm (6") away from parallel joints in floor covering substrates.
 - .3 Avoid cross seams.
 - .4 Lay sheet flooring centered in corridors, with equal sized sheet to either side of center sheet.
 - .5 Mitre intersections at corridors typically. "T" type corridors shall be butt type installation.
 - .6 Layout seaming uniformly, using full length flooring typically, minimum flooring size of not less than roll width. Limit quantity of less than full length floor pieces at corridors to maximum of 1.
 - .7 Layout flooring to match reviewed shop drawings floor pattern including borders and accents.
 - .8 Match edges of floor coverings for colour shading at seams.
- .4 Allow material to relax overnight, minimum 12 hours in installation areas.
- .5 Cutting and fitting sheets:

Linoleum Flooring

- .1 Cut pieces to length allowing approximately 75 mm (3") to 150 mm (6") excess for trimming.
- .2 Remove 12.7 mm (1/2") off the factory seam edge using an edge trimmer or straight edge and knife.
- .3 Seams shall be a minimum of 150 mm (6") away from levelling underlayment and concrete joints, saw cuts and other type of joints.
- .4 Cut sheet and fit neatly around fixed objects without gaps.
- .5 Position remaining sheets so that the top sheet overlaps the previous sheet by 12.7 mm (1/2") to 19 mm (3/4").
- .6 Install one sheet at a time in wet adhesive.
- .7 Roll the flooring immediately in both directions using a clean, 45 kg (100 lb) three-section roller.
- .8 After the material has been laid and rolled in wet adhesive, underscribe the seam using the short scribes with a scribed pin right away.
- .9 Cut the material along the scribe line using a hooked blade knife and holding it at an angle so to slightly undercut the material.
- .10 Roll the seam with a hand roller.
- .11 Cross seams:
 - .1 Straight edge and undercut at an angle the end of the first sheet.
 - .2 Spread adhesive and lay in wet adhesive.
 - .3 Roll the flooring immediately in both directions using 45 kg (100 lb) three-section roller.
 - .4 Overlap the second sheet at butt seam approximately 25 mm (1").
 - .5 Adhere second sheet except for last 450 mm (18") of butt seam; wait 20 – 30 minutes.
 - .6 Spread the adhesive for the last 450 mm (18"), lay in material, underscribe the seam to a neat, fit cut, and roll flooring immediately in both directions using 45 kg (100 lb) three-section roller.
- .6 Apply adhesive uniformly and install flooring in accordance with flooring manufacturer's requirements. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .7 Obtain 100% adhesive coverage to flooring backing.
- .8 Install flooring to entire area indicated or scheduled, including coverplates occurring within finished floor areas. Maintain overall continuity of colour and pattern with pieces of flooring installed on cover plates. Tightly butt edges to perimeter of floor around cover plates and to cover plates. Cut flooring to floor drains occurring within finished floor areas.
- .9 Terminate flooring at centerline of door in openings where there is an adjacent floor finish or colour is dissimilar unless otherwise indicated or scheduled.
- .10 Centreline of transition should coincide with centreline of door.
- .11 Heat-welded seams:

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- .1 Weld seams in accordance with ASTM F1516-13(2018).
- .2 Wait minimum of 24 hours after flooring installation before grooving and heat welding seams.
- .3 Prepare, weld, and trim seams to produce flat surfaces flush with adjoining floor covering surfaces.
- .4 Rout joints to approximately 2/3 of the thickness of the material and use welding bead to permanently fuse sections into a seamless floor covering. Groove shall be between 3 mm (0.118") and 3.5 mm (0.138") wide.
- .5 Using a weld plate and skiving knife to make first cut and allow weld rod to fully cure to room temperature.
- .6 Using a skiving knife only, finish the trimming of the remainder of the weld. The finish should be smooth and on the same level as the flooring.
- .7 Trimming of welded joint while warm is not permitted unless final trimming is performed after weld has cooled to flooring temperature. Excess weld shall be removed using a heated standard putty knife.
- .8 Roll the seam area with 45 kg (100 lb) three-section roller.
- .9 Maximum variation of welds from plane or from straight: 6 mm (1/4") in 3 m (10 ft) length using a 3 m (10 ft) straight edge.
- .12 Flooring installation shall not show telegraphing of substrate. Flooring installation shall be homogenous free of substrate lines, pockets, bumps and unevenness.

3.4 Installation - Transition Strips

- .1 Protect exposed edges of flooring, where finished and unfinished areas adjoining, by means of a transition trim butting to and flush with the finished surface of the flooring covering material and securely adhered to the substrate material.
- .2 Coordinate transitions with work of other sections.
- .3 Allow coiled vinyl material to lay flat for at least 24 hours at 21°C prior to installation.
- .4 Set to ensure installation is free of gaps.
- .5 Install in longest lengths possible.
- .6 Install straight to maximum allowable variation of 3 mm (1/8") over 3 m (10'-0").
- .7 Scribe and fit to obstructions.
- .8 Fit joints tightly, straight and vertical as applicable and not less than 610 mm (24") from corners.
- .9 Mitre corners.

3.5 Field Quality Control

- .1 Conduct quality control in accordance with Section 01 45 00.
 - .1 Field tests and inspections:
 - .1 Adhesion bond test:
 - .1 Proceed with bond test after substrates have been prepared and alkalinity and moisture test have been completed.

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- .2 Select six substrate test areas, each 915 mm (3'-0") x 915 mm (3'-0") in size. Test areas shall be spaced a minimum 1220 mm (48") apart.
 - .3 Cut 915 mm (3'-0") x 915 mm (3'-0") panels from specified material.
 - .4 Using the specified adhesive, glue down each panel using adhesive manufacturer's recommended trowel.
 - .5 After 72 hours, attempt to remove the panels of flooring by pulling up from the corners.
- .2 Manufacturer's field review to be in accordance with Section 01 45 00.

3.6 Adjusting and Cleaning

- .1 Remove excess adhesive from surfaces of the sheet flooring and base as work progresses.
- .2 Only use materials and products recommended by flooring manufacturer to remove excess adhesive.

3.7 Protection

- .1 Prohibit foot traffic on installed flooring for a period of 24 hours after installation. No heavy traffic, rolling loads, or furniture placement are permitted for a minimum of 72 hours after installation.
- .2 Protect new floors from time of final set of adhesive until final inspection.
- .3 Install floor protection in areas where other work, repairs and installation of equipment, and foot traffic will occur.

3.8 Maintenance

- .1 Perform initial maintenance according to the manufacturer's written requirements.
- .2 Allow flooring to dry prior to applying protection.

END OF SECTION

Carpet

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Carpet tile; CPT-1.

1.2 Administrative Requirements

- .1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Carpet tile layout drawings: Submit for review drawings of tile layout pattern, location and type of accessories.
- .4 Samples:
 - .1 Submit 3 samples of each type and colour of carpet.
 - .2 Minimum sample sizes:
 - .1 Carpet tile: Full size tile.
- .5 Manufacturers' instructions:
 - .1 Submit carpet and adhesive manufacturer's written installation recommendations for each type of substrate required.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Maintenance materials:
 - .1 Carpet tile: 2% of each carpet colour and type specified, supplied in full size units.
 - .2 Maintenance materials to be same production run as installed materials.
 - .3 Suitably package for protection and storage, each identified with name of manufacturer and flooring material.
 - .4 Tag and store where directed by *Owner*.

1.5 Quality Assurance

- .1 Qualifications:

Carpet

.1 Installers:

- .1 Shall have 5 years' experience, minimum, in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

1.6 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.

.2 Extended warranty:

.1 System:

- .1 Labour, materials, and workmanship for work of this section.
.2 Duration: 2 years.

.2 Manufacturer's warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement materials for defects attributable to materials within specified warranty period. Defects include the following:

- .1 Excessive Wear, no more than +/-15% loss of pile fibre.
.2 Static electricity, no more than 3.0 KV per AATCC 134.
.3 Delamination.
.4 Edge Ravel.
.5 Zippering.
.6 Duration: 10 years.

PART 2 - PRODUCTS

2.1 Carpet Tile

.1 CPT-1:

- .1 Tile size: 500 mm x 500 mm x 6.9 mm (20" x 20" x 0.27") overall thickness.
.2 Installation method: Non-directional.
.3 Construction: Needlepunch.
.4 Backing: CQuestBio.
.5 Acceptable *Product*:
.1 Flor 'Industrious'.
.1 Colour: 12-1552, Iron.
.2 Substitutions: in accordance with Section 01 25 00.

.2 Adhesive stripes:

- .1 Acceptable *Product*:
.1 Flor 'FLORDots+'.
.2 Substitutions: in accordance with Section 01 25 00.

Carpet

PART 3 - EXECUTION

3.1 Installation - Carpet

- .1 Install in accordance with manufacturer's written requirements, or authorities having jurisdiction requirements, and in accordance with reviewed shop drawings.
- .2 Adhesive stripes:
 - .1 Install adhesive stripes in accordance with manufacturer's written installation requirements.

3.2 Field Quality Control

- .1 Conduct quality control in accordance with Section 01 45 00.

3.3 Adjusting and Cleaning

- .1 After installation is completed, clean and vacuum carpet of dirt, dust and foreign materials. Remove spots with suitable spot remover, remove cuttings, vacuum carpet thoroughly using approved commercial type equipment and leave clean. Provide necessary commercial vacuum cleaning equipment.

3.4 Protection

- .1 Prohibit foot traffic on installed flooring for a period of 24 hours after installation. No heavy traffic, rolling loads, or furniture placement are permitted for a minimum of 72 hours after installation.
- .2 Protect new floors from time of final set of adhesive until final inspection.
- .3 Install floor protection in areas where work, repairs and installation of equipment, and foot traffic will occur.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Moss wall; AWP-1.

1.2 Administrative Requirements

- .1 Coordination:
 - .1 Coordination of work: coordinate layout and installation of acoustic wall panels and support systems components with other work supported by or penetrating through acoustic wall panel systems.
- .2 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data:
 - .1 Submit *Product* data sheets for work of this section, complete with required anchors.
- .3 Shop drawings:
 - .1 Submit shop drawings, indicating panel layout and system components, for each panel system.
 - .2 Include plans, elevations, sections and large scale details, and indicate components and methods of assembly, materials and their characteristics, fastenings, finishes, and other fabrication information required for the work of this section. Indicate assembly joint lines.
 - .3 Submit coordination drawings indicating locations of concealed grounds, cutouts, plates, and other required fabrications.
 - .4 Show relation to adjoining construction, details of outside and inside corners and door openings.
- .4 Samples:
 - .1 Submit 2 - 300 mm x 300 mm (12" x 12") samples of each component of panel system to *Consultant* for review.
 - .2 Samples shall fully represent materials to be supplied in colour, texture, finish and construction.
- .5 Acoustic data:
 - .1 Submit acoustic data verifying that *Products* meet specified acoustic design requirements.
 - .2 Acoustic data shall include detailed descriptions of both mounting method and test method used to calculate acoustical performance, complete with references to codes and standards used in such calculations.
 - .3 Acoustic data submitted shall be from a certified acoustic testing agency.

Acoustic Wall Panels

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Maintenance materials:
 - .1 Maintenance materials: At completion, hand over to the *Owner* an additional 1% of each type installed in the *Work*.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 Installers:
 - .1 Shall have 5 years' experience, minimum, in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .2 Mock-ups:
 - .1 Submit 300 mm x 300 mm (12" x 12") mock-up of each acoustical wall panel system, for review and acceptance by *Consultant*.
 - .2 Install at the *Place of the Work* a pre-selected mock-up of full size panel system.
 - .3 Obtain *Consultant's* acceptance of surface, finish and workmanship as a standard by which remainder of the *Project* will be judged. Apply material in accordance with manufacturer's written application requirements. Mock-up must be approved and accepted prior to start of system application. Maintain mock-up during construction for workmanship comparison. Do not alter, move or destroy mock-up until the work is completed and approved by *Consultant*.

1.6 Delivery, Storage, and Handling

- .1 Ship panels in rigid crates to avoid damage. Bent or deformed material shall be rejected.
- .2 Deliver panels and system components to the *Place of the Work* in original, unopened packages and store in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- .3 Before installing panels, permit them to reach room temperature and stabilized moisture content. Acclimatization period shall be 24 hours, minimum, longer as recommended by panel manufacturer.
- .4 Handle panels carefully to avoid chipping edges or damaging units in any way.

1.7 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranty:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 Duration: 2 years.

PART 2 - PRODUCTS

2.1 General

- .1 Single source responsibility: Obtain system components for each panel system type from a single source with resources to provide *Products* of consistent quality in appearance and physical properties without delaying progress of the *Work*.

2.2 Acoustic Panels - Shop Built (AWP-1)

- .1 Moss wall:
 - .1 Composition: 100% natural preserved moss with backing, 75 mm (3") thick.
 - .2 Panel size: Custom, as indicated on the drawings.
 - .3 Colour: Allow for 2 colours, to later selection by *Consultant*.
 - .4 Backing: Coroplast.
 - .5 Flame spread: in accordance with CAN/ULC-S102-10:
 - .1 Flame Spread Rating (FSR): 95.
 - .2 Smoke Developed Classification (SDC): 445.
 - .6 Acceptable *Products*:
 - .1 ByNature 'Sheet Moss'.
 - .2 Substitutions: in accordance with Section 01 25 00.

PART 3 - EXECUTION

3.1 Examination

- .1 Gypsum board assemblies shall be taped and sanded by Section 09 29 00 and painted in accordance with Section 09 91 00 and shall not permit any air leakage through wall.
- .2 Concrete masonry unit walls shall have flush joints and painted in accordance with Section 09 91 00 and shall not permit any air leakage through wall.
- .3 Do not proceed with installation until unsatisfactory conditions have been corrected. Beginning of installation indicates acceptance of existing substrate conditions.
- .4 Do not start installation until exterior glazing has been completed and exterior openings are closed in. Ensure wet work is completed and dried out to a degree acceptable to panel manufacturer before installation is commenced. Maintain uniform temperatures of at least 16°C for 72 hours prior to commencement of the work of this section and maintain temperature until completion of the work of this section.
- .5 Do not commence installation until work of other sections behind panels has been completed, inspected and accepted by *Consultant*.

3.2 Installation - Panels

- .1 Install acoustical panels to clean, dry and firm substrates in accordance with manufacturer's written requirements.
- .2 Install system in accordance with manufacturer's written installation requirements.

Acoustic Wall Panels

- .3 Panel arrangements as indicated. Maintain dimensions and contours as indicated. Coordinate layout with *Consultant* prior to commencing installation.
- .4 Make allowance for thermal movement.
- .5 Panels shall have no visible fastenings.
- .6 Mounting methods:
 - .1 Shop built panels:
 - .1 Direct mounted in accordance with manufacturer's written installation requirements.

3.3 Installation Tolerances

- .1 Install panels plumb, level, tight, rigid, and secured.
- .2 Comply with the following maximum tolerances:
 - .1 Plumb and level: 3 mm (1/8").
 - .2 Variation from indicated position: plus/minus 3 mm (1/8").
 - .3 Maximum variation of reveal widths: plus/minus 1.5 mm (1/16").
 - .4 Maximum variation of surfaces intended to be flush: plus/minus 1.5 mm (1/16").

3.4 Adjusting and Cleaning

- .1 Examine work of this section on completion and replace uneven or defective materials, eliminate all waves, remedy damaged exposed finished surfaces and remove soiled or stained areas.

END OF SECTION

Painting

PART 1 - GENERAL

- .1 Section includes:
 - .1 Painting of interior paintable surfaces.
- .2 Paintable and non-paintable surfaces:
 - .1 Paint and finish paintable surfaces included in the *Work*, except where excluded by the *Contract Documents*.
 - .2 The following surfaces are considered non-paintable, except as otherwise indicated or scheduled:
 - .1 Material and equipment furnished prime and finish painted.
 - .2 Internal surfaces of steel tanks and stacks.
 - .3 Sprayed fire-resistive materials.
 - .4 Stainless steel, weathering steel, copper, bronze, chromium plate, nickel, anodized or lacquered or mill finished aluminum, Monel metal.
 - .5 Insulation, glass, plastic, brick, stone.
 - .6 Metallic and mastic insulation finishes.
 - .7 Abrasive material finishes on floors, stair treads, stair nosing and landings.
 - .8 Insulated electric cables.
 - .9 Machined parts of machinery and equipment.
 - .10 Concealed surfaces.
 - .11 Manufactured finish materials.

1.2 Administrative Requirements

- .1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets and list of *Products* proposed for use in the work of this section as identified in 'Approved Product List' section of the MPI (Master Painters Institute) Architectural Painting Specification Manual. Correlate *Products* to Schedule furnished by *Consultant*.
- .3 Samples:
 - .1 Samples for initial paint colour and finish selection:
 - .1 Submit manufacturer's colour charts showing full range of colours available, including light and deep dark tones, for each type of finish material indicated for colour selection by *Consultant*.
 - .2 *Consultant* shall have complete freedom in choice of colours in compiling colour schedule and will not necessarily select colours from standard colour charts of manufacturer of *Products* specified.

Painting

- .3 Submit 3 drawdowns of each selected colour for review by *Consultant* and resubmit to *Consultant* as required to obtain approval. Drawdown to be of specified colour, sheen, and paint formula for applicable surface.
- .2 Samples for verification:
 - .1 Submit 3 samples on 200 mm x 305 mm (8"x 12") material of same type as that on which coating is to be applied, for *Consultant's* approval, at least 30 days before materials are required.
 - .2 Identify each sample as to *Project*, finish, formula, colour name, number, gloss name and number, date and name of *Contractor* and painting *Subcontractor*.
 - .3 Resubmit as required until colours and gloss value are approved.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Maintenance materials:
 - .1 Provide 2 sealed containers, each of 4 litres (1 gallon) capacity of each paint product in each colour used in the *Work* for *Owner's* maintenance use. Containers shall be new, clearly labelled with manufacturer's name, type of paint, colour and colour number. Store at *Place of the Work* where directed by *Owner*.

1.5 Quality Assurance

- .1 Qualifications
 - .1 Manufacturers:
 - .1 Paint manufacturers and *Products* used shall be as listed under the Approved Product List section of the MPI Painting Manual.
 - .2 Installers / applicators / erectors:
 - .1 Applicators: Shall have minimum 5 years proven satisfactory painting experience of projects of similar size and class subject to *Consultant's* approval.
 - .2 Only qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices shall work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .2 Mock-ups:
 - .1 Provide mock-ups of each paint system for indicated surfaces of each colour and finish selected to verify preliminary paint selections made under Sample submittals.
 - .2 Mock-ups shall be located to areas as directed by *Consultant* under lighting conditions matching final area lighting, for acceptance by *Consultant*.

Painting

- .3 Mock-ups shall demonstrate aesthetic effects of paint colour and sheen and shall set quality standards for material and execution of the *Work*. Final approval of colour and finish selections shall be based on mock-ups. If colour selections are not approved, apply additional mock-ups of additional colours selected by *Consultant* at no added cost to the *Owner*.
- .4 Do not proceed with work, including ordering of paint *Products*, until mock-ups of each paint colour and finish and paint system for indicated surfaces have been reviewed and accepted by *Consultant*.
- .5 Provide the following in-situ mock-ups:
 - .1 Gypsum board: 9.3 m² (100 ft²) of vertical surfaces and 9.3 m² (100 ft²) of horizontal surfaces.
 - .2 Hollow metal doors and frames: 1 door and frame for each finish specified.
 - .3 Painted wood base.
 - .4 Site painted structural steel, *Consultant* shall designate steel items and to be included as part of mock-up.
- .6 Upon completion and approval, mock-ups shall serve as a standard for the balance of the work of this section. Subsequent work carried out and not in the *Consultant's* opinion equal to standard shall be repainted without charge.

1.6 Delivery, Storage, and Handling

- .1 Deliver painting materials in sealed, original labelled containers bearing manufacturer's name, brand name, type of paint or coating and colour designation, standard compliance, materials content as well as mixing and/or reducing and application requirements.
- .2 Store paint *Products* and materials in original labelled containers in secure (lockable), dry, heated and well ventilated single designated area meeting minimum requirements of both paint manufacturer and authorities having jurisdiction, and at a minimum ambient temperature of 7°C.
- .3 Protect floor and wall surfaces of storage area. Protect floors with sheets or clean plywood or metal pans where mixing is being carried out.

1.7 Field Conditions

- .1 Ambient conditions:
 - .1 Comply with environmental requirements of MPI Manual.
 - .2 Perform no painting work when ambient air and substrate temperatures are below 10°C for both interior and exterior work, unless suitable weatherproof covering and sufficient heating and ventilation facilities are in place in accordance with MPI Manual.
 - .3 Perform no painting work when relative humidity is above 85% or when dew point is less than 3°C (5°F) variance between air/surface temperature.

1.8 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranties:

Painting

- .1 System:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 Duration: 2 years.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

- .1 Except where more stringent requirements are specified, the following reference standard shall govern the work of this section:
 - .1 Master Painters Institute (MPI) Architectural Painting Specification Manual (MPI Manual), including Identifiers, Evaluation, Systems, Preparation and Approved Product List, latest edition, and referenced herein as the MPI Manual, as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
 - .2 Materials, preparation and workmanship shall conform to requirements of latest edition of Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
 - .3 Painting systems:
 - .1 Shall remain free from failure due to causes including: material failure; surface preparation less than that specified; and paint film thickness less than that specified, or when not specified, less than that coverage recommended by manufacturer.
 - .2 Presence of any of following shall constitute failure: visible corrosion; film peeling, blistering, checking, scaling, embrittling or general film disintegration; and poor adhesion as determined by tape "peel-off" test procedures.

2.2 Materials

- .1 *Products* listed in MPI Manual shall be used in the *Work*, unless specified otherwise.
- .2 Paint and materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and the like) shall be in accordance with the MPI Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .3 Other paint materials, such as linseed oil, shellac, and the like, shall be highest quality *Products* of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials as required.
- .4 Paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags.
- .5 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by building code requirements and/or authorities having jurisdiction.

2.3 Equipment

- .1 Painting and coating equipment in accordance with written requirements of MPI Manual.

Painting

2.4 Mixing and Tinting

- .1 Unless otherwise specified, paints shall be ready-mixed. Re-mix prior to application to ensure colour and gloss uniformity.
- .2 Paste, powder or catalysed paint mixes shall be mixed in accordance with manufacturer's written requirements.
- .3 Perform colour tinting operations prior to delivery of paint to *Place of the Work*.
- .4 Where thinner is used, addition shall not exceed paint manufacturer's recommendations.

2.5 Colours and Gloss Levels

- .1 Paint colours and gloss levels shall be as selected by the *Consultant*. Locations as indicated or scheduled.
- .2 Colour schedule:
 - .1 PT-1: Benjamin Moore OC-57, White Heron.
 - .2 PT-2: Benjamin Moore HC-165, Boothbay Grey.
 - .3 PT-3: to later selection by *Consultant*.
- .3 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI values:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat finish	0 to 5	10 maximum
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 minimum
G5	Semi-gloss finish	35 to 70	
G6	Gloss finish	70 to 85	
G7	High-Gloss finish	> 85	

PART 3 - EXECUTION

3.1 Examination

- .1 Prior to commencement of work of this section, thoroughly examine surfaces scheduled to be painted.
- .2 Check moisture content and alkalinity of surfaces to be painted in accordance with paragraph above titled Field Conditions.
- .3 Inspect surfaces to be coated for gouges, marks, nibs, and other defects and properly prepare patching, filling, smoothing or other surface preparation necessary to ensure satisfactory finish.
- .4 Report in writing any condition adversely affecting work of this section.
- .5 Proceed with work only when surfaces and conditions are satisfactory. Remove dust, grease, rust, scale and extraneous matter, tool and machine marks and insects from surfaces which could be detrimental to a satisfactory and acceptable finish.

Painting

3.2 Preparation

- .1 Comply with manufacturer's written requirements and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- .2 Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - .1 After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- .3 Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, mildew, grease, and incompatible paints, encapsulants, and other deleterious materials.
- .4 Paint surfaces when moisture content or alkalinity of surfaces to be painted comply with paragraph 3.5 Field Quality Control / Standard of Acceptance.
- .5 Shop-primed steel substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- .6 ZF75 and ZF120 galvanized-metal substrates: Remove grease and oil residue from galvanized sheet metal by methods to produce clean surfaces that promote adhesion of subsequently applied paints.
- .7 Z275 galvanized-metal substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- .8 Existing painted substrates:
 - .1 Clean substrates as indicated above.
 - .2 Sound existing paint surfaces and remove paint surfaces that are not sound, loose or are otherwise stained, cracked, wrinkled, peeling, or defective.
 - .3 Dull hard or glossy surfaces by sanding or other abrasive methods prior to finishing.
 - .4 Apply tie-coat primer product that compatible with substrate as recommended by paint coatings manufacturer.
 - .5 Follow with paint finish coats as specified for like substrate materials specified herein.

3.3 Installation

- .1 Do not paint unless substrates are acceptable and/or until Field Conditions (heating, ventilation, lighting and completion of work of other sections) are acceptable for applications of *Products*.
- .2 Apply primer, paint or stain in accordance with MPI Manual Premium Grade finish requirements.
- .3 Apply paint and coatings within an appropriate time frame after cleaning when Field Conditions encourage flash-rusting, rusting, contamination or manufacturer's paint specifications require earlier applications.

Painting

- .4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .5 Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- .6 Unless otherwise approved by *Consultant*, apply a minimum of 4 coats of paint where deep or bright colours are used to achieve satisfactory results.
- .7 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").
- .8 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- .9 Prime coat of stain or varnish finishes may be reduced in accordance with manufacturer's directions.
- .10 Paint finish shall continue through behind wall-mounted items (i.e. chalk and tack boards) and exposed/ visible in complete work including interiors of cupboards and closets, tops of doors, trim, and the like, whether in sight line or not, including behind surface mounted fixtures and heating units.
- .11 *Consultant* shall have right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to *Owner*.
- .12 Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels shall be painted to match adjacent surfaces in terms of colour, texture and sheen, unless otherwise indicated.

3.4 Field Quality Control / Standard of Acceptance

- .1 Conduct quality control in accordance with Section 01 45 00.
 - .1 Field tests and inspections:
 - .1 Paint and Coating Quality Assurance Inspections:
 - .1 Field quality control shall be in accordance with Section 01 45 00.
 - .2 Moisture and alkalinity testing:
 - .1 Check moisture content of surfaces to be painted using properly calibrated electronic moisture meter approved by paint manufacturer, and *Consultant*, or other approved method. Maximum moisture contents shall be in accordance with manufacturer's recommendations and as follows:
 - .1 Concrete and concrete masonry (clay and concrete brick/block): Maximum 12%.
 - .2 Gypsum board and plaster: Maximum 12%.
 - .3 Wood: Maximum 15%.
 - .2 Conduct moisture tests on concrete floors using cover patch test method.
 - .3 Test concrete, masonry and plaster surfaces for alkalinity.
 - .3 Painted interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the *Consultant*.

Painting

- .1 Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
- .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
- .3 Damage due to touching before paint is sufficiently dry or any other contributory cause.
- .4 Damage due to application on moist surfaces or caused by inadequate protection from weather.
- .5 Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- .4 Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces to the *Consultant*:
 - .1 Visible defects are evident on vertical and horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
 - .2 Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - .3 When final coat on any surface exhibits a lack of uniformity of colour, sheen, texture, and hiding across full surface area.
- .5 Painted surfaces rejected by the *Consultant* shall be made good at the expense of the *Subcontractor*. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.
- .6 Painting *Subcontractor* shall obtain from *Contractor* written confirmation of specific surface preparation procedures and primers used for fabricated steel items from the fabricator/*Supplier* to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

3.5 Adjusting and Cleaning

- .1 Promptly as work proceeds and on completion of *Work*, remove paint where spilled, splashed or spattered during the progress of the *Work*. Keep the premises free from unnecessary accumulation of tools, equipment, surplus materials and debris; at the conclusion of the work leave the premises clean.

3.6 Interior Paint Systems

- .1 System references listed are based on MPI Manual and are Premium Grade, High Performance Architectural, unless otherwise indicated:
 - .1 Primed ferrous metal; touch-up and finish coats required under this section:
 - .1 Ferrous architectural metal fabrications: Prepared and primed in accordance with Section 05 50 10.
 - .2 INT 5.1R High performance architectural latex (over alkyd primer); gloss level G5.

Painting

- .2 Galvanized metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.)
 - .1 INT 5.3M High performance architectural latex (over water based galvanized primer); gloss level G5.
- .3 Plaster and gypsum board: (gypsum wallboard, drywall and textured finishes)
 - .1 INT 9.2B High performance architectural latex finish (over latex primer/sealer):
 - .1 Gloss level:
 - .1 Walls, except as otherwise indicated: G3.
 - .2 Ceilings, except as otherwise indicated: G1.
 - .3 Wet and service areas; walls and ceilings: G5.
 - .2 Use high-hide primer sealer type at glass mat finished gypsum board.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Glass marker boards; WB-1.
 - .2 Related trim, adhesives, and fastenings.

1.2 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Show proposed system of anchorage and materials being supplied on shop drawings submitted for review.
 - .2 Show dimensional layouts, hardware items, anchorage devices, dimensions, description of materials and finishes, and all other pertinent information.
- .4 Samples:
 - .1 Submit 305 mm x 305 mm (12" x 12") samples of each *Product* specified, diagonally cut to show cross section through assembly, complete with accessories and trim.
 - .2 Submit 305 mm (12") square samples of each glass type and colour indicated.

1.3 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

1.4 Quality Assurance

- .1 Qualifications:
 - .1 Installers / applicators / erectors:
 - .1 Erection of materials to be carried out by competent workers supervised by a foreperson with at least 10 years' experience in this specialized field and approved in writing by manufacturer for installation of their *Product*.

1.5 Delivery, Storage, and Handling

- .1 Package *Products* to prevent distortion in shipment and handling. Label and protect finish surfaces by sturdy wrappings.

1.6 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Provide manufacturer's standard product warranty.

PART 2 - PRODUCTS

2.1 Design/Performance Requirements

- .1 Trademarks and labels:
 - .1 No trademarks or labels will be accepted on exposed finished work.

2.2 Glass Marker Board System (WB-1)

- .1 Basis of design:
 - .1 Clarus 'Glassboard Float'.
 - .2 Substitutions: in accordance with Section 01 25 00.
- .2 Size: as indicated or scheduled.
- .3 Colour: Back-painted to match PT-1, White Heron.
- .4 Glass type:
 - .1 Tempered low iron glass; ANSI Z97.1 and CPSC 16 CFR 1201, ASTM C1036-16 and ASTM C1048 for Quality Q3, Kind FT.
 - .2 Glass edges shall be polished with slight arrises.
 - .3 Manufacturer's standard back paint coating applied to #2 (back) side uniformly.
 - .1 For back-painted marker boards: white paint coating.
 - .2 For magnetic marker boards: adhered steel backing.
 - .4 Glass thickness: 6.4 mm (1/4").
- .5 Mounting method:
 - .1 Concealed mounting: concealed z-bar hanger furnished with 3M 'Dual Lock' fasteners to hold bottom of board firmly in place.
- .6 Accessories:
 - .1 Marker caddy and magnetic eraser.
 - .2 Provide Skyline 'Rare Earth Magnets':
 - .1 Quantity per marker board: 2.
 - .2 Colour: White.
 - .3 Use screws of galvanized steel.

2.3 Attachment Hardware

- .1 Use manufacturer's standard mounting hardware.

PART 3 - EXECUTION

3.1 Installation

- .1 Install in accordance with manufacturer's written installation requirements.
- .2 Locate seams as directed by the *Consultant*.

3.2 Installation - Trim Components

- .1 Install in accordance with manufacturer's written installation requirements.

3.3 Installation Tolerances

- .1 Install plumb, level, tight and secured. Comply with the following maximum tolerances:
 - .1 Within 1.5 mm (1/16") of plumb and level, and flush with adjacent panels.
 - .2 Within 25 mm (1") variation from indicated position.

3.4 Adjusting and Cleaning

- .1 Verify under work of this section that installed *Products* function properly, and adjust them accordingly to ensure satisfactory operation.
- .2 Do not remove protective coatings until final cleaning, or earlier if directed by *Consultant*.
- .3 Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at *Place of the Work* only if approved.

END OF SECTION

Corner Guards

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Corner guards.

1.2 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- .3 Samples:
 - .1 Submit 3 samples, 300 mm (12") long or 300 x 300 mm (12 x 12") in size as applicable, for each *Product* in specified finish.
- .4 Shop drawings:
 - .1 Include plans, elevations, hardware, and installation details.
 - .2 Show seam locations.
- .5 Templates:
 - .1 Submit templates to *Contractor* for use by installers and fabricators as required for proper location and installation of hardware.

1.3 Delivery, Storage, and Handling

- .1 Package or crate, and brace *Products* to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.
- .2 Deliver *Products* to location at the *Place of the Work* designated by *Contractor*.

1.4 Field Conditions

- .1 Install materials of this section only when surfaces and air temperatures have been maintained between 18°C and 24°C for 48 hours preceding installation, and will be so maintained during installation and for 48 hours thereafter. Maintain a minimum temperature of 13°C after above period. Relative humidity shall be 50 +/- 10%.
- .2 Ensure that adequate ventilation is provided during installation and curing of materials of this section.
 - .1 Do not expose wall protection to direct sunlight during or after installation.

1.5 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.

PART 2 - PRODUCTS

2.1 General

- .1 Incorporate reinforcing, fastenings and anchorage required for building-in of *Products*.

Corner Guards

- .2 Heights of corner guards are to be full wall heights.

2.2 Corner Guard Protection

- .1 Surface mounted, 90 mm x 90 mm (3.5" x 3.5"), 1.6 mm thick (0.063") (16 gauge) stainless steel angle in accordance with ASTM A276/A276M-17, Type 304, AISI No. 4 satin finish, radius edge.
- .2 Acceptable *Product*:
 - .1 Construction Specialties 'Acrovyn Model CO-8'.
 - .2 Substitutions: in accordance with Section 01 25 00.

PART 3- EXECUTION

3.1 Installation

- .1 Install work to meet manufacturer's written requirements, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.
- .2 Clean substrates to remove dirt, debris and loose particles prior to installation.
- .3 Fit joints and junction between components tightly and in true planes.
- .4 Install units on solid backing as indicated, and erect with materials and components straight, tight and in alignment.
- .5 Corner guards:
 - .1 Corner guard edges shall be smooth.
 - .2 Adhere corner guards with continuous adhesive beads in accordance with manufacturer's written requirements.
 - .3 Install corner guard shall be tightly fitted without gaps.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

- .1 Section includes:
 - .1 Roller window sun shades at interior locations.
 - .1 Manual operation: RWS-M.

1.2 Administrative Requirements

- .1 Conduct a pre-installation meeting in accordance with Section 01 31 19.

1.3 Submittals

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
 - .2 Submit flammability performance data.
 - .3 Submit manufacturers' installation instructions.
- .3 Shop drawings:
 - .1 Submit shop drawings or fully dimensioned catalogue cuts.
 - .2 Window treatment schedule: Use same designations indicated on *Contract Documents*.
 - .3 Clearly indicate general construction, configurations, jointing methods and locations, fastening methods, handing of controls, required blocking locations, banding (tandem shades), and installation details.
- .4 Samples:
 - .1 Submit samples of each material and finish colour selected and each accessory.

1.4 Closeout Submittals

- .1 Submit closeout submittals in accordance with Section 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 Manufacturers:
 - .1 Company specializing in manufacturing the *Products* specified in this section, with 10 years' experience minimum.
 - .2 Installers / applicators / erectors:

Roller Window Shades

- .1 Work of this section shall be by forces in the direct employ or under control of the system manufacturer, skilled, trained, and experienced in work of similar scope and complexity.
- .2 Mock-ups:
 - .1 Erect 1 full size mock-up each roller shade type at the *Place of the Work* for review. Completed and accepted mock-up shall act as the standard to which balance of the work of this section will be judged.

1.6 Delivery, Storage, and Handling

- .1 Before delivery to the *Place of the Work*, check each shade for operation; remove finger marks and smudges.
- .2 Package *Products* to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

1.7 Warranty

- .1 Warrant work of this section in accordance with Section 01 78 36.
- .2 Extended warranty:
 - .1 Labour, materials, and workmanship for work of this section.
 - .2 Duration: 2 years.

PART 2 - PRODUCTS

2.1 Manufacturers

- .1 Subject to compliance with requirements, provide *Products* by one of the following manufacturers:
 - .1 Altex.
 - .2 Elite Pro Shading.
 - .3 Hunter Douglas Inc.
 - .4 MechoShade Systems, Inc.
 - .5 Solarfective Products by Legrand Global.
 - .6 Sun Glow Window Covering Products of Canada Ltd.
 - .7 Substitutions: in accordance with Section 01 25 00.

2.2 Performance/Design Requirements

- .1 Manual operation:
 - .1 Every part of a corded window covering that is accessible to a child and is small enough to be totally enclosed in a small parts cylinder in accordance with 'Corded Window Coverings Regulations - SOR/2019-97' must be affixed to the corded window covering so that the part does not become detached when it is subjected to a force of 90 N applied in any direction.
 - .2 Unreachable cords:

Roller Window Shades

- .1 A cord that is not reachable must remain so, whether the corded window covering is fully opened, fully closed or in any position in between, throughout the useful life of the corded window covering.
- .3 Reachable cord with one free end — length:
 - .1 A reachable cord with one free end must not exceed 22 cm in length when it is pulled in any direction by the gradual application of force attaining 35 N.
- .4 Reachable cord between two consecutive contact points — length:
 - .1 A reachable cord with no free end must not exceed 22 cm in length between two consecutive contact points when it is pulled in any direction by the gradual application of force attaining 35 N.
- .5 Loop created by a reachable cord — perimeter:
 - .1 If a reachable cord is pulled in any direction by the gradual application of force attaining 35 N, the perimeter of any loop, whether it is existing, created or enlarged, must not exceed 44 cm.
- .6 Two reachable cords:
 - .1 If two reachable cords with one free end each can be connected to one another, end to end, after each has been pulled in any direction by the gradual application of force attaining 35 N, the following criteria must be met:
 - .1 the length of the resulting cord must not exceed 22 cm; and
 - .2 the perimeter of the loop that is created must not exceed 44 cm.

2.3 Hardware - Manual Controlled Shades (RWS-M)

- .1 Shades shall be operated to permit infinite positioning. Right hand operation and banding as applicable to suit *Place of the Work* condition.
 - .1 Drive assembly:
 - .1 Allow finger tip control and include a built in shock absorber system to prevent cord breakage under normal operating conditions;
 - .2 Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.

2.4 Assembly

- .1 Provide fully factory assembled shade unit consisting of 2 shade brackets, one piece extruded aluminum shade tube, extruded aluminum fascia, aluminum profile hembars, extruded vinyl fabric spline, and fabric as specified.
- .2 Fabric shall hang straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.
- .3 Factory modify housings where necessary to bypass columns.
- .4 End brackets: a two piece moulded ABS construction with nylon drive sprocket. Bracket colour shall coordinate with the fascia colour.
- .5 Shade tube: Minimum 1.52 mm (0.060") thick extruded aluminum with three equally spaced continuous stiffening fins, non-sag design, maximum deflection under full load of fabric L/700.

Roller Window Shades

- .6 Fascia: Minimum 1.5 mm (1/6") thick extruded aluminum.
- .7 Hembar: Extruded aluminum with matching plastic end finials.
- .8 Mounting: Removal of shade system shall not require the disassembly of the shade unit.

2.5 Shade Mounting System

- .1 Design extruded aluminum bracket to accept preassembled shade system.
 - .1 Use brackets to facilitate the alignment with shade opening.
- .2 Modular construction: Shades shall be removable as a complete modular unit without any component disassembly required.

2.6 Aluminum Finish

- .1 Exposed aluminum: Baked enamel, colour to match window mullion finish.
- .2 Unexposed aluminium: Mill finish.

2.7 Shade Fabric Types

- .1 Sun control fabric; dimensionally stable shade fabric:
 - .1 Acceptable *Products*; 3% open area:
 - .1 Elite Pro 'Green Screen Evolve'.
 - .2 Substitutions: in accordance with Section 01 25 00.
 - .2 Colour: Cloud.
- .2 Fabric:
 - .1 Hang flat, without buckling or distortion. Edge, where trimmed, shall hang true and straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.
 - .2 Colour fast, retain its shape, and not be affected by moisture or heat.
- .3 Flammability performance:
 - .1 Certified by an independent laboratory, shade fabric shall pass CAN/ULC S109-14.

2.8 Fabrication

- .1 Finished assemblies: Square, true to size and free from distortion, twist, or other defects that could affect their strength, operation or appearance.
- .2 Factory applied finish: Uniform, smooth and without blemishes.
- .3 The fabric shall be colour fast, retain its shape, not be affected by moisture or heat, and shall non-flammable.
- .4 Cut fabric to eliminate glare and reflection from shining surfaces while maintaining exterior view.
- .5 The top of the fabric is retained in recessed spline of the roller shade and the bottom of the fabric is retained by the hem bar.

PART 3 - EXECUTION

3.1 Installation

- .1 Install shade systems in plumb, squared, adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane. Fabric shall not travel more than 3 mm (1/8") in either direction within channels after installation.
- .2 Fabric shall be pre-measured and manufactured off-site.
- .3 Shades shall be snapped into place without screws or visible fasteners.
- .4 Incorporate reinforcing, fastening and anchorage required for installation of shades.
- .5 Securely attach installation fittings to their mounting surfaces with stainless steel or hardened aluminum screws of proper length and type, and durable anchors.
- .6 Install shade roller true and level, and with cloth to hang flat without buckling or distortion.

3.2 Adjusting and Cleaning

- .1 Verify that installed shade system functions properly, and adjust it accordingly to ensure satisfactory operation.
- .2 Refinish damaged or defective work so that no variation in surface appearance is discernible.

3.3 Closeout Activities

- .1 Demonstration:
 - .1 Before acceptance of system, arrange for demonstration of equipment with authorized representatives of *Owner*, to be performed by representative of shade manufacturer to assure proper function, operation and explanation.
 - .2 Conduct comprehensive demonstration for *Owner's* staff on operation and care of interior window treatments.

END OF SECTION



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MECHANICAL SPECIFICATION

FOR

GOLDRING STUDENT CENTER

150 CHARLES ST. W., TORONTO, ON

THIS SPECIFICATION SHALL BE READ IN CONJUNCTION WITH DRAWINGS:

REFER TO DRAWING TM-0.1 FOR DRAWING LIST

OUR PROJECT NUMBER:

23501.003.M.001

DATE:

2024-02-02

ISSUED FOR:

TENDER

20.00.00.00
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END OF SECTION

20 05 00.00
General Instructions for Mechanical Sections

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.
- 1.1.2. The Specification is divided into Sections which are not intended to identify contractual limits between Subcontractors nor between the Contractor and their Subcontractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.
- 1.1.3. Provide mechanical components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.

1.2. INTENT

- 1.2.1. Mention in the Specifications or indication on the Drawings of equipment, materials, operation and methods, requires provision of the quality noted, the quantity required, and the systems complete in every respect.
- 1.2.2. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.
- 1.2.3. Be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment and part of equipment and repair related damages.

1.3. SECTIONS AFFECTED

- 1.3.1. These instructions apply to and form a part of all Division 20, 21, 22, and 23 Sections referred herein as Mechanical.

1.4. REGULATIONS

- 1.4.1. Work shall be performed in accordance with codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.
- 1.4.2. The plumbing and drainage systems shall comply with regulations respecting plumbing made under the following legislation except as modified by rules, regulations and by-laws of authorities having jurisdiction:
 - .1 Ontario Water Resources Act.
 - .2 Ontario Plumbing Code.
- 1.4.3. These Specifications are supplementary to the requirements above.
- 1.4.4. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the Contractor shall notify the Engineer's Representative.

1.5. PERMITS, FEES INSPECTION

- 1.5.1. Obtain all permits, make submissions, pay all fees and arrange for all inspections required for the work of this Division.

1.6. EXAMINATION OF SITE

- 1.6.1. Before submitting Bids, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.

1.7. DRAWINGS, CHANGES AND INSTALLATION

- 1.7.1. The Drawings shall be considered to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operational installation.
- 1.7.2. The location, arrangement and connection of equipment and material as shown on the Drawings represents a close approximation to the intent and requirements of the work. The right is reserved by the Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no additional cost.
- 1.7.3. In order to show more clearly the arrangement of the work, plans and sections do not show every valve, thermometer, pressure gauge or other system accessory. Refer to the Mechanical Standard Details and to the Specifications to determine the requirements.
- 1.7.4. Equipment installed by this Division shall installed in accordance with the manufacturer's installation requirements. In the event of conflicts between the Drawings or Specifications and the manufacturer's installation requirements, the Contractor shall notify the Engineer's Representative.
- 1.7.5. Certain Details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence.
- 1.7.6. All piping and ductwork in finished areas shall be concealed in ceiling spaces and shafts or furred into walls. No exposed piping or ductwork shall be installed in such areas unless specifically reviewed and accepted by the Engineer's Representative. No piping shall be concealed in outside walls.
- 1.7.7. The location and size of existing services shown on the Drawings are based on the best available information. The Contractor shall site verify the actual location of existing services before work is commenced. Particular attention shall be paid to buried services.
- 1.7.8. Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other Trades, or to accommodate existing conditions, shall be made at no additional cost.
- 1.7.9. Leave areas clear of piping and ducts where space is indicated as reserved for future equipment and equipment for other Trades.
- 1.7.10. Adequate space and provisions shall be left for removal of coils and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.7.11. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Engineer's Representative before proceeding with the work.

- 1.7.12. Before fabricating ductwork or piping for installation, make certain that such items can be installed as shown on the Drawings without interfering with the structure or the work of other Trades. Any problems that cannot be solved in agreement with the other Trades affected, shall be submitted for decision. If ductwork or piping is prefabricated prior to the investigation and reaching of a solution to possible interference problems, necessary changes in such prefabricated items shall be made at no additional cost.
 - 1.7.13. Location of diffusers, grilles registers, thermostats, sprinklers and all other equipment shown on plans is diagrammatic. Layout of each device in finished areas is critical in terms of symmetry and location. Refer to Architectural Drawings and to site instructions in all regards. Any work not installed in the correct location (at the sole discretion of the Engineer's Representative) shall be remedied by this Contractor at their expense. This Contractor is responsible for mark-out of their work, fully co-ordinated with all other trades, in sufficient time for review by Engineer's Representative prior to rough-in. All mechanical and sprinkler services shall be located precisely.
- 1.8. MATERIALS
- 1.8.1. Make and quality of materials used in the construction of this work shall be subject to the approval of the Engineer's Representative.
 - 1.8.2. Materials and equipment supplied by this Division shall be new and free from defects and shall be as specified by the manufacturer's name and catalogue reference.
 - 1.8.3. Where a manufacturer's equipment has been specified by name and/or model number, the Contractor shall be responsible to ensure that the performance and quality of equipment provided by an acceptable manufacturer, meets the specified equipment performance, is inclusive of all standard and specified optional features, and can be installed in the planned location with access and maintenance clearances in accordance with the manufacturer's recommended installation. This Contractor shall also confirm all required piping, duct and electrical connections are provided at no additional cost.
- 1.9. CO-OPERATION WITH ENGINEER'S REPRESENTATIVE
- 1.9.1. To assist in the successful execution of the project, the Contractor will receive an initial job report that summarizes the expectations of the Engineer's Representative and the Contractor. This job report covers topics such as progress billings, shop drawing requirements, change order pricing, the commissioning process, installation drawings, the Specifications, as-built drawings and operations and maintenance manuals, along with a number of other items. This job report is intended to reiterate key items from the Contract Documents and is not intended to impose new requirements.

- 1.9.2. At the appropriate time during construction the Contractor shall submit the applicable documentation listed in the Mechanical/Electrical Unfinished Building Occupancy Checklist. The checklist shall be issued by the Engineer's Representative during the course of the project, however, a sample checklist can be provided at any time upon request. The checklist shall be completed by the Contractor when the information required for occupancy is submitted. The Engineer's Representative shall review the information and checklist and will identify when the information is complete. The Engineer's Representative's general review letter (required for building occupancy) will only be issued when the information requested in the checklist is submitted by the Contractor and deemed to be complete by the Engineer's Representative.

1.10. CO-OPERATION WITH OTHER DIVISIONS

- 1.10.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.
- 1.10.2. Pipes transporting hot fluids shall be installed at least 150 mm (6 in.) away from pipes carrying cold fluids, unless approval from the Engineer's Representative is obtained to install services closer than 150 mm (6 in.).
- 1.10.3. Electrical conduits shall not touch or be supported from piping or ductwork.
- 1.10.4. Each Section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other Sections or Divisions. Where the space allocated to another Section or Division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various Sections and Divisions. Relocation of materials and work involved shall be paid for by the Section responsible for the encroachment at no additional cost.
- 1.10.5. Supply all items to be built in ample time for rapid progress of the work. Schedule and proceed with work as required to satisfy the construction schedule.

1.11. TEMPORARY USE OF EQUIPMENT

- 1.11.1. Where systems, or a part thereof, are operated during construction, the Contractor shall maintain the system and equipment in proper operating condition.
- 1.11.2. Prior to application for substantial performance of the work as certified by the Engineer's Representative, the systems and/or equipment shall be returned to new condition by replacing all consumables such as air or water filters, belts in belt driven equipment, etc. with new components. This Contractor shall clean the air side of all coils in the air handling systems, lubricating all bearings according to manufacturer's factory standards and adjust the thermostatic control system according to Specifications. This Contractor shall clean all duct systems to NADCA Standards.

1.12. EXISTING SERVICES AND EQUIPMENT

- 1.12.1. Provide temporary filters, 1 in. thick disposable media type, over all return air openings in the base building HVAC. systems that remain in operation during construction. Maintain and replace the temporary filter media as required to prevent construction dust from fouling the base building equipment. Remove same at the completion of construction. Filters in all base building air handling equipment i.e., Air Handling Units, Induction Units, Fan Coil Units, etc., shall be replaced after construction is completed

- 1.12.2. Reuse existing materials and equipment wherever possible. Provide new materials and equipment as required to ensure a complete installation. All existing equipment, materials and associated controls not used in this contract shall be packaged and turned-over to the Landlord. Include in the tender for all shipping and placement in a designated on-site storage location. Remove any equipment or material not wanted by the Landlord from the site.
- 1.12.3. All changes and connections to existing services shall be made only in a manner and at a time approved by the Engineer's Representative so as to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal working hours, without additional cost.
- 1.12.4. Prior to operating any existing or new equipment during any stage of construction, approval from the Landlord and Engineer's Representative must be received in writing
- 1.12.5. Whenever existing services or equipment are to be removed, all piping and ducts for such services or equipment shall be removed back to the main, nearest pipe or duct and any open ends securely capped or plugged in an approved manner. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this Contractor without additional cost.
- 1.12.6. Whenever it becomes necessary to relocate existing piping, ducts or equipment to make possible installation of the work under this Contract, such relocation shall be done by this Contractor without additional cost.
- 1.12.7. Where connections are made to existing services, existing insulation shall be made good under this Division.
- 1.13. **INTERRUPTION OF SERVICES**
 - 1.13.1. All shutdown, draining, filling and chemical treatment for any portion of the existing base building systems shall be performed to the satisfaction of the Landlord's building operations staff and shall be co-ordinated with the Landlord for time and duration of interruptions. Comply with all of the Landlord's instructions and include for all costs of this work, including work performed by the Landlord's chemical treatment supplier, in the tender price.
 - 1.13.2. Any interruption of the mechanical services to any part of the building shall come at a time agreeable to the Landlord. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.
 - 1.13.3. Testing and operation of major equipment shall be approved by the Engineer's Representative to avoid excessive utility charges. Such testing is to be generally carried out after normal working hours or on weekends.
 - 1.13.4. All such overtime work shall be carried out without additional cost.
- 1.14. **STATEMENT OF PRICES**
 - 1.14.1. For the purpose of progress applications the Contractor shall submit a summary statement of their estimated prices for the various portions of the work, including labour, materials and equipment shown separately. The total price of all portions of the work shall equal the total price of the work covered under Divisions 20, 21, 22, and 23.

- 1.14.2. The Contractor shall submit the summary of work for this Contract to the Engineer's Representative for review and approval. The summary shall be in sufficient detail to enable the Engineer's Representative to evaluate the progress of work and shall identify all major equipment, components and sub trades.
- 1.15. **DEMOLITION**
 - 1.15.1. The Drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services follow the service through to ensure other areas of the building are not affected. Open shafts, walls and ceilings as required to examine the services.
 - 1.15.2. If there are no isolating valves readily available to isolate sections of pipe that requires removal, add valves as required. The cost of these valves will be paid for from the Cash Allowance Section. Co-ordinate with the Engineer's Representative to shut-down the system. Install caps on all services. Add cap to all valves at the termination point of existing services.
 - 1.15.3. Where valves are removed, remove valve tags, revise existing charts and hand tags over to Owner.
- 1.16. **SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP**
 - 1.16.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.
 - 1.16.2. Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Conditions and conform to all requirements.
 - 1.16.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. In particular no open flames shall be used without prior written approval of the Owner. There shall be no smoking, and the site shall be kept clean at all times.
- 1.17. **MECHANICAL DIVISIONASHRAE 90.1**
 - 1.17.1. All mechanical equipment shall comply with the minimum efficiency standards set out in ASHRAE 90.1 and the National Energy Code of Canada for Buildings. Submit all necessary information to substantiate conformance.
- 1.18. **HOISTING FACILITIES**
 - 1.18.1. This Division shall provide its own hoisting facilities.
 - 1.18.2. Hoisting facilities provided by the General Contractor may be available for Sub-Contractors use. If the General Contractor's hoist facilities are inadequate then Sub-Contractors shall provide their own. This Division shall coordinate requirements with the General Contractor prior to submission of Tender.

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Section 20 05 00.00
General Instructions for Mechanical Sections

1.19. INTELLECTUAL PROPERTY

- 1.19.1. The Contractor acknowledges, represents, warrants and agrees that the Owner, its Consultants, and the Engineer's Representative are not responsible, and hereby indemnified against any action as a result of patent infringement made through the review, acceptance, or receipt of materials, equipment, work, etc. provided by the Contractor or any of their suppliers or manufacturers in the execution of this Contract.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

20 05 02.00
Record and As-built Drawings

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. Refer to Record and/or As-built Drawings in Section 01 70 00.00 (01 72 29.00) - CLOSEOUT SUBMITTALS.
 - 1.3. RECORD OF REVISIONS ON SITE
 - 1.3.1. Print and maintain two complete sets of white prints to mark the project progress, changes and deviations.
 - 1.3.2. Maintain an updated copy of plans and schematics in the digital format for which the project is provided (i.e. AutoCAD or Autodesk Revit MEP) and be capable to produce documents in Adobe PDF upon request.
2. Products
 - 2.1. NOT USED
3. Execution
 - 3.1. DOCUMENTATION REQUIREMENTS
 - 3.1.1. As the project progresses record all changes and deviations..
 - 3.1.2. Maintain an accurate dimensional record of revisions. Specifically record:
 - .1 Above ground piping revisions
 - .2 Duct revisions
 - .3 Equipment revisions
 - .4 Locations of access doors and panels. Identify the equipment and components they serve.
 - .5 Locations of valves
 - 3.1.3. Keep revisions up-to-date during construction including change orders, change directives, and site instructions. Documentation shall be available for review at all times.

- 3.2. Final as-built documents shall not contain markings or corrections electronically or by hand (i.e. marker, pen, pencil, etc.). Drawings submitted that contain mark-ups will not be accepted.
- 3.3. SUBMISSION REQUIREMENTS
- 3.3.1. On completion of the Work, submit the draft documentation indicating all such changes and deviations for review by the Engineer's Representative. Submit all documents in PDF format.
- 3.3.2. Upon return of the "Reviewed" draft submittal, transfer "As-Built" information and any additional submittal comments to the final software submission requirement (i.e. Autodesk AutoCAD or Autodesk Revit MEP).
- .1 Request the acceptable version(s) of the software that may be used. Owner shall confirm the acceptable software version upon receipt of request. If the Owner has no preference, the latest published version shall apply.
- .2 Conform to the Owner/Engineer's Representative's standards.
- .3 The Mechanical Contractor may request from the Engineer's Representative the most current electronic documentation in AutoCAD Documents to be forwarded via a secure file transfer (at a nominal charge of \$500.00).
- .4 Clearly label electronic files with Engineer's Representative and Owner, Contract number, file names and the Drawing number.
- 3.3.3. Submit the documents in PDF along with the submission of the completed electronic source software documentation on an approved electronic storage device for review by the Engineer's Representative.
- 3.3.4. The project will remain incomplete and monies retained until a satisfactory as-built submission is provided.
- 3.4. AUTOCAD SPECIFIC SUBMISSION REQUIREMENTS
- 3.4.1. Submit a complete list of symbol (block) names with a description of each symbol.
- 3.4.2. Make special effort to ensure that drafting is accurate, i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and that entities are placed on correct layers.
- 3.4.3. Use the standard fonts available in the software. Do not use custom fonts, shape files, etc.,.
- 3.4.4. Provide all drawings in the same scale of measurement and units as issued on Bid Documents.

END OF SECTION

20 05 03.00
Shop Drawings

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. Comply with Section 01 33 00.00 (01 33 23.00) for Submittals except as amended below.
2. Products
 - 2.1. SHOP DRAWINGS
 - 2.1.1. Submit shop drawings organized by Specification Section. Do not combine more than one Section into one submission. Incorrect submissions will be returned without review.
 - 2.1.2. Submit shop drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:
 - .1 S+A project number and Contractor Shop Drawing Identifier in Subject Line
 - .2 Attachments shall be limited to 10MB
 - .3 Provide FTP hyperlink for all attachments in excess of 10MB with appropriate information for downloading the file (as required)
 - .4 Shop Drawing Submission to the following email address:
 - .1 ContractAdmin.Toronto@smithandandersen.com
 - 2.1.3. Shop drawings submitted directly Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.
 - 2.1.4. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
 - 2.1.5. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation. The Engineer's Representative may also request that this information be added to the maintenance and operating manual.
 - 2.1.6. Provide a cover sheet with the project name, issue date, issue number, Specification section number, title of section and with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

3. Execution

3.1. SUBMISSIONS

- 3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that they have checked the submission for conformance with all requirements of the Drawings and Specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting drawings for review.
- 3.1.2. Scanned PDF versions are not acceptable.
- 3.1.3. Installation of equipment or connecting services shall not start until after final review of Shop Drawings by the Engineer's Representative has been completed.
- 3.1.4. Provide all necessary copies required for the trades, suppliers or other Consultants.

END OF SECTION

20 05 29.00
Hangers and Supports

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.
- 1.1.3. Hangers, supports shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment. The Mechanical Division shall prepare detailed shop drawings showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall bear the signed seal of a Professional Engineer licensed to practice in the appropriate discipline and place of work. The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the project Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division. No anchor points shall be permitted without reviewed shop drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Engineer's Representative.

2. Products

2.1. MATERIALS

- 2.1.1. Provide hangers and supports manufactured by Anvil International, Taylor Pipe Supports, or E. Myatt & Co.
- 2.1.2. All pipe hangers and supports shall be manufactured to the latest requirements of MSS-SP-58. Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME Code for Pressure Piping B31.1.

3. Execution

3.1. INSTALLATION

- 3.1.1. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent undue stress to building structural components.

- 3.1.2. Piping shall be supported from walls, beams, columns, and slabs using approved structural attachments. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies shall receive approval prior to installation. Prior approval shall be given for any cutting or drilling of building structural steel. Damage or modification to the structure through welding, cutting, or drilling shall not be permitted if it reduces the integrity of the building structure as deemed by the Structural Engineer's Representative. It shall be the responsibility of the Mechanical Division to supply anchor bolts and base diagrams for equipment and pipe supports showing exact location of attachments.
- 3.1.3. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.
- 3.1.4. Auxiliary structural members shall be provided under the Mechanical Section concerned where piping, ducts or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Auxiliary structural members shall be the same material and finish as the primary structure (i.e. prime painted, galvanized, etc.). Submit details for review as requested.
- 3.1.5. Depending on the type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts. Submit proposed hanger details for review and acceptance by the Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.
- 3.1.6. For precast concrete construction, hanger rods shall pass between slabs and be supported on the slab within the topping by a 100mm x 100mm x 3mm (4 in. x 4 in. x 1/8 in.) steel plate welded to the hanger rod. A lock nut threaded to the hanger rod together with a 50mm (2 in.) minimum dia. washer shall be applied tight against the under surface of the deck to prevent rising of the hanger.
- 3.1.7. Approved type expansion shields and bolts may be used for pipe up to 100mm (4 in.) diameter where the presetting of concrete inserts is not practical. Submit proposed hanger details for review and acceptance by the Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.
- 3.1.8. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer's Representative. Drawings of the proposed method of suspension must be submitted for review.
- 3.1.9. Hanger rods shall be subject to tensile loading only. Suspended piping shall be supported by adjustable hanger rods sized as follows:

Pipe Size	Hanger Rod Diameter
50mm (2 in.) and under	9mm (3/8 in.)
65mm (2-1/2 in.) and 75mm (3 in.)	12mm (1/2 in.)

- 3.1.10. Unless otherwise specified or shown hanger spacing for all services shall be as follows:

Nominal Pipe Diameter	Maximum Span
Up to and including 25mm (1 in.)	2.1 m (7 ft.)
32mm (1-1/4 in.) to 125mm (5 in.)	3 m (10 ft.)

- 3.1.11. In addition, provide a hanger within 600mm (2 ft.) on each side of valves, fitting or tees on pipes 38mm (1½ in.) diameter and larger.

- 3.1.12. Hanger spacing for plumbing and drainage services shall be in accordance with the plumbing code or municipal by-laws as applicable.
- 3.1.13. Hanger spacing for fire protection services shall be in accordance with the NFPA codes.
- 3.1.14. All horizontal piping 50mm (2 in.) diameter and larger shall be supported by adjustable wrought iron clevis type hangers. Smaller piping shall be supported by adjustable split ring hangers or clevis type hangers.
- 3.1.15. Suspending one hanger from another shall not be permitted.
- 3.1.16. For hot water or steam piping 38mm (1-1/2 in.) and smaller, use line size hangers.
- 3.1.17. For cold water services such as domestic cold water and hot water pipe 25mm (1 in.) and smaller, install a section of high density insulation complete with continuous vapour barrier between the pipe and the hanger. Refer to Section 20 07 00.00 - MECHANICAL INSULATION.
- 3.1.18. The shield width shall be minimum 1/4 of the pipe circumference. The length and gauge shall be as follows:
- 3.1.19. Hangers and riser clamps in contact with copper pipe shall be copper coated construction or plastic coated. Taped hangers and riser clamps shall not be accepted.
- 3.1.20. Other means of support shall be as shown or as specified hereunder.
- 3.1.21. For special equipment supports refer to equipment sections. Where no support method is identified secure wall mounted equipment to metal framing or masonry, with steel toggle or expansion fasteners, machine screws or sheet metal screws as applicable. Plastic, fibre or soft metal inserts shall not be acceptable. Wall mounted equipment shall not exceed 45.5 Kg (100 lbs) in weight or 250mm (10 in.) in depth unless reviewed or detailed by the Engineer's Representative. Where framing does not permit direct attachment, provide metal strut sub-framing or minimum 19mm (3/4 in.) fire retardant treated plywood backboards, unpainted, attached to the framing. Provide attachments for backboards at 600mm (24 in.) on centres with no less than 4 attachments.

END OF SECTION

20 05 48.00
Vibration and Noise Control

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. None.
 - 1.3. SUBMITTALS
 - 1.3.1. None.
 - 1.4. PERFORMANCE REQUIREMENTS
 - 1.4.1. Adequately isolate all equipment to maintain acceptable noise levels in the occupied area of the building as specified below. Take noise measurements over the complete audible frequency range in each of the occupied zones under, above and beside Mechanical Equipment Rooms, and where indicated by the Engineer's Representative. Noise levels due to mechanical equipment, ductwork, grilles, registers, terminal devices, diffusers, etc, shall not exceed sound pressure levels in all 8 octave bands corresponding to the NC levels per ASHRAE handbook as indicated.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. All equipment provided for vibration isolation or noise control shall be new and manufactured specifically for the purpose intended.
 - 2.1.2. All vibration isolation devices shall be Vibro-Acoustics, Kinetics Noise Control, VMC Amber Booth, or Mason Industries and shall be one manufacturer throughout the project.
 - 2.1.3. Provide vibration isolation devices for all motorized or electrical equipment. Static deflection of isolators shall be as given in the Vibration Isolation Schedule and/or as specified below. The Vibration Isolation Schedule shall take precedence.
 - 2.2. VIBRATION ISOLATION
 - 2.2.1. Type SPNH (Spring and Neoprene Hangers) - Vibro-Acoustics Model SHR, Kinetics Model SRH, or Mason Industries Model 30N
 - .1 Type SPNH shall be as above with the addition of a neoprene element in series with the spring. The neoprene element shall have a deflection of not less than 9mm with a strain not exceeding 15%. Unless otherwise specified, the static deflection of SPNH hangers under actual load conditions shall be 50 mm (2 in.).

- 2.2.2. All spring mounts shall be complete with levelling devices 6 mm (1/4 in.) thick ribbed neoprene sound pads and completely colour coded stable springs.
- 2.2.3. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50% above the design deflection.
- 2.2.4. All vibration isolators shall have either known undeflected heights of calibration markings to that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to design.
- 2.2.5. Neoprene mounting sleeves for hold down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.

2.3. INTERNAL ACOUSTIC DUCT LINING

- 2.3.1. Fiberglass duct liner shall be manufactured by Certainteed, Owens-Corning, Knauf Insulation, or Johns Manville.
- 2.3.2. Natural fibre duct liner shall be manufactured by Bonded Logic.
- 2.3.3. Duct lining shall have a minimum density of 24 kg/m³ (1.5 lbs/ft³).
- 2.3.4. Duct liner shall comply with the requirements of NFPA 90A and the "Duct Liner Materials Standard" of the Thermal Insulation Manufacturer's Association.
- 2.3.5. Duct sizes shown on the Drawing are free area dimensions (after the installation of duct liner). Duct liner shall be a minimum of 25 mm (1 in.) unless shown otherwise.
- 2.3.6. All acoustical duct lining shall incorporate means to prevent fiber entrainment in the air stream.
- 2.3.7. The following ductwork shall be internally lined:
 - .1 All ductwork specifically identified in Specifications and/or on the Drawings.
 - .2

2.4. SOUND BAFFLES

- 2.4.1. Sound baffles indicated on the drawing shall be 2 layers of 4.9 kg/sq. m. (1 lb/ sq. ft.) sheet acoustic barrier material installed in the perimeter induction enclosures and centred on adjoining partitions. Seal sheets to enclosure and around all piping etc. inside the enclosures. Cover the acoustic sound barrier sheet with drywall on both sides to ensure the acoustic sheets are encapsulated. Acoustic barrier shall be Kinetics KNM or AcoustiGuard Noise-Blok.

3. Execution

3.1. INSTALLATION

- 3.1.1. On system start-up, inspect the complete installation and provide a report in writing.
- 3.1.2. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

- 3.1.3. Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping, and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.
- 3.1.4. All wiring connections to mechanical equipment on isolators shall be made with a minimum long flexible conduit installed in a slack "U" shape.
- 3.1.5. Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.
- 3.1.6. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

3.2. EQUIPMENT ISOLATION

- 3.2.1. The first isolator both upstream and downstream of equipment on springs shall have a static deflection of 1.5 times the deflection of the vibration isolated equipment to a maximum of 50 mm (2 in.). All other piping supports shall have a static deflection of 25 mm (1 in.) minimum.
 - 3.2.2. Flexible piping connectors shall be installed to connect piping of diameter 50 mm (2 in.) or greater to reciprocating or rotating equipment.
 - 3.2.3. No rigid connections between equipment and the building structure shall be made that degrades the specified noise and vibration control system.
 - 3.2.4. Any conflicts with other trades which result in rigid contact with the equipment or piping due to inadequate space or other unforeseen conditions should be brought to the Engineer's Representative's attention prior to installation. If not brought to the attention of the Engineer's Representative prior to installation corrective work necessitated by conflicts shall be at the Contractor's expense.
 - 3.2.5. Locate isolation hangers with the housing a minimum of 50 mm (2 in.) below but as close as possible to the structure. Where isolator hangers would be concealed by a non-accessible acoustical sub-ceiling, install the hangers immediately below the sub-ceiling for access.
- .1 Flexible connectors shall be in accordance with Section 23 31 13.00 - DUCTWORK AND SPECIALTIES.

3.3. ACOUSTICAL LINING OF DUCTS

- 3.3.1. Ductwork shall be acoustically lined where shown on the Drawings and as Specified.
- 3.3.2. Acoustical duct lining shall be a minimum of 25 mm (1 in.) thick in all internally lined sheet metal ducts, unless otherwise specified or shown on the Drawings.
- 3.3.3. The acoustic liner shall be fixed to the duct with a minimum of 50% coverage of a fire-resistant adhesive. Where the duct width exceeds 300 mm (12 in.) or the height 600 mm (24 in.), the liner shall be additionally secured with mechanical fastening on maximum 450 mm (18 in.) centers on all sides. Mechanical fasteners that pierce the duct are unacceptable. Mechanical fasteners shall be in accordance with Section 20 07 00.00 - MECHANICAL INSULATION. All ends of the liner shall be coated with a fire resistant cementing material to prevent delamination, leakage or erosion. All joints shall be firmly butted and ends coated with an adhesive to ensure that the lining is smooth across all joints.

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- 3.3.4. Where acoustical duct lining is installed, the dimensions of the sheet metal shall be increased to include the thickness of the lining material. Dimensions shown on the Mechanical Drawings are the clear internal dimensions after the liner has been installed.

END OF SECTION

20 05 63.00
Access Doors and Accessibility

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Submit Drawings showing size, type and location of all access doors, for review, before installation.

2. Products

2.1. MATERIALS

- 2.1.1. Access doors shall be Acudor, or Mifab Manufacturing Inc.
- 2.1.2. Doors in solid walls shall be with a 14 U.S. gauge, prime painted steel door panel, rust resistant concealed hinges, flanged frame, and screwdriver operated lock. Acudor Model UF 5000 or Mifab Model UA.
- 2.1.3. Doors in drywall partitions or ceilings shall be 16 US gauge, prime painted steel recessed door panel for the acceptance of a drywall insert, concealed hinges, drywall bead frame, and screwdriver operated lock. Acudor model DW 5015 or Mifab Model CAD-DW.
- 2.1.4. Doors in drywall partitions or ceilings shall be 14 US gauge, prime painted steel flush door panel, concealed hinges, drywall bead frame, and screwdriver operated lock. Acudor model DW 5040 or Mifab Model MDW.
- 2.1.5. Access doors in fire rated walls or ceilings shall be ULC labeled with insulated door panel, concealed hinge, self-closing, self-latching, flanged frame, and prime painted. Provide master key operated catch in areas accessible to the public. Acudor Model FW 5050 or Mifab MPFR.
- 2.1.6. Doors in tiled walls or ceilings shall be 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock. Acudor Model UF 5000 or Mifab Model UA-SS.
- 2.1.7. Minimum size of doors shall be 300 mm x 450 mm (12 in. x 18 in.). Wherever possible 600 mm x 600 mm (24 in. x 24 in.) doors shall be used.

3. Execution

3.1. INSTALLATION

- 3.1.1. All parts of the installation requiring periodic maintenance shall be accessible. Wherever valves, dampers and other appurtenances are concealed by building construction, access doors shall be furnished by this Section and installed under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.) This Section is responsible for the proper location of the access doors.
- 3.1.2. Wall mounted plumbing fixtures with back water connection shall have an adjacent access door.

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- 3.1.3. Wherever possible, items requiring access shall be located in easily accessible areas (i.e. exposed or T-bar ceilings).
- 3.1.4. Group items in order to minimize the number of access doors required.
- 3.1.5. Each access door shall be installed to provide complete access to equipment for maintenance and servicing.
- 3.1.6. Make any changes to locations of access doors as directed by the Engineer's Representative.
- 3.1.7. The final installed locations of all access doors shall be shown on the As-Built Record Drawings.

END OF SECTION

20 05 83.00
Sleeves and Escutcheons

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. Firestopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers, etc.) with the exception of sleeves shown for future use installed in fire or smoke rated partitions shall be the responsibility of Mechanical Division. All other firestopping and smoke seals of mechanical services are part of Mechanical Division.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Sleeves passing through stud partitions shall be 0.75 mm (0.0299 in. - 22 G.S.G.) steel.
 - 2.1.2. Sleeves passing through concrete or masonry partitions shall be Schedule 40 steel pipe.
 - 2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal.
 - 2.1.4. Firestopping and smoke seal systems shall be in accordance with CAN4-S115 - Standard Method of Fire Tests for Firestop Systems, CAN/ULC-S101 - Standard Methods for Fire Endurance Tests of Building Construction and Materials, ASTM E119 - Standard Test Methods for Fire Tests of Building and Construction Materials, and ASTM E814 - Standard Test for Fire Tests of Through-Penetration Firestop Stops.
 - .1 Unless noted otherwise "F" and "T" ratings are shown on the drawings.
 - .2 Systems shall be asbestos free and maintain an effective barrier against flame, smoke, and gases in accordance with CAN4-S115 and shall not exceed opening sizes for which they are intended.
 - .3 Firestopping and smoke seals at openings around mechanical services shall be an elastomeric seal for sound and vibration control.
 - .4 Fire resistance rating of firestopping assembly shall not be less than the fire resistance rating of surrounding floor or wall assembly.
 - .5 Service penetration assemblies shall be ULC certified in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.
 - .6 Service penetration firestop components shall be ULC certified in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15.
 - .7 Firestopping and smoke seals shall be by Hilti, Tremco/Royal Quickstop, or 3M.
 - .8 Firestop products shall be mold and mildew resistant

- 2.1.5. Escutcheons shall be satin finish stainless steel or satin finish chrome or nickel plated brass, with non-ferrous set screws. Do not use stamped steel split plates. Split cast plates with screw locks may be used. For escutcheons for plumbing fixtures refer to Section 22 42 00.00 - FIXTURES AND TRIM.
- 2.1.6. Provide adequate bracing for support of sleeves during concrete and masonry work. For floors and walls with a fire resistance rating, build fire damper assemblies into structure to attain fire rated construction, in a manner acceptable to the governing authorities.

3. Execution

3.1. INSTALLATION

- 3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Mechanical Division for the mechanical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.
- 3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer's Representative.
- 3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers.
- 3.1.4. Sleeves shall be sized to maintain insulation and vapour barrier around all pipes and ducts for all service penetrations. Coordinate thickness requirements with Section 20 07 00.00 - MECHANICAL INSULATION.
- 3.1.5. For sleeves through barriers without a fire resistance rating, for non-insulated pipe, fill the annular space between the service and the sleeve with insulation as specified in Section 20 07 00.00 - MECHANICAL INSULATION and caulk around the edges with sealant.
- 3.1.6. Firestopping and smoke seal material and components shall be installed in accordance with the ULC certification and manufacturers instructions. Examine the sizes and conditions of the cavities to be filled to determine the correct thicknesses and installation of materials. All substrates and surfaces in contact with firestopping materials shall be dry and prepared in accordance with the Manufacturers instructions at appropriate ambient conditions.
- 3.1.7. Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.
- 3.1.8. Provide escutcheons at all penetrations of piping into finished areas, and at insulated pipes, make the escutcheons large enough to fit around the insulation.

END OF SECTION

20 05 88.00
Cutting and Patching

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Openings required for mechanical services for new construction shall be in accordance with Section 20 05 83.00 - SLEEVES AND ESCUTCHEONS. This Section shall apply for openings required in existing construction or where sleeves for mechanical services have been omitted in new construction in error.
- 1.1.3. Include for all cutting and patching for all mechanical services for holes and openings with dimensions up to 200 mm (8 in.) in size and related patching. Perform cutting and patching work in accordance with requirements of Section 01 60 00.00 - PROJECT FORMS.
- 1.1.4. Cutting and Patching shall be in accordance with Section 01 60 00.00 - PROJECT FORMS.

2. Products

2.1. MATERIALS

- 2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Section 01 60 00.00 - PROJECT FORMS, and shall be carried out by professional workers experienced in the cutting and patching work to be done.

3. Execution

3.1. INSTALLATION

- 3.1.1. Locate all openings in non-structural elements requiring cutting and patching in cooperation with the applicable Trades in a timely manner to avoid unnecessary cutting. All openings shall be shown on Drawings and submitted to the Engineer's Representative for review. No holes through structure shall be permitted prior to review by the Structural Engineer's Representative.
- 3.1.2. Core drilling for individual services shall be by this Division. Cut all openings no larger than is required for the services.
- 3.1.3. Locate all openings in structure elements requiring cutting and patching and x-ray the structure to obtain Structural Engineer's Representative's approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar and completely avoid electrical conduit.
 - .1 Cut holes through slabs only.
 - .2 Do not cut holes through beams.
 - .3 Holes to be cut are 200 mm (8 in.) (diameter) or smaller only.

- .4 Maintain at least 100 mm (4 in.) clear from all beam faces. Space at least 3 hole diameters on Centre.
- .5 For holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.
- .6 For holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.
- .7 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity.
- 3.1.4. Obtain written approval from the Landlord and the Structural Engineer's Representative before cutting or core drilling openings or holes.
- 3.1.5. Patch all openings after services have been installed to match the surrounding finishes.

END OF SECTION

20 07 00.00
Mechanical Insulation

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 21 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Provide shop drawings with technical data on all types of insulation to be installed.
- 1.1.3. Provide two samples of each type of insulation indicating where each is to be used and a sample of a typical vapour barrier dam. Samples shall be mounted on boards. One shall be kept at the Contractor's site office and the other shall be turned over to the Engineer's Representative.

2. Products

2.1. MATERIALS

- 2.1.1. Fibreglass insulation shall be Owens-Corning, Certainteed, Manson, Johns Manville, Knauf or Fibrex.
 - .1 Duct insulation shall be rigid board vapour seal 48 kg/cu.m. (3 lbs/cu.ft.) density duct insulation with factory applied vapour barrier.
 - .2 Flexible duct insulation shall be 12 kg/cu.m. (3/4 lb.cu.ft.) type with vapour barrier.
 - .3 Pipe insulation shall be preformed sectional fibreglass or mineral wool insulation with factory applied all service jacket.
- 2.1.2. All cements and adhesives shall be as recommended by the manufacturer of the insulation. Insulation, insulation jacket, canvas and adhesive shall be fire retardant with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50 when tested in accordance with CAN/ULC-S102-M.
- 2.1.3. Provide all insulation, adhesives, coatings, and jacket systems for indoor applications that are Certified under the GREENGUARD Environmental Institute (GEI) Certification Program for low chemical and particle emissions for indoors,

3. Execution

3.1. INSTALLATION

- 3.1.1. Install insulation in accordance with the manufacturer's printed installation instructions unless noted otherwise.
- 3.1.2. Insulation thicknesses and conductivities shall meet or exceed the minimum standards set out in ASHRAE 90.1 (refer to Table 1 following) and as specified herein for the services covered.
- 3.1.3. Apply insulation to clean, dry surfaces only while ambient temperature is at least 10 Deg. C. (50 Deg. F.).

- 3.1.4. Where vapour barrier dams are called for, terminate the insulation and seal the vapour barrier to the pipe or ductwork using a mesh embedded in a vapour barrier mastic. Provide dams at valves, fittings used for servicing, groups of other types of fittings, irregular shaped objects at floor and wall penetrations, and at 15 m (50 ft.) intervals of straight pipe or straight ductwork for the following services: water piping that is less than 80 deg. F., including but not limited to the following:
 - .1 Domestic cold water piping
- 3.1.5. Terminate insulation on pipes passing through fire rated walls or floors, and fit tight to the fire stop material.
- 3.1.6. Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, shall be insulated with removable caps or sections. All edges shall be sealed between pipe and vapour barrier and held in place with stainless steel straps. Finish all insulation smooth, making the outline of pipe insulation a true circular and concentric shape. Shape the outline of fitted insulation to blend with adjacent covering.
- 3.1.7. On piping systems specified to be insulated, include insulation on valves, flanges, couplings and unions.
- 3.1.8. Do not use staples to secure joints of insulation jackets.
- 3.1.9. Hot Services
 - .1 On hot services, insulate valves, fittings, couplings, unions, flanges and all other appurtenances through which the fluid passes, using mitred sections of preformed insulation of a thickness equal to the adjoining pipe insulation, and securely wire in place. Over mitred section, apply one coat of field applied mesh reinforced mastic. Finish services with a vapour barrier using two full brush coats of vapour seal adhesive.
 - .2 Apply glass fibre preformed vapour barrier jacket pipe insulation to domestic hot water piping. Refer to Table 1 following for required insulation thickness. Apply with all joints butted firmly together, and bond securely, sealing flaps by pasting down to give a smooth finish.
 - .3 Apply 50 mm (2 in.) thick mineral fiber tank wrap insulation (wired on) to the following:
 - .1 All domestic hot water tanks
- 3.1.10. Cold Services
 - .1 For domestic cold water piping less than 75 mm (3 in.) where hangers on cold water lines penetrate vapour barrier make sure the penetration is properly sealed with insulation and vapour barrier continued up hanger a further 75 mm (3 in.).
 - .2 Apply 12 mm (1/2 in.) thick, preformed glass fibre pipe insulation with vapour barrier jacket or 12 mm (1/2 in.) thick flexible elastomeric insulation to all domestic cold water piping.
 - .3 On cold water service valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges and other irregular shaped objects, apply flexible elastomeric sheet insulation, thickness to suit service, cut and mitre as necessary, and attach with adhesive and stainless steel banding. Bond and seal edges of insulation to the adjacent surfaces and finish with field applied mesh reinforced mastic.
 - .4 Refer to the Table 1 for required insulation thicknesses.
- 3.1.11. Drainage Piping

- .1 Cover cast iron drainage pipe 75 mm (3 in.) and smaller with 12 mm (1/2 in.) preformed glass fibre pipe insulation, and finish with vapour barrier jacket. Seal band to the fibreglass insulation. Apply 25 mm (1 in.) thick insulation for all larger pipes.
 - .2 Sanitary drainage piping to be insulated:
 - .1 All piping passing through high humidity areas
- 3.1.12. Ductwork and Equipment
- .1 Ductwork and equipment internal to the building within conditioned spaces shall have 25 mm (1 in.) thick rigid glass fibre duct insulation with vapour barrier. In conditioned concealed spaces and on round duct smaller than 600 mm (24 in.) insulation may be 38mm (1-1/2 in.) flexible type with vapour barrier. Flexible duct connections do not require insulation except where a factory applied insulation has been specified with the flexible duct connection.
 - .2 Butt join insulation and attach with pins and speed washers, one per 0.186 sq.m. (2 sq.ft.), but not more than 450 mm (18 in.) apart in any direction. Apply fire resistive adhesive in 100 mm (4 in.) wide strips on 300 mm (12 in.) centres. Seal all joints with adhesive and apply vapour barrier tape. Install pins of suitable length for the thickness of insulation and clip flush after final installation of washers. Tack weld pins to sheet metal.
 - .3 Insulation Contractor shall coordinate with sheet metal contractor to ensure duct insulation is applied prior to ductwork being installed to underside of slabs, beams or other services or behind other duct risers and shafts.
- 3.1.13. Insulate the following ductwork and equipment:
- .1 All supply ductwork from fans to VAV box for variable volume systems and all supply ductwork on constant volume systems.

3.1.14. TABLE 1: MINIMUM PIPE INSULATION THICKNESS/PERFORMANCE (BASED ON ASHRAE 90.1 AND MODEL NATIONAL ENERGY CODE FOR BUILDINGS)

3.1.15. Minimum Pipe Insulation - mm (in.)

.1 Domestic Hot Water Systems^c

Fluid Design Operating Temp. range deg. C. (deg. F.)	Insulation Conductivity [W(m-K)] [h-cu.ft. - deg. F. (Btu-in.)]	Mean Rating Temp deg. C. (deg. F.)	Nominal Pipe Diameter - mm (in.)					
			Runouts ^b Up to 32 (1-1/4)	Less than 25 (1)	25-32 (1 to 1- 1/4)	38-75 (1-1/2 to 3)	100- 150 (4- 6)	200 (8) and up
41-60 (105 -140)	0.040 (0.28)	38 (100)	25 (1.0)	25 (1.0)	25 (1.0)	38 (1.5)	38 (1.5)	38 (1.5)

^c Applies to recirculating sections of service or domestic hot water systems and first 2.4 m (8 ft.) from storage tank for non-recirculating systems.

END OF SECTION

21 13 00.00
Sprinkler Systems

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Sprinkler system shall conform to applicable NFPA Standards and to all authorities' requirements.

• DESCRIPTION OF SYSTEM

- 1.1.3. The sprinkler systems shall be wet type as shown, consisting of distribution and interconnecting piping, sprinkler heads, hangers and all necessary equipment to provide a complete sprinkler system ready for immediate operation.

1.2. DENSITY AND AREA REQUIREMENTS

- 1.2.1. The following minimum density and area requirements shall be the basis of the hydraulic design. Any request for modifying the density requirement shall be submitted by the Contractor for review by the Engineer's Representative.

Location Served	Hazard	Density L/m/sq. m. (gpm/sq. ft)	Area Sq. m. (sq. ft)	Remarks
Office Areas	Light	4.1 (0.10)	139.5 (1500)	Wet Type. Loop main shall have the capacity to serve 5 additional sprinkler heads at the most remote 139.5 sq.m. (1500 sq.ft.) area of application.
Lobby, suite and amenity space	Light	4.1 (0.10)	139.5 (1500)	Wet Type. Loop main shall have the capacity to serve 5 additional sprinkler heads at the most remote 139.5 sq.m (1500 sq.ft.) area of application

1.3. SUBMITTALS

- 1.3.1. Shop Drawings: Submit sprinkler drawing layouts in accordance with Section 21 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS showing all component parts complete with Shop Drawings of all valves and accessories to I.A.O. (F.M.) and to the Engineer's Representative for review. These drawings shall be designed and bear the signed stamp of an engineer licensed to --practice in the appropriate discipline and in the Place of Work. The Contractor's design Engineer shall provide periodic review in accordance with all applicable requirements of their licence and shall sign and seal an occupancy letter indicating the installation is in conformance with their design.
- .1 Clearly indicate on sprinkler layout drawings the location of all drain connections.
 - .2 Prepare complete sprinkler layout drawings, arranging piping runs and sprinkler heads in proper relation with bus ducts, air conditioning ducts, piping, etc., and to ensure clear ceiling heights indicated on the drawings. Where piping occurs in ceiling spaces, keep piping above level of top of lighting fixtures.
- 1.3.2. Submit hydraulic calculations in approved formats.

1.4. QUALIFICATIONS .

- 1.4.1. The installation company shall be a member of the Canadian Sprinkler Association and regularly engaged in this work.

2. Products

2.1. MATERIALS

- 2.1.1. General:
- .1 All components used in the sprinkler system shall be ULC Listed and FM Approved. UL Listed and/or FM Approved equipment not bearing a ULC listing shall only be acceptable if written approval from the local authority is obtained.
 - .2 All components used in the sprinkler system shall be manufactured in Canada or USA, whenever available.
- 2.1.2. Pipe and fittings less than 1206 kPa (175 psi) working pressure shall be as follows:
- .1 Pipe, black steel, Schedule 40, ASTM A53.
 - .2 Fittings for a minimum of 1206 kPa (175 psi) working pressure, 1035 kPa (150 psi) malleable iron ASME B16.3, 860 kPa (125 psi) cast iron ASME B16.4, butt welding schedule 40 ASME B16.25, or roll grooved Victaulic, Viking Anvil-Gruvlok or Tyco/JCI Grinnell.
 - .3 Acceptable valve manufacturers:
 - .1 Viking Nibco
 - .2 Viking Gruvlok
 - .3 MA Stewart W Series
 - .4 Victaulic
 - .5 Tyco Grinnell
 - .4 All grooved products including couplings, fittings and valves shall be of one manufacturer.

- .5 Provide fittings with grooved connections at all legs of the fitting or couplings equal to Victaulic 920, Tyco/Grinnell Figure 730, or Gruvlok Figure 7045 Clamp-T. Fittings and couplings that are not acceptable are ones equal to Victaulic 921, Tyco/Central Sprinkler Strap 40-5, or Gruvlok Figure 7045 U-bolt.

- 2.1.3. No grooved fittings or products shall be used except for those specified. All grooved products shall be of one manufacturer.
- 2.1.4. Sprinkler heads shall be the automatic spray type, ULC listed and as approved by I.A.O. or F.M. as applicable. Where heads are located close to heating coils, unit heaters or other hot equipment, they shall be of the high temperature type to suit regulations.
- 2.1.5. Unless otherwise specified, hangers shall conform to the requirements of NFPA 13.

3. Execution

3.1. INSTALLATION

- 3.1.1. Spacing of sprinklers shall suit the hazard of the occupancy shown. Where specific locations of sprinkler heads have been shown on Drawings, these shall be maintained. Sizing of piping shall be based on hydraulic design. Submit all calculations to the city, the Owner's Insurers and the Engineer's Representative for review. The calculations shall be designed and bear the signed stamp the engineer.
- 3.1.2. Installation shall conform to all applicable codes.
- 3.1.3. Review all other Sections of the Specifications and include for all work that may affect this section. Pay particular attention to the requirements for valve tags and identification.
- 3.1.4. Fully coordinate the sprinkler piping with that of other trades on the job. Mains and branches shall be run so as not to interfere with the building's structure, electrical, plumbing, ventilation and heating installations. Sprinkler heads shall be located in the centre and/or quarter points of ceiling tile as shown on the reflected installation of additional sprinkler heads.
- 3.1.5. In all office areas, any additional sprinkler heads added to the floor because of increased requirements, shall be piped directly from the loop main.

3.2. TESTING OF SYSTEM

- 3.2.1. All testing shall be executed in accordance with the latest regulations of NFPA 13 and with any other regulations that the authoritative inspector demands.
- 3.2.2. Testing shall include the flushing and cleaning of the entire system.

END OF SECTION

22 05 76.00
Cleanouts

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
 - 2.1. MATERIALS
 - 2.2. FINISHED AREAS
 - 2.2.1. Cleanouts in finished areas with membrane floors shall be coated cast iron body with adjustable nickel bronze frame and round scoriated gas tight access cover with secondary gas tight plug. J.R. Smith 4020-F-C, Zurn ZN 1400-KC, Mifab C1100C-R-1-34, Watts CO-100-C-R-1-34G.
 - 2.2.2. Cleanouts with recess for terrazzo shall be similar to cleanouts in finished areas with membrane floors but shall have terrazzo recess. J.R. Smith 4180-F-C, Zurn ZN 1400-Z-KC, Mifab C1100C-UR-1-34, Watts CO-100-C-R-1-34G.
 - 2.2.3. Cleanouts with recess for tile shall be similar to cleanouts in finished areas with membrane floors but shall have 3 mm (1/8 in.) tile recess. J.R. Smith 4140-F-C, Zurn ZN 1400-X-KC, Mifab C1100C-UR-1-34, Watts CO-100-C-R-1-34G.
 - 2.2.4. Cleanouts for carpeted areas shall be similar to cleanouts in finished areas but shall have stamped stainless steel carpet marker. J.R. Smith 4020-Y, Zurn ZN 1400-CM, Mifab C1100-RC-1-34, Watts CO-100-C-R-1-34G.
 - 2.3. NON-FINISHED AREAS
 - 2.3.1. Cleanouts in non-finished areas shall be all coated cast iron body with heavy duty cast iron or ductile iron top. J.R. Smith 4220-F-C, Zurn Z-1400-KC, Mifab C1100-XR-4-34, Watts CO-100-C-R-1-34G.
 - 2.3.2. Cleanouts at the base of each vertical stack and rain water leader shall be either Daisy or Barrett type.
3. Execution
 - 3.1. INSTALLATION
 - 3.1.1. Cleanouts in furred ceiling spaces shall extend up through floor slab above, except where the Engineer's Representative gives specific approval to its location in the ceiling space.
 - 3.1.2. Cleanouts shall be installed in horizontal drains at each change of direction and as required.

22 11 13.00
Pipes, Valves and Fittings (Plumbing System)

1. The General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Pipes and fittings shall be in accordance with the following unless specified otherwise by local authorities.
 - 2.1.2. All valves on potable water systems shall be equal in performance to the models specified, shall be lead free or low lead meeting the requirements of CSA B125.3, CSA B125.14, ANSI 372/NSF-61, ANSI/NSF-14, and/or ANSI/AWWA C550 as applicable
 - 2.1.3. All city and domestic water, above grade, 75 mm (3 in.) and smaller, less than 1380 kPa (200 psi) working pressure:
 - .1 Pipe: Copper Tubing, Type "L", Hard Drawn, ASTM B88. Fittings: wrought copper solder joint pressure fittings, ANSI/ASME B16.22 or cast copper alloy solder joint pressure fittings, ANSI/ASME B16.18.
 - .2 Joints made with 95-5 tin antimony, 96-6 tin silver, or 96-4 tin silver solder, ASTM B32.
 - .3 Grooved end copper fittings conforming to ASTM B75/B75M-11.
 - .4 Drain valves and blow-off valves shall be 4137 kPa (600 psi) WG 19 mm (3/4 in.) ball valves with lead free, bronze body or forged brass body, solid ball, male threaded garden hose end, brass cap and chain equal to Watts B-6000, Toyo 5046-LF, Kitz 868C or Apollo 78-100.
 - 2.1.4. All domestic water above grade 75 mm (3 in.) and smaller, over 1380 kPa (200 psi) working pressure and under 2070 kPa (300 psi) working pressure:
 - 2.1.5. Sanitary drains and vents above grade shall be cast iron or copper pipe installed as in regulations, except where copper pipe is used, joints to be made with 95-5 solder. ABS, asbestos cement (Transite) and PVC pipes are not acceptable.
 - 2.1.6. Ball valves 50 mm (2 in.) and smaller shall be lead free, bronze body or forged brass 4137 kPa (600 psi) WOG, virgin Teflon seat, TFE stem packing and thrust washer, 1/4 turn open-closed operation with solid ball. Ball valves shall be Watts No. B-6000, Toyo 5044A-LF/5049A-LF, Kitz 858/859 or Apollo 70-100/200. Stem extensions shall be provided on all ball valves. Ball valves may be substituted for gate valves only.

2.1.7. Except where special feature are required or unless otherwise approved or noted, all valves shall be of one manufacturer with the manufacturer's name and the pressure rating clearly marked on the outside of the valve body. Valves shall be manufactured by Crane, Jenkins, Toyo or Kitz. Butterfly valves shall be by Keystone, DeZurik, Bray, Challenger, Centerline, Crane, Apollo, Kitz or Victaulic. Non-slam check valves shall be Pro-Quip, Duo CHEK II, Centerline, Mueller or Victaulic. Ball valves shall be Apollo, Watts, Toyo or Kitz. Valves shall be equal to the model numbers specified. .

2.1.8. Water meters located in service rooms or ceiling spaces shall be Neptune model T-10 disc type complete with Pulser RM visual remote read-out. Read-out to be located in base building janitor closet or riser room. Meter shall be size 5/8 in. (0.7 to 7.0 usgpm) or 3/4 in. (7.0 to 15.0 usgpm).

3. Execution

3.1. INSTALLATION

- 3.1.1. Valves shall be provide as shown and as required for the satisfactory operation and control of all equipment and shall be installed to enable each piece of equipment to be isolated.
- 3.1.2. Isolation valves shall be installed at the base of each riser and at each branch take-off. Where the equipment is to be isolated within easy view of and not more than 6000 mm (20 ft.) from the main, at the branch take-off, then the branch take-off valve may serve as the equipment isolating valve.
- 3.1.3. Drain valves shall be installed at each low point in the piping systems and at each tank.
- 3.1.4. Blow-off valves shall be provided on each 65 mm (2-1/2 in.) strainer and larger.
- 3.1.5. Globe valves shall be installed as shown and in each bypass.
- 3.1.6. Install reduced pressure backflow preventers where recommended by CSA B64 and in the following locations:
 - .1 Where shown on the Drawings
 - .2 As requested by the Authority having Jurisdiction
- 3.1.7. Check valves shall be installed as shown and where required to prevent backflow.
- 3.1.8. Connections between copper and steel pipe shall be made with brass or bronze fittings where other type of connection is not specified in regulations.
- 3.1.9. All piping shall run parallel with closest wall.
- 3.1.10. Piping in walk-in pipe spaces shall be installed as close to one wall as possible.
- 3.1.11. Each water hammer arrester shall be accessible for service and replacement. They shall be installed in compliance with the recommendations of the Plumbing and Drainage Institute as found in Standard PD1-WH201.
- 3.1.12. Slope all drains and vents in accordance with the plumbing code but not less than the minimum slopes shown on the drawings. Slope all water lines 25 mm in 12 m (1 in. in 40 ft.) unless shown otherwise.

GOLDRING STUDENT CENTER
150 CHARLES ST. W.,
TORONTO, ON
Project Number: **23501.003.M.001**

Section 22 11 13.00
Pipes, Valves and Fittings (Plumbing System)

- 3.1.13. Vent stack covers shall be properly sized for each vent penetrating the roof.
Division 23 shall supply vent stack covers for installation and flashing by the roofing contractor.

END OF SECTION

22 42 00.00
Fixtures and Trim

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. SUBMITTALS
 - 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Plumbing fixtures shall be as indicated and specified with all required supports, accessories, drainage, vent and water connections to make the fixtures complete.
 - 2.1.2. Fittings that supply water to a fixture shall not exceed the maximum flow rates in accordance with the following:
 - .1 Part 7 of the Building Code
 - 2.1.3. Fixtures shall be American Standard, Crane, Toto, Kohler, Franke, Zurn or Novanni, equivalent to the fixtures specified. American Standard – Eljer and Crane Placidus are not permitted. Fixtures shall be white.
 - 2.1.4. Fittings and trim shall be American Standard, Crane, Kohler, Sloan, Chicago Faucets, Zurn, Moen, Symmons, or Delta/Cambridge except where specified otherwise. All exposed valves, fittings, escutcheons, trim, etc., at each fixture shall be polished chrome plated brass, unless specified otherwise.
 - 2.1.5. Provide Fixtures and Trim equal to product specification sheets. This should be used when the ats style product specification sheets are used.
 - 2.2. GENERAL SINK UNITS
 - 2.2.1. Sinks shown as 'S-1' – Kohler Vault K-3840-3-NA Stainless steel undermount sink.
 - .1 Faucet for sink unit above shall be Elkay LKAV7051FLS – Elkay Avado Single Hole 2-in-1 Kitchen Faucet with Filtered Drinking Water Lustrous Steel
 - 2.2.2. Sinks shown as 'S-2' – Kohler Undertone K-3333-NA Stainless steel undermount sink.
 - .1 Faucet for sink unit above shall be Elkay LKAV7051FLS – Elkay Avado Single Hole 2-in-1 Kitchen Faucet with Filtered Drinking Water Lustrous Steel
 - 2.2.3. "P" trap for all sink units shall cast brass 38 mm (1½ in.) with union, cleanout, and escutcheon, Delta Commercial 33T360, McGuire 8912C, or Zurn Z8702BD-PC.

- 2.2.4. Supplies for all sink units shall be a pair of chrome plated, heavy pattern angle lavatory supplies, lockshield, screw driver slot, stuffing box cartridge, 3/8 in. IPS brass inlet supply nipple, flexible braided stainless steel risers, and stainless steel wall flange. Delta Commercial 47P2512SD, McGuire H165LKN5RB, Zurn ZH-8820-LR-LK-PC-3.

3. Execution

3.1. INSTALLATION

- 3.1.1. Provide necessary plates, brackets, cleats, supports, etc, for rigidly securing fixtures in place. Accurately lay out all roughing piping, avoiding offsets.
- 3.1.2. Examine fixtures for defects. Remove and replace any fixture which, in the opinion of the Engineer's Representative, is damaged. Make necessary adjustments to ensure fixtures function as per manufacturer's operating criteria. Clean and polish all fixtures and trim upon completion.
- 3.1.3. Ensure wall-mounted fixtures with back water connections have an adjacent access door, unless the pipe space is sufficiently wide to allow the water connection to be made from within the pipe space. For this, pipe space shall be 600 mm (24 in.) minimum clear width.
- 3.1.4. Fixtures shall be installed symmetrical with wall tile pattern, unless otherwise dimensioned or shown on Architectural Drawings.

END OF SECTION

23 05 93.23
Testing and Balancing Air Systems

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.1.2. This Section is split into two Sections of work, the Contractors testing and balancing and the Independent Company's testing and balancing.
 - 1.2. INDEPENDENT TESTING AND BALANCING COMPANY PROCUREMENT
 - 1.2.1. The cost for the Independent Company's testing and balancing scope of work shall be paid for under the Allowance Section.
 - 1.2.2. The Mechanical Contractor shall administer and obtain bids from the acceptable Independent Companies and shall submit unopened bids for review and selection by the Engineer's Representative or Owner within 20 days from award of the Mechanical Contract.
 - 1.3. QUALITY ASSURANCE
 - 1.3.1. Balancing companies shall be members of A.A.B.C. or N.E.B.B.
 - 1.3.2. Acceptable balancing companies are limited to the following:
 - .1 Ace Commercial Air Test & Balancing
2. Products
 - 2.1. NOT USED
3. Execution
 - 3.1. GENERAL
 - 3.1.1. Sample of a Test Verification Sheet is provide at the end of the Section and this sheet or a similar one with all pertinent information is to be filled out for all tests called for in the Specification or required by code. The sheets shall be signed by the Contractor and the Independent Company to verify that the data recorded is correct.
 - 3.1.2. The following systems shall be tested and balanced:
 - .1 Air distribution (supply, return and exhaust)
 - 3.1.3. The Contractor shall provide a schedule for all testing and balancing.

3.2. THE CONTRACTORS TESTING AND BALANCING

- 3.2.1. All tests for systems shall be performed in the presence of, and test reports signed by, the Independent Company. Notify the Independent Company in writing a minimum of one week in advance of testing.
- 3.2.2. Co-ordinate with the Independent Company to ensure all necessary manual dampers and splitter dampers for balancing the systems are installed. Notify the Engineer's Representative in writing that this co-ordination has taken place before installation begins. If this Contractor fails to co-ordinate with the Independent Company and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the Contractor at no cost to the Owner.
- 3.2.3. Ensure access is provided to all fire dampers and equipment that requires servicing.
- 3.2.4. The Contractor is responsible for all equipment operating to design conditions and shall change fan sheaves, etc., to provide the required conditions, but is not responsible for balancing the system.
- 3.2.5. The Contractor shall make available staff, as required by the Independent Company, to correct any deficiencies in the mechanical systems which prevent the Independent Company from balancing the system.
- 3.2.6. The Contractor shall provide copies of all Shop Drawings requested by the Independent Company.
- 3.2.7. The Contractor will provide new filters, etc. required for the measurements. Costs of filters shall be paid for.

3.3. THE INDEPENDENT COMPANY'S TESTING AND BALANCING

- 3.3.1. Co-ordinate with the Contractor to ensure that all necessary manual and splitter dampers for balancing are installed in all locations required. Notify the Engineer's Representative in writing that this co-ordination has taken place. Include in this letter any recommendations made regarding dampers, locations, installation, etc. If this Independent Company fails to co-ordinate with the Contractor and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the Independent Company at no cost to the Owners.
- 3.3.2. The Independent Company shall balance the entire air systems including air volumes and control settings under maximum system pressure drop conditions (filter at replacement condition).
- 3.3.3. The Independent Company will measure, make final adjustments and report upon the air volume at each variable volume box, diffusers, register and grille. The static pressure upstream and downstream of the fan, the fan speed and the motor current.
- 3.3.4. Report upon are the air flow at outside, return and exhaust air dampers under conditions of minimum outside air, for maximum and minimum volumes and maximum outside air, exhaust air and return air.
- 3.3.5. Air volumes measured by the Independent Company shall be within plus or minus 5% of those shown on Drawings for diffusers, grilles, registers, variable air volume boxes and fans, at both maximum and minimum volumes shown.
- .1 Duct traverse readings shall be taken through the access ports provided. Where no access ports have been provided new holes shall be made as required. These holes shall be resealed after final readings with sheet metal cover plates and sealant. Duct tape is not acceptable.

- .2 Where insulation is damaged it shall be repaired including the vapour barrier in an approved manner. Duct tape is not acceptable.
- 3.3.6. The Independent Company shall not disconnect any control device. Command control devices and enter adjusted set points into the building automation system with tools and training that are furnished under Section 23 09 00.00 - BUILDING AUTOMATION SYSTEM. If the Independent Company fails to co-ordinate with Section 23 09 00.00 - BUILDING AUTOMATION SYSTEM and if failure to co-ordinate results in any cost, the cost of any change required shall be paid by the Independent Company at no cost to the Owner.
- 3.3.7. In all cases where measurements by the Independent Company show failure to comply with the Drawings and Specifications, the Contractor shall change fan sheaves, etc., as required, and new balancing measurements shall be made by the Independent Company.
- 3.3.8. Ensure all thermostats and controls are set to give specified conditions and include settings is report.
- 3.3.9. For additional information on variable volume boxes refer to Section 23 36 16.00 - VARIABLE VOLUME BOXES.
- 3.3.10. The Independent Company shall witness all system tests and sign all test reports. Include one copy of all test reports in each copy of the balancing reports.
- 3.3.11. Fans on all systems shall be set up to give the minimum discharge pressure required to overcome the resistance of the box, discharge ductwork and diffusers.
- 3.3.12. The Independent Company is responsible for balancing the systems to obtain the design conditions and shall repeat the balancing until the required conditions have been met.
- 3.3.13. At the time of final inspection, recheck in the presence of the Engineer's Representative random selections of air quantities and fan data recorded in the certified report. Points or areas for recheck shall be selected by the Engineer's Representative and be approximately 10% of the report data.
- 3.3.14. At the time of verification measure space temperature and humidity in a representative number of rooms to verify performance. Tabulate these results and bind into certified report as an appendix.
- .1 A measured flow deviation of more than 10% between the verification reading and the reported data shall be considered as failing the verification procedure.
- 3.3.15. Following final acceptance of the certified reports by the Engineer's Representative, permanently mark the settings of all valves, dampers, splitters and other adjustable devices so that balance set position can be restored if disturbed at any time. Do not mark such devices until after final acceptance.

END OF SECTION

23 31 13.00
Ductwork and Specialties

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. SUBMITTALS
 - 1.2.1. Shop Drawings
 - .1 Submit Shop Drawings of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.
 - .2 Submit Shop Drawings of each supporting structural assembly required in the ductwork systems, designed by an engineer licensed to practice in the place of work in the appropriate discipline. Same design engineer stamps each and every Shop Drawing.
 - 1.2.2. Samples: Submit samples as required.
 - 1.2.3. Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.
 - .1
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Fabricate all ductwork unless specifically noted otherwise, of galvanized sheet steel with Z180 coating to A653/A653M-98.
 - 2.1.2. Sealing compound: Minnesota Mining and Manufacturing or other approved manufacturer. Duct tape shall be Duro-Dyne or other approved manufacturer.
 - 2.1.3. Flexible ducting:
 - .1 Flexible metal ducting shall be Flexmaster Triple-Lock Aluminum Flexible ducting T/L. ULC listing S110
 - 2.1.4. Access Ports shall be Lawson-Taylor or other approved manufacture of 32 mm (1-1/4 in.) dia. ports.
 - 2.1.5. Flexible Connections:
 - .1 Ventfabrics, Duro Dyne or Dyne-Air.
 - 2.1.6. Dampers:
 - .1 Dampers: For right angle branch duct take-off from vertical riser; Air vector Vectrol or other approved manufacturer.
 - .2 Fire Dampers: Underwriters' Laboratories Classified to ANSI/UL 555 Standard for Fire Dampers and CAN/ULC S112 Standard Method of Fire Test of Fire Damper Assemblies or ANSI/UL 555C Standard for Ceiling Dampers as applicable.

- .1 Fire dampers shall be curtain type, rated as 'Dynamic', and shall have the blades clear of the air stream. Fire dampers shall be Type B or Type C as required to suit system air velocity and pressure. Fire dampers in return and exhaust systems may be Type A with the blades in the air stream where permitted by the Engineer's Representative. Dampers shall be multi-sectional as required to suit size and UL/ULC Listing requirements. Where the specified curtain fire dampers are limited by the UL/ULC Listing for maximum size, they shall be substituted with multi-blade type complete with power actuation and/or fusible link as required to satisfy the fire rating of the partition.
- .2 Fire-stop flaps or ceiling mounted fire dampers shall be as shown in the Underwriters' Laboratories Listing for the specific ceiling assembly used.
- .3 Fabricate manual duct dampers as shown on Standard Details from galvanized steel 1.26 mm thick (0.048 in - 18 GSG gauge) or heavier. Dampers for ducts up to 300 mm (12 in.) deep shall be one blade carried on a 9 mm (3/8 in.) square steel rod mounted inside the duct. Dampers for ducts of greater depth than 300 mm (12 in.) shall be multi-blade, opposed-acting type, and shall have blades mounted in 38 mm (1-1/2 in.) steel channel frame, and interconnected for operation from one locking type hand quadrant. Dampers for right angle take-off of branch from vertical riser shall have operator extended to an accessible location. For externally insulated ducts, mount quadrant on a bracket, designed to clear the insulation. All dampers shall have indicator to show position of damper blade.
- .4 Fabricate splitter dampers as shown on Standard Details from at least the same thickness of galvanized steel as the duct in which it is installed, down to a minimum of 0.95 mm thick (0.0374 in - 20 GSG gauge). Fabricate of double thickness so that the entering edge presents a round nose to the air flow, and mount securely on hinges at the air leaving edge. Length of splitter shall be at least 1-1/2 times the width of the smaller branch duct, but in no case less than 300 mm (12 in.) long. Attach splitter hinge near the air entering edge with support passing through a clamp on the side of the duct, located where it is most accessible for external adjustment and locking of the damper.
- .5 Gravity backdraft dampers shall be multi-blade louver type, constructed of light grade aluminum. Blades shall be joined with a tie bar and have rust-proof shafts rotating in bronze bushings.
- .6 Motorized dampers for Control Operation: In accordance with applicable requirements control systems (pneumatic) or central energy management systems section.
- 2.1.7. Acoustic Insulation: 25 mm (1 in.) thick rigid coated glass fibre.
- 2.1.8. Interior Duct Protective Coating: Chlorinated rubber base paint or Eisenheiss Black.
- 2.1.9. Hardware and Accessories:
 - .1 Spin-in connections shall be specifically built for that purpose. Dampers shall be a minimum 1 gauge heavier than the ductwork in which it is installed and shall have a full length shaft pivoted at two diametrically opposed points. An indicator shall be attached to the shaft to indicate the damper position.
 - .2 Hardware for balancing or splitter dampers shall be rattle-free and leak resistant. Bearing rods shall be sized to suit the damper size. Neoprene seals shall be used to minimize leaks. Hardware shall be Dyn-Air or equal.
 - .3 Turning vanes shall be either double thickness or single thickness with extended leading and trailing edges as specified in ASHRAE and SMACNA Standards. Rails shall be securely set in the elbow so that they cannot loosen. Turning vanes shall be Dyn-Air or equal.
- 2.1.10. Provide following duct penetrations with barred duct inserts to restrict passage for minimum and maximum security applications:

2.2. FABRICATION

- 2.2.1. Fabricate ductwork in accordance with applicable duct construction requirements of SMACNA.

3. Execution

3.1. INSTALLATION

- 3.1.1. Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.
- 3.1.2. Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.
- 3.1.3. Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.
- 3.1.4. Hang all ductwork securely and in a rigid manner. Provide hangers as follows:

TABLE 1: HANGERS

DUCT DIMENSION	HANGER CONSTRUCTION
Horizontal rectangular duct	
Up to 1500 mm (60 in.) for Low Pressure Ductwork Only	Two 25 mm (1 in.) x 16 US gauge straps with two screws on side of duct one screw on bottom. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
For all sizes of Medium and High Pressure Ductwork up to 3000 mm (120 in.) and Low Pressure Ductwork from 1525 mm to 3000 mm (61 in. x 120 in.)	50 mm x 50 mm x 6 mm (2 in. x 2 in. x 1/4 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
Horizontal round duct	
Up to 450 mm (18 in.)	One 25 mm (1 in.) x 16 US gauge hanger ring supported from one 25 mm (1 in.) x 16 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.

- 3.1.5. The following low pressure, medium pressure and high pressure duct construction is based on an ASHRAE method of construction, and gives a minimum standard of construction. Alternative ASHRAE or SMACNA duct construction is acceptable, provided it meets the minimum standards as outlined by these Specifications. Submit proposed alternatives for review prior to fabrication.
- 3.1.6. Construct low pressure rectangular ducts for systems less than 0.5 kPa (2 in.) static pressure and under 10.2 m/s (2000 fpm) velocity as follows:

TABLE 2: LOW PRESSURE DUCT CONSTRUCTION

MAX. DUCT DIMENSION	SHEET METAL US GAUGE	TRANSVERSE JOINT CONNECTION AND BRACING
Up to 300 mm (12 in.)	26	Flat drive or flat 'S' no bracing
325 mm to 425 mm (13 in. to 18 in.)	24	Flat drive or flat 'S' no bracing

- .1 Bracing spacing shown is maximum spacing between two bracings or between bracing and joint.
 - .2 Locate bracings mid-way between joints.
 - .3 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.
- 3.1.7. Medium pressure rectangular ducts are required for all smoke exhaust systems and in the following areas. Construct medium pressure rectangular ducts as follows:

TABLE 3: MEDIUM PRESSURE RECTANGULAR DUCT CONSTRUCTION

MAX. DUCT DIMENSION	SHEET METAL US GAUGE	TRANSVERSE JOINT CONNECTION & BRACING
Up to 300 mm (12 in.)	24	25 mm (1 in.) standing seam, 16 mm (5/8 in.) welded flange 25 mm (1 in.) pocket lock, no bracing.
325 mm to 425 mm (13 in. to 18 in.)	24	25 mm (1 in.) standing seam, 22 mm (7/8 in.) welded flange, 25 mm (1 in.) pocket lock, bracing 25 mm x 25 mm x 16 gauge (1 in. x 1 in. x 16 UG gauge) at 1200 mm (48 in.) centres.

- .1 Bracing spacing shown above is maximum spacing between two bracings or between bracing and joint. Locate bracing mid-way between joints.
 - .2 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.
- 3.1.8. Medium and high pressure round ducts are required in the following areas .
Medium and high pressure round ducts up to 750 mm (30 in.) dia. shall be factory fabricated, helically wound galvanized iron strips with spiral lock seam as follows:

TABLE 4: MEDIUM AND HIGH PRESSURE ROUND DUCT CONSTRUCTION

DIAMETER	STRIP METAL US GAUGE	STRIP JOINT	GIRTH JOINT
Up to 200 mm (8 in.)	26	100 mm (4 in.)	50 mm (2 in.) long slip
225 mm to 550 mm (9 in. to 22 in.)	24	100 mm (4 in.)	50 mm (2 in.) long slip

- 3.1.9. Join with galvanized iron coupling sleeves or conduit fittings of welded construction.

- 3.1.10. Construct larger ductwork as follows with longitudinal lock or butt welded seams:

US GAUGE	SHEET METAL US GAUGE	REINFORCING	GIRTH JOINT
775 mm to 900 mm (31 in. to 36 in.)	20	None	100 mm (4 in.) long slip

- 3.1.11. High pressure rectangular ductwork is required in the following areas .
Construct high pressure rectangular ducts as follows:

Seal all joint of all ducts. Brush joints with the compound before and again after assembly.

- 3.1.12. Seal the bottom and side joints of outside air ducts or plenums water-tight.
- 3.1.13. Flexible duct shall be connected to sheet metal duct and diffusers using duct sealer, minimum of two screws separated by 180 degrees and metal draw bands. Duct tape is not acceptable.
- 3.1.14. Flexible ductwork may be used under the following conditions:
 - .1 Flexible ductwork shall be used where shown to allow easy location of diffusers.
 - .2 Minimum length of flexible duct used to connect diffusers and interior troffers shall be 2,400 mm (84 inches).
 - .3 Maximum length of flexible duct shall be 3,000 mm (120 inches).
 - .4 Flexible ductwork shall not pass through floors or fire walls,
 - .5 Flexible ductwork shall be a single section of duct (no joints). In the event that building construction requires connection between lengths of flexible duct use a rigid section of duct as the joint. Flexible duct shall be secure to the rigid section using ties and sealant.
 - .6 Flexible duct lengths greater than 2,400 mm (84 inches) shall be supported at the midpoint with strap hangers.
- 3.1.15. Where ductwork passes through a wall or floor, other than when a fire damper is required, pack around the duct using a fire resistant material to ensure a sound and airtight joint.
- 3.1.16. If changes of size of ducts are necessary because of building construction, maintain the same circular equivalent for the new size. Ratio of the longest side of the duct to the least shall not exceed 4 to 1 unless specifically authorized by the Engineer's Representative.
- 3.1.17. Select the gauge of metal and method of construction for the new size. Notify the Engineer's Representative of any change before such changes are incorporated into the work.
- 3.1.18. If changes of location of duct, are required because of building construction, review with the Engineer's Representative before the locations indicated are changed in any way.
- 3.1.19. Make changes of direction of horizontal ducts with elbows having an inside radius not less than 3/4 the width of the duct. Make change of direction from horizontal to vertical duct with elbows having an inside radius equal to the depth of the duct. Where this is not possible due to the building construction, use turning vanes.
- 3.1.20. Provide access ports at convenient locations in all main ducts and main branch take-offs with airtight covers and extension sleeves through insulation to allow air meter readings. Access ports shall be approved by the Engineer's Representative and the testing company before installation.
- 3.1.21. Provide flexible connections at each air handling unit and fan duct connection.
- 3.1.22. Install manual duct dampers as shown on Standard Details. Ensure dampers for right angle take-off of branch from vertical riser have operator extended to an accessible location. Adjust quadrants to clear duct insulation.
- 3.1.23. Provide splitter dampers as shown on Standard Details.
- 3.1.24. Incorporate gravity backdraft dampers where shown.

- 3.1.25. Install fire dampers where shown and at all penetrations through all fire rated assemblies. Where fire dampers are shown in grilles or diffusers at ceiling level they shall be firestop flap. Obtain local authorities approvals for all damper locations and keep one set of marked-up prints on site. Approvals shall be obtained before installation of fire dampers.
- 3.1.26. Where fire dampers for ducts shown on Drawings require a change of type and/or powered actuation due to dimension limitations to satisfy the cUL Classification requirements, provide transitions as required to adjust duct dimensions while maintaining the equivalent circular duct diameter to avoid exceeding any specific listed maximum dimension. Where transitions are not possible or dimensions cannot be adjusted to avoid powered actuation, provide power from the closest available emergency power source as required. Review all conditions with the Engineer's Representative in advance of fabrication.
- 3.1.27. Receive automatic dampers from separate Section on site, and set in place under the supervision of the control manufacturer.
- 3.1.28. Provide access panels at all fire dampers, gravity dampers, motorized dampers, coils, heaters, humidifiers, fan bearings or similar equipment requiring occasional maintenance or inspection. Panels shall be 600 mm x 450 mm (24 in. x 18 in.) or full width of duct if less than 450 mm (18 in.) wide. Panels shall be of double wall construction and shall be internally insulated on insulated ducts. Frame shall be of structural angle with welded corners, gasketed to receive the panel. Panel shall be held in place with 4 window sash locks.
- 3.1.29. Paint visible internal surface behind each grille or register flat black.
- 3.1.30. Where duct is acoustically lined, duct dimensions shown are net, inside of lining.
- 3.1.31. Apply acoustic insulation internally to ductwork where shown. In addition, internally line all low or medium pressure supply air ductwork in mechanical rooms, fan rooms, or equipment rooms. For acoustic lining downstream of VAV boxes refer to Section 23 36 16.00 - VARIABLE VOLUME BOXES. Install using both pins and adhesive. Pins shall be maximum 450 mm (18 in.) centres and shall be tack welded to the duct or plenum. Seal all edges of acoustic insulation to prevent air erosion with sheet metal nosing that overlaps the insulation by 19 mm (3/4 in.) minimum.
- 3.1.32. Spin-in connections shall only be used downstream of variable volume boxes.
- 3.1.33. Ductwork shall be run parallel to the closest wall. Coordinate with piping and structural elements.
- 3.1.34. All open ends of ductwork that do not have a diffuser, grille or register shall have a protective screen mounted in a suitable frame to connect the screen securely to the duct, wall and floor as applicable. Where a duct terminates at a supply, return or exhaust air opening provided by other sections and located less than 2000mm (79 in.) Above the finished floor, the screen shall be installed and painted matte black and shall not be capable of passage of anything larger than a 15mm (1/2 in.) Sphere through the openings.
- 3.1.35. Supply air ductwork to variable volume boxes shall be rigid duct of size shown in schedules. If the length exceeds 3000 mm (10 ft.) or if there are 2-45 deg. elbows or 1-90 deg. elbow or more increase in supply air ductwork to the variable volume box one size. If the length exceeds 6000 mm (20 ft.) increase the duct by two sizes. Under no conditions shall be supply ductwork exceed 9000 mm (30 ft.) or have more than 3-90 deg. elbows or the equivalent.

END OF SECTION

23 34 53.00 Room Ventilators

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. SUBMITTALS
 - 1.2.1. Shop Drawings:
 - .1 Submit Shop Drawings of all room ventilators with catalogued components to be supplied. Include manufacturer's data sheets for, performance criteria, ratings, and physical dimensions and finishes.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Room ventilators shall be Penn Zephyr, Greenheck, Loren Cook Gemini, Soler & Palau or Twin City.
 - 2.1.2. Centrifugal fans shall be mounted in a galvanized steel, acoustically insulated housing and shall be internally isolated. Fans shall be AMCA certified for both air and sound, UL labelled and CSA approved.
 - 2.1.3. Arrange casing for in-line installation with access to both fan and motor through the casing.
 - 2.1.4. Inlet and discharge shall be flanged for duct connections.
 - 2.1.5. Discharge shall be complete with spring loaded backdraft damper.
 - 2.1.6. Motors shall be prewired to terminal box located on the unit housing.
 - 2.1.7. Motors shall be 120 volts, 1 phase.
 - 2.1.8. Speed control shall be Lek-Trol variable speed/off, solid state controller.
 - 2.1.9. All intake and discharge ductwork shall have 25 mm (1 in.) thick acoustic lining.
 - 2.1.10. Room ventilators shall be in accordance as per below:
EF-2.1 – Greenheck CSP-200, 200CFM, 0.5 in.wg., 120V/1Ph/60Hz. Complete with reverse acting thermostat.
3. Execution
 - 3.1. INSTALLATION
 - 3.1.1. Install room ventilators where shown.
 - 3.1.2. All ventilators on vibration isolation hangers shall have flexible connections on both inlet and outlet.
 - 3.1.3. Speed control switch to be supplied only. Electrical Division to include for wall mounting and wiring.

GOLDRING STUDENT CENTER

Section 23 34 53.00 Room

**150 CHARLES ST. W.,
TORONTO, ON**

Ventilators
Ductwork and Specialties

Project Number: **23501.003.M.001**

- 3.1.4. Where reverse acting thermostats are specified in the Drawings, thermostat to be supplied by the Mechanical Division, Electrical Division to include for wall mounted and wiring.

END OF SECTION

23 37 13.00
Diffusers, Grilles and Registers

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. None.
 - 1.3. SUBMITTALS
 - 1.3.1. Shop Drawings: Submit detailed Shop Drawings of all components furnished under this Section. Manufacturer to indicate ceiling installation type for each type of diffuser specified.
 - 1.3.2. Manufacturer's Data: Submit test results of type " "diffuser models to be used on the project, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Diffusers, registers and grilles shall be EH Price.
 - 2.1.2. Select all diffusers to provide uniform air coverage without overlap. Air velocity up to a height of 1800 mm (6 ft.) above the floor shall be 0.127 to 0.254 m/s (25 to 50 fpm).
 - 2.1.3. Noise generated by diffusers shall be such that room sound pressure level does not exceed noise criteria 32 with an 8 db room attenuation, the sound power level reference to 10 to -12 power watts.
 - 2.1.4. All volume and air pattern devices shall be fully adjustable from the face of the diffuser, register or grille.
 - 2.1.5. In T-bar ceilings, manufacturer shall coordinate diffuser compatibility with t-bar ceiling specified by the architectural division. Colour shall match colour of ceiling tile in lay-in ceilings. Diffusers to suit ceiling grid as required imperial or metric.
 - 2.1.6. Diffusers shall meet test requirements of A.S.H.R.A.E. Standard 36B-63, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63 and NC ratings shall be determined using an 8 db room attenuation factor

2.2. SQUARE SUPPLY DIFFUSERS

- 2.2.1. All diffusers shown as type "P" shall be steel square plaque diffuser 600 mm x 600 mm (24 in. x 24 in.) face size and shall be square, coned metal. Diffusers shall consist of a precision formed back cone of one piece seamless construction which shall incorporate a round (or square) inlet collar of sufficient length for connecting rigid or flexible duct as shown. An inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck. E.H. Price SPD.

2.3. LINEAR SUPPLY AND RETURN DIFFUSERS

- 2.3.1. All diffusers shown as type "T1" shall be T-bar plug-in, 1 slot diffuser modified with square ends to limit side spread, and of lengths shown. Diffuser shall be installed with manufacturer plenum to match the length of the diffuser shown. Provide diffuser with mounting clips to suit in continuous T-bar openings. Pattern controllers shall be split mid length to allow each half of diffuser shall be set for different throw patterns. Throw patterns shall be fully adjustable from vertical to horizontal and variations in between. Provide blank-off panels between diffusers. Pattern controllers and blank-off panels shall be finished matte black. Plenum shall be fabricated from coated steel. Refer to Architectural Details for installation of continuous supply air slot. Duct connection to diffuser shall be of sufficient height to allow for 175 mm (7 in.) clearance from ceiling to underside of duct. EH-Price TBD3 series, Nailor 5800, Krueger PTBA, Carnes DASC.

2.4. RETURN, EXHAUST AND TRANSFER GRILLES

- 2.4.1. Return grilles shown as type "E" shall be size as shown and shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick. Grilles shall be enclosed in a channel frame for inverted T-bar mounting or with a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system. Colour shall match adjacent ceiling tiles. E.H. Price Series 80, Nailor 5100 Series, Krueger EGC5 Series, Carnes RPAH.
- 2.4.2. Return registers shown as type "K" shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return. Key operated damper shall be mounted behind. General appearance, type of material and finish shall match the type "..." supply register. E.H. Price 530, Nailor 6100 Series, Krueger S80, Carnes model RSBAH.
- 2.4.3. Return registers shown as type "S" shall be linear slot return diffuser E.H. Price SDR150.

3. Execution

3.1. INSTALLATION

- 3.1.1. Refer to the architectural drawings for actual locations of diffusers, grilles and registers and install to suit these drawings. The mechanical drawings show intent and number of diffusers, grilles and registers required.

- 3.1.2. Provide transfer grilles in all finished spaces where air is transferred through a ceiling or partition.
- 3.1.3. For exposed ductwork installations, all connections to grilles shall be oversized and shall have in-turned flanges to meet the flange of the grilles and the duct. Out-turned or exposed flanges with screw mounting shall not be accepted.
- 3.1.4. For special mounting of diffusers, grilles and registers refer to Architectural Drawings.
- 3.1.5. Where rigid duct is connected to the diffuser, grille or register all devices used for flow pattern adjustment, flow balancing and flow equalizing shall be accessible from the face of the diffuser.
- 3.1.6. Install mounting frame tied into plaster and gypsum board ceilings to allow lay in type diffusers to rest on the frame.
- 3.1.7. Diffusers for installation in lay-in ceiling shall lay on inverted T-bars.
- 3.1.8. Contractor shall be responsible for mounting concealed flange linear diffusers in heated environment and following manufacturers' instructions.
- 3.1.9. Contractor shall caulk around edges of linear diffusers in installations with imperfect walls.

END OF SECTION

23 83 00.14 Electric Radiation Heaters

4. General

4.1. WORK INCLUDED

4.1.1. Conform to Section 20 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

5. Products

5.1. MATERIALS

5.1.1. Provide Electric Baseboard Heaters:

- .1 0.9525 mm thick (0.0375 in. – 20 MSG) steel, factory standard white powder painted, complete with end caps.
- .2 Built-in thermostat and controls, unless otherwise indicated on Drawings.
- .3 Acceptable manufacturers are Ouellet, Reznor, Dimplex, Stelpro, Chromalox or Indeeco.

5.1.2. Provide Electric Baseboard Heaters with capacities as shown on Drawings.

5.1.3. Provide Electric Baseboard Heaters with a single 120/1/60 electrical connection that powers all components including but not limited to:

- .1 Control panel
- .2 Safeties

6. Execution

6.1. INSTALLATION

6.1.1. Install in accordance with manufacturer's current installation guidelines.

END OF SECTION



Smith + Andersen

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ELECTRICAL SPECIFICATION

PROJECT NAME:

GOLDRING STUDENT CENTRE RENEWAL

OUR PROJECT NUMBER:

23501.003.E.001

DATE:

2024-02-02

ISSUED FOR:

TENDER

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END OF SECTION

26 01 00.00 Operating and Maintenance Instructions

1. General

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 03.00 – AS-BUILT DRAWINGS.
- 1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.4. Section 26 08 00.00 – COMMISSIONING.
- 1.1.5. Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

2. Products

2.1. NOT USED

3. Execution

3.1. REQUIREMENTS FOR MANUALS

- 3.1.1. A minimum of three copies of complete and approved operating and maintenance instructions for all electrical equipment and systems shall be supplied before substantial completion. Provide additional copies if required under the General Requirements. In addition to the three copies of manuals, the contractor to provide a manual in a searchable PDF format on USB stick or sent via electronic transfer. As-Built Drawings to be included on the USB stick or sent via electronic transfer.
- 3.1.2. The contractor to identify the cost of AS-BUILT DRAWINGS and the Operation and Maintenance Manuals as a separate line item on their progress draw. The values to be broken out can be found in Section 26 05 03.00 – AS-BUILT DRAWINGS. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received and reviewed without comments.
- 3.1.3. Binders shall be three-ring, hard-cover, loose-leaf type and identified on the binding edges as "Maintenance Instructions and Data Book", for "Goldring Student Centre Renewal."
- 3.1.4. Terminology used in all the sections shall be consistent.
- 3.1.5. Volume One shall contain the master index of all systems, the name of the Contractor, Electrical Subcontractors and the date of substantial performance for the Contract.
- 3.1.6. Volume One shall contain a section with all necessary warranty information.
- 3.1.7. Each binder shall have a complete index for all volumes.
- 3.1.8. Each binder shall be no more than half filled.
- 3.1.9. There shall be a separate section for all materials used on the project which fall under the WHMIS legislation. There shall be Material Safety Data Sheet (MSDS), hazard data sheet, for each of the materials.
- 3.1.10. There shall be a separate section for all Insurance Certificates, Test Certificates, Verification Forms and Test Forms.

- 3.1.11. All relevant information relating to a system or product shall be contained within one binder.
- 3.1.12. The manual sections shall follow the specification sections.
- 3.1.13. Any diagrams, installation drawings, single line diagrams charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved they shall be carefully folded and contained within a clear plastic wallet within the manual.
- 3.2. DATA FOR MANUALS
 - 3.2.1. Equipment data shall contain:
 - .1 Operating instructions.
 - .2 Operating conditions such as temperature and pressure.
 - .3 Location of equipment.
 - .4 Maintenance instructions and schedules for one-year routine.
 - .5 Recommended list of spare parts.
 - .6 Maintenance schedule.
 - .7 A trouble shooting table showing where to look for problems under various conditions of malfunction.
 - .8 All wiring diagrams.
 - .9 Equipment operating curves.
 - .10 Equipment nameplate data and serial numbers.
 - 3.2.2. System data shall contain:
 - .1 A listing of all systems.
 - .2 All panel, mcc and fire alarm schedules and locations.
 - .3 Equipment name tags.
 - .4 Cleaning, maintaining and preserving instructions for all material, products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.
 - 3.2.3. Sub-Contractor manuals are required for:
 - .1 Switchboards and power distribution systems.
 - .2 Lighting systems.
 - .3 Emergency power systems.
 - .4 Fire alarm systems.
 - 3.2.4. As-Built documentation shall contain:
 - .1 Reviewed As-Built Shop Drawings.
 - .2 As-Built Construction Drawings.
 - .3 Originals of test forms.
 - .4 Originals of test certificates.
 - .5 Cyber Security Report Letter and backup schedule as required by Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 3.3. OPERATING INSTRUCTIONS
 - 3.3.1. Instruct the Owner's representative in all aspects of the operation and maintenance of systems and equipment.

- 3.3.2. Where commissioning is a requirement of the project, the Contractor shall comply with all requirements of Section 26 08 00.00 – COMMISSIONING, for duration of tests.
- 3.3.3. Instruct the Owner for a minimum of five (5) working days.
- 3.3.4. All instruction sessions to be video-taped and copy must be provided to the Engineer's Representative/owner.
- 3.3.5. Arrange for and pay for the services of engineers and other manufacturers' representatives required for instruction on the systems and the equipment as requested by the Engineer's Representative and/or the Owner.
- 3.3.6. At the time of final review, provide a sheet for each system and piece of equipment showing the date instructions were given. Each sheet shall show the duration of instruction, name of persons receiving instruction, other persons present (manufacturer's representative, Engineer's Representative, etc.), system or equipment involved and signature of the Owner's staff stating that they understood the system installation, operating and maintenance requirements. This information shall be inserted in the manuals after all instructions have been completed.
- 3.3.7. Review information with the Owner's representative to ensure that all information required has been provided.
- 3.3.8. Electrical equipment and systems included in the instruction requirements, include but not limited to the following:
 - .1 Switchboards and related power distribution equipment.
 - .2 Emergency generator.
 - .3 Automatic transfer switches.
 - .4 Fire alarm systems.
- 3.4. TRIAL USAGE
 - 3.4.1. The Owner shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties nor be construed as acceptance, and no claim for damage shall be made against the Owner for any damage or breakage to any part or parts due to the tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or workpersonship of any kind.

END OF SECTION

26 05 01.00 General Instructions for Electrical Sections

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.

1.2. DESCRIPTION OF SECTION

- 1.2.1. The specification is divided into sections of work and a section may consist of the work of more than one subcontractor. The responsibility as to which electrical subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Electrical Contractor.

1.3. SECTIONS AFFECTED

- 1.3.1. These instructions apply to and form a part of all electrical sections.

1.4. SCOPE

- 1.4.1. Provide all labour, materials, equipment and services to complete the work of the electrical division as further specified and as shown on the drawings.
- 1.4.2. Should any discrepancy appear between any parts of the specifications and/or the drawings to cause doubt as to the true meaning and intent of the drawings and specifications, a ruling shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the following will be assumed:
- .1 Where a discrepancy occurs between the specification and the drawings, the more expensive/onerous alternative will be deemed as included in the contract.
 - .2 Where a discrepancy occurs in the drawings the more expensive/onerous alternative will be deemed as included in the contract.
 - .3 Where a discrepancy occurs in the specifications the more expensive/onerous alternative will be deemed as included in the contract.
- 1.4.3. For any equipment/device where circuit numbers and/or panel designation labels are missing and not indicated on the drawings or specifications, a clarification shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the Contractor shall power the equipment/device from the respective 120 V/208 V or 600 V electrical panel serving the equipment in that area at no additional cost to the Owner.
- 1.5. REGULATIONS
- 1.5.1. All work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of all authorities having jurisdiction except where the requirements of the drawings and specifications exceed the codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.
- 1.5.2. These specifications are supplementary to the requirements above.
- 1.5.3. Comply with all guidelines and standards issued by the authorities having jurisdiction.
- 1.5.4. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the contractor shall notify the Engineer's Representative.

1.6. PERMITS, FEES, AND REVIEWS

- 1.6.1. Make submissions to obtain all permits. Include for and pay for all fees and arrange for all reviews required for the work of this division.
- 1.6.2. If required by code, plans and specifications have been previously submitted to the Authority Having Jurisdiction.
- 1.6.3. Furnish certificates of Acceptance from the Authority Having Jurisdiction and include them in the Operation and Maintenance manual.

1.7. VOLTAGE RATINGS

- 1.7.1. Operating voltages are as specified in CAN3-C235 (latest edition).
- 1.7.2. Motors, electric heating, control and distribution devices and equipment are to operate satisfactorily at 60 Hz within operating limits established by the above standard.

1.8. COORDINATION WITH MECHANICAL DIVISIONS.

- 1.8.1. Unless indicated otherwise on the Electrical Drawings, Electrical Contractor will be responsible for the supply and installation of the following:

- .1 Starters.
- .2 Line and load side wiring for starters.
- .3 Reduced voltage starters including "Soft Start" starters.
- .4 Line and load side wiring to variable speed drives, including but not limited to wiring of associated harmonic filters, AC line input reactors, dV/dT filters, and output filters.
 - .1 Where harmonic filter is complete with a capacitor switching system, route a harmonic filter output conductor through the current transformer window within the harmonic filter. Coordinate with Mechanical Contractor and follow harmonic filter manufacturer's written instructions.
- .5 Disconnect switches for all mechanical equipment.
- .6 All power wiring (120 V & above) to all mechanical equipment.
- .7 Electrical ramp heating cables and controls.
- .8 All motorized damper power connections (120 V & above).
- .9 Fire alarm devices.
- .10 Wiring to electric space heaters.

- 1.8.2. Mechanical Divisions will be responsible for the supply and installation of the following:

- .1 All variable speed drives and control wiring to starters.
- .2 Pipe tracing and related controls.
- .3 Electric hot water heaters.
- .4 All electrical heaters including baseboard heaters, cabinet heaters, force flow heaters and radiant heaters.
- .5 All interposing relays, relays, contactors and 120 V control devices.
- .6 All 120 V and low voltage control wiring and conduits.

- 1.8.3. Determine exact location of starters, motors and line voltage controls based on the Mechanical Drawings to coordinate with the locations of all equipment to ensure the required clearances are maintained. If no wall location is suitable for the motor starters, then mount the starters on a plywood backboard on Unistrut supports near the respective equipment to meet the applicable code requirements for motor isolation switches. If a motor or piece of equipment is listed on one of the starter schedules but is not shown on the floor plans, the contractor is to reference the Mechanical Drawings for the location of the respective piece of equipment. No additional costs will be entertained.
- 1.8.4. Should the Mechanical Contractor change any of the motor or equipment sizes from those identified on the Mechanical Schedules and Drawings at any stage of the project to aide their installation, the Mechanical Contractor will incur all extra electrical costs to revise the electrical feeders/wiring, breakers, fuses, starters and equipment to supply power to the revised piece of equipment.
- 1.8.5. Should the Mechanical Contractor provide alternates to any mechanical equipment selection by deviating from the make and model identified on the Mechanical Schedules and Drawings, the Mechanical Contractor will incur all extra costs to revise the electrical provisions including but not limited to feeders/wiring, breakers, fuses, starters and equipment to supply power to the alternate piece of equipment.
- 1.8.6. Where power for any flush valves, hands-free faucets, or other powered plumbing fixtures are shown on the Drawings, provide either a hard wired direct connection or a duplex receptacle, as required for the valve/faucet/fixture in question, based on coordination with the Mechanical Contractor.
- 1.9. PLYWOOD BACKBOARDS, EQUIPMENT MOUNTING, & HOUSEKEEPING PADS
- 1.9.1. Provide fire rated plywood backboards as shown on the drawings and mount where all communication equipment is to be wall mounted. Plywood is to be 21 mm, urea-formaldehyde (UF) free and shall be either, Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or CSA Z809 - (latest edition) certified. Plywood to be either fire rated with the appropriate label displayed once installed or coated with fire retardant paint. Do not paint over plywood fire rating certification stamp. All Certification not to be painted.
- 1.9.2. For clause above, submit documentation as a shop drawing for review by the LEED Representative prior to ordering.
- 1.9.3. Surface mounted electrical equipment boxes are to be installed on galvanized Unistrut stand-offs. Electrical equipment boxes shall include, but not be limited to electrical panels, LV lighting control, fire alarm, security, communication, electrical sub-metering, etc. Panels are to be grouped on common base wherever practical.
- 1.9.4. Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment and where noted on the drawings. All housekeeping pads to be a minimum of 100 mm high above finished floor and shall not extend beyond 50mm beyond the electrical equipment unless shown otherwise on the drawings.
- 1.10. FINISHES
- 1.10.1. Metal enclosure surfaces are to be finished by the application of rust resistant primer on both the inside and outside, with at least two coats of enamel.
- 1.10.2. Clean and touch up all surfaces of equipment scratched or marred during shipment or installation. Match the original paint.
- 1.10.3. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

- 1.10.4. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.
- 1.11. SAFETY
- 1.11.1. Protect exposed live equipment during construction for personnel safety.
- 1.11.2. Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- 1.11.3. Arrange for the installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.
- 1.12. FIRE STOPS
- 1.12.1. Provide fire stops in accordance with front end, and Division 1 documents and as described herein. Contractor to coordinate fire stops with General Contractor.
- 1.12.2. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.
- 1.12.3. Fire stops and smoke seal systems: in accordance with CAN/ULC-S115 (latest edition).
- .1 Asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 (latest edition) and not to exceed opening sizes for which they are intended.
 - .2 Fire stop system rating for service penetrations: to suit the latest edition of the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
 - .3 Fire stop system rating for sealing junction of rated walls to rated floors and ceilings: to suit the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
- 1.12.4. Service penetration assemblies: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.
- 1.12.5. Service penetration fire stop components: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.
- 1.12.6. Fire resistance rating of installed fire stop assembly not less than the fire resistance rating of surrounding floor and wall assembly, and in accordance with the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
- 1.12.7. Fire stops and smoke seals at openings intended for ease of re-entry, such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
- 1.12.8. Fire stops and smoke seal all electrical penetrations through rated assemblies as per ULC Standards.
- 1.12.9. Where sound and vibration control is required, use an elastomeric seal; do not use a cementitious or rigid seal at such locations.
- 1.12.10. Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- 1.12.11. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

- 1.12.12. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- 1.12.13. Sealants for vertical joints: non-sagging.
- 1.12.14. Colour: if range available to Engineer's Representative's choice of standard colours, generally to match background colour where visible in finished spaces.
- 1.12.15. Through non-fire or non-smoke separations or where waterproof membrane is field applied, where pipes are insulated, sleeves shall be sized to accommodate the insulation and vapour barrier.
- 1.12.16. Where-holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.
- 1.12.17. Submit a complete fire stop system shop drawing package, identifying the products that may be used on the project. Prior to submitting data, review with Authority having Jurisdiction to confirm acceptability of proposed materials and assemblies.
- 1.12.18. Installation
 - .1 Install fire stops and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
 - .2 Seal-holes or voids made by through penetrations, poke through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
 - .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
 - .4 Tool or trowel exposed surfaces to a neat finish.
 - .5 Remove excess compound promptly as work progresses and upon completion.
- 1.13. ACOUSTIC TREATMENT
 - 1.13.1. Electrical Contractor will be responsible for coordinating the electrical installation with the recommendations of the acoustic consultant and their report where one has been included in the contract documents.
 - 1.13.2. Refer to the recommendations of the acoustic report where provided, and provide and install acoustic treatments as necessary. This may include separation of receptacles in stud bays, sealing of junction boxes, application of sound insulating materials etc. Coordinate the installation of these materials with the General Contractor and Drywall/Partition Subtrade.
 - 1.13.3. Do not install back to back receptacles/back boxes within the same stud bay wherever possible. Where it is not possible to stagger receptacles, provide acoustic seal around receptacle/back box to provide acoustic isolation/separation of spaces.
- 1.14. HOISTING
 - 1.14.1. Electrical Contractor will be responsible for the hoisting of all the equipment in the contract. Contractor to coordinate with General Contractor for use of the general hoisting facilities. If hoist facilities are inadequate, then subcontractors must provide their own. Subcontractors must inform general contractors in writing of requirements before tender closing date. Any hoisting required in addition to that provided by the General, will be included in the bid price.
 - 1.14.2. Electrical Contractor to include for the qualified millwrights to move and place all equipment over 1000 lbs. Contractor to provide proof of millwright certification.

1.15. CLEANING AND WASTE REMOVAL

- 1.15.1. Clean all electrical equipment that has been exposed to construction dust and dirt.
- 1.15.2. Contractor to clean all electrical equipment, inside and out, prior to turn over to Owner. Equipment is subject to review by Engineer's Representative and/or Owner.
- 1.15.3. Contractor is responsible to remove their own waste from the site. All re-usable materials shall be recycled.

1.16. SPRINKLERS

- 1.16.1. All electrical equipment shall be suitable for installation in a sprinklered environment and enclosures are to be CSA Type 1 with drip hood, sprinkler proof enclosure unless otherwise noted.

1.17. TEMPORARY LIGHT AND POWER

- 1.17.1. Temporary light and power for construction shall be provided, metered, and maintained by the electrical trade, as directed by the General Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their work.
- 1.17.2. All temporary light to be fluorescent or LED. Provide adequate lighting to meet all health and safety standards.

1.18. EXAMINATION AND PROTECTION OF SITE

- 1.18.1. Before submitting Bid, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.
- 1.18.2. Contractor to document any existing conditions on site and submit a pre-condition survey including pictures. Contractor will be responsible to return the site back to its original form, which includes but is not limited to ground repair including grading and new sod and repair of damaged walls, doors and/or floors.
- 1.18.3. Contractor is to protect trees and plants on site and on adjacent properties. Plants to be protect with burlap. Trees and roots within construction area to be protected by the erection of temporary 2 m high plywood hoarding at the drip line of the tree. Contractor to avoid unnecessary traffic, dumping and storage of materials at or near trees or plants.
- 1.18.4. When requested by the Owner and/or Engineer's Representative, the Contractor is to provide digital pictures of the site, including but not limited to progress of work and installed equipment, via e-mail to the Owner and/or Engineer's Representative.

1.19. DRAWINGS AND INSTALLATION

- 1.19.1. The drawings are intended to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.
- 1.19.2. The location, arrangement and connection of equipment and materials shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Owner.
- 1.19.3. Certain details indicated on the drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the drawings.

- 1.19.4. The actual location of switches, outlets and luminaires, etc. shall be reviewed by the Engineer's Representative before installation.
- 1.19.5. The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.
- 1.19.6. Changes and modifications necessary to ensure co-ordination and avoid interference and conflicts with other trades or to accommodate existing conditions, shall be made at no extra cost to the Owner.
- 1.19.7. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.
- 1.19.8. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.19.9. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Engineer's Representative before proceeding with the work.
- 1.19.10. Contractor is to review Architect's specifications, drawings and details to confirm locations of devices and equipment.
- 1.19.11. This Contractor is responsible to mark-out his work, fully coordinated with all other trades, in sufficient time for review by Architectural Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by Architectural Consultant. Do not proceed with any work until the Architectural Consultant has reviewed the layout drawings.
- 1.19.12. The Contractor will reimburse the Engineer's Representative for their time spent on answering any written questions or requests for information where the answer is clearly identified on the drawings or in the specifications.
- 1.20. **INSTALLATION, INTERFERENCE AND SETTING DRAWINGS**
 - 1.20.1. The Contractor is to complete installation, interference and setting drawings, dimensioned and to scale for all systems. They shall be made available for review by the Engineer's Representative, if requested. The drawings are required to make clear the work intended or to show its relation to adjacent work or to the work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, drawings of the area involved shall be prepared by this division.
 - 1.20.2. Slab layout drawings are to be submitted for review by the Structural Engineer's Representative. These slab layout drawings are to be included in the as-built drawings. Refer to Section 26 05 03.00 – AS-BUILT DRAWINGS.
 - 1.20.3. Interference drawings are required for shafts, ceiling spaces, basement areas, typical floors and wherever there is possible conflict in the positioning of electrical equipment, piping, ductwork sub-trades or architectural features.
 - 1.20.4. This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for conduit, bus ducts and equipment for review by the Structural Engineer and Architect. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.
- 1.21. **SUPPLEMENTARY BID FORM AND SUBMISSIONS OF BID**
 - 1.21.1. Submit with tender, if included in the documents, a complete Electrical Supplementary Bid Form. Tenders not completed in full may, at the discretion of the Owner be rejected.

- 1.21.2. Several alternative, separate and itemized prices may have been requested. These shall be completed on the Electrical Supplementary Bid Form. Refer to the specific sections of the specifications and to the drawings for details.
- 1.22. Approved Manufacturers
- 1.22.1. Where only one name appears in the specification, the bid shall include for the specified equipment.
- 1.22.2. Where two or more names are shown in the specifications as alternates or equal to, this division can select which manufacturer is to be carried.
- 1.22.3. The Contractor is to list substitute equipment as a price deduction to the Bid Price on the Electrical Supplementary Bid Form. Space has been provided to show manufacturers not specifically mentioned. Acceptance of substitute equipment shall be at the discretion of the Owner and/or Engineer's Representative. Any substitutes not listed on the Electrical Supplementary Bid Form will not be entertained.
- .1 The proposed substitution shall show product name and complete description and also what difference, if any, will be made in the amount of the Bid Price for each substitution, should it be accepted.
 - .2 Materials and products specified by the name of the manufacturer, the brand or trade name, or catalogue reference, shall be the basis of the Bid Price.
 - .3 Any alternate and/or substitute equipment listed shall be equal in performance and quality to that specified. If space, power, structural or any other requirements are different from the equipment specified, the cost of any changes shall be included for in the price shown on the Electrical Supplementary Bid Form.
 - .4 The Owner reserves the right to accept or reject any substitution without question.
 - .5 The "Base and Alternate Equipment" is for North American manufactured products. Where a listed manufacturer can offer either North American or non-North American source for the equipment, the country of origin shall be shown under "Substitute Equipment" and the cost savings shown under "Deduct from Tender Price".
- 1.23. PRODUCTS AND MATERIALS
- 1.23.1. Make and quality of materials used in the construction of this project shall be subject to the approval of the Engineer's Representative.
- 1.23.2. All equipment and material are to be CSA certified or approved by an accredited organization. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authorities.
- 1.23.3. Factory assemble control panels and component assemblies.
- 1.23.4. Materials and equipment supplied by this division shall be new and free from defects and shall be equivalent in physical characteristics and performance to that specified by the manufacturer's name and catalogue reference.
- 1.23.5. Where a certain manufacturer's equipment has been specified by name or model number, the contractor shall be responsible for ensuring that the performance and quality meets the specified equipment and that the same access or maintenance space is available for an alternative manufacturer's equipment that is used and that interfacing connections with other trades can be made at no extra cost.
- 1.23.6. Within 30days of the award of contract, the Contractor is to submit a complete list of the manufacturers for all equipment being supplied on the project.
- 1.23.7. Availability

- .1 In submitting Bid, Contractor warrants that all materials are available in suitable time to meet Contract dates.
- .2 Subject to sentence .3 below, where the Contractor advises that the Contractor cannot supply materials in suitable time to meet Contract dates, and should it subsequently appear that Work may be delayed for such reason, the Engineer's Representative reserves the right to substitute more readily available products of similar character, even if more costly to the Contractor, at no increase in Contract Price.
- .3 Where the Contractor can show that the Contractor promptly ordered the originally specified materials the Owner will pay the differential in cost between the originally specified material and the substitute material without any mark-ups applicable by the Contractor, subcontractors, sub-subcontractors or suppliers. For greater certainty, the Contractor's failure to submit shop drawings or other submittals or seek direction in those instances where the Contract Documents so require in sufficient time to permit ordering materials is not cause for the Owner to pay the cost differential in sentence .2 above.

1.24. CO-OPERATION WITH CONSULTANTS

- 1.24.1. To assist in the successful execution of the project, the Contractor shall receive a job report that summarizes the expectations of the Consultant and the Contractor. This document covers topics such as progress billings breakdowns, shop drawing requirements, change order pricing breakdowns, the commissioning process, installation drawings, the specifications, as-built drawings and O+M manuals, along with a number of other items. This job report is intended to reiterate and elaborate on key items of the Contract Documents and is not intended to impose new requirements.
- 1.24.2. At the appropriate time during construction the Contractor shall submit the applicable documentation listed in the "Mechanical/Electrical Unfinished Building Occupancy Checklist". The list shall be issued by the Consultant during the course of the project; however, a sample checklist can be provided at any time upon request. The checklist shall be completed by the Contractor when the information required for occupancy is submitted. The Consultant shall review the information and checklist and shall identify when the information is complete. The Consultant's general review letter (required for building occupancy) shall only be issued when all the information requested in the checklist is submitted by the Contractor and deemed to be complete by the Consultant.
- 1.24.3. For electrical systems occupancy, provide a PDF copy of the following documents to the Engineer's office for review:
 - .1 Electrical inspection authority inspection certificate/report with no deficiencies.
 - .2 Fire alarm verification report with no deficiencies.
 - .3 CAN/ULC-S561 "Standard for Installation and Services for Fire Signal Receiving Centres and Systems" certificate.
 - .4 Maglock test and verification report with no deficiencies.
 - .5 CAN/ULC-S1001 "Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems" reports for electrical systems with no deficiencies.
 - .6 Letter confirming that all emergency lighting and exit signs are installed and illuminated.
 - .7 Letter confirming that all unit equipment for emergency lighting (batteries, heads, exit signs) are installed and powered and have been tested to demonstrate that they last for the run time indicated in the Specifications or on the Drawings.
 - .8 Emergency generator testing and commissioning reports with no deficiencies.
 - .9 Emergency generator TSSA inspection report with no deficiencies.

- .10 Fire pump testing and commissioning reports with no deficiencies.
- .11 Emergency power (inverter) testing report with no deficiencies.
- .12 Seismic Engineer's letter for seismic restraint system (if applicable).
- .13 Letter confirming that all openings in walls and floors for electrical services have been fire stopped.
- .14 Cyber Security Report Letter and backup schedule as required by Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- .15 Additional items as indicated by the Engineer's Representative.
- .16 Additional items as indicated on the Occupancy of Unfinished Buildings Checklist issued by Engineer's Representative.

1.25. CO-OPERATION WITH OTHER DIVISIONS

- 1.25.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.
- 1.25.2. Electrical conduits shall not touch or be supported on pipe or duct walls.
- 1.25.3. Each section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other sections or divisions. Where the space allocated to another section or division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various sections and divisions. Relocation of materials and work involved shall be paid for by the section responsible for the encroachment at no extra cost to the Owner.
- 1.25.4. The supply of all items is to have built-in to the delivery schedule, ample time for rapid progress of work. Proceed with work determined by the construction schedule.
- 1.25.5. The Electrical Contractor shall coordinate the exact breaker/fuse sizes with all mechanical equipment shop drawings prior to rough-in and ordering of the electrical distribution equipment. Size of breakers/fuses shown on drawings are based on generic equipment manufacturers and sizes may change depending on successful equipment manufacturer. No additional costs shall be allowed for non-coordinated mechanical shop drawing reviews by the Electrical Contractor.

1.26. TEMPORARY USE OF EQUIPMENT

- 1.26.1. Where the electrical systems are operated during construction, the Electrical Contractor shall maintain the system and equipment in proper operating condition.
- 1.26.2. Before any area of the building is turned over to the Owner for acceptance and for beginning of the guarantee/warranty period, the systems and equipment shall be returned to the initial new condition.
- 1.26.3. Permanent electrical equipment is only to be used upon permission of Owner and Engineer's Representative and is only to be used on a limited basis. All equipment must be cleaned prior to turnover.

1.27. TESTING

- 1.27.1. General
 - .1 Refer to the testing requirements outlined in each individual specification section and provide all required staffing, materials, tools and expertise to perform the required testing. Where specification Section 26 08 01.00 - TECHNICAL SERVICES DIVISION

STARTUP SERVICE has been included, ensure all testing is performed accordingly by the Technical Services Division Startup Service trade.

- .2 This specification is intended to capture the requirements for factory testing, factory witness testing, site startups, site testing and training of electrical equipment. This specification represents a minimum requirement and does not absolve the equipment manufacturers from performing any tests required by the standards referenced in the individual specification sections.
- .3 The testing process for the Electrical Systems shall include:
 - .1 Verification that the installation meets the requirements of the contract documents.
 - .2 Verification that the system's performance meets the design intent.
 - .3 Building operator training.
 - .4 As-Built documentation, operating and maintenance manuals, and systems operating manuals.
- .4 The Contractor, Engineer's Representative, Technical Services Division Startup Service (where called for in the Specification) and Commissioning Agent (where identified as part of the project) shall provide the services to complete the process. See further explanation below defining the areas of responsibility.
- .5 Provide labour, equipment and material to conduct the testing process as outlined in this Section.

1.27.2. Factory testing

- .1 All equipment is to have factory testing performed by the equipment manufacturer. These tests are to include the manufacturers standard factory testing, and any required testing to conform to the standards, and any additional testing referenced in the individual specification sections.
- .2 The manufacturer is to perform the required testing and submit test reports recording the results of all tests to the Electrical Contractor for review and if found acceptable submit to Engineer's Representative for Shop Drawing review and the final copy included in the O&M Manuals. Test reports are to be submitted and reviewed by the Electrical Contractor and Engineer's Representative prior to shipment to site.
- .3 Any deficiencies noted in the factory testing are to be corrected prior to shipment of electrical equipment unless otherwise agreed to by the Electrical Contractor.

1.27.3. Factory Witness Testing

- .1 For all factory witness testing, the manufacturer is to act as the test leader and is responsible for all required organization, coordination, performance of testing and documentation of test results. The manufacturer is to ensure the tests being performed are in alignment with the requirements of the Specification in advance of the testing and provide hard copies of the latest Shop Drawings and test scripts for each attendee of the witness test. Any deviations to the tests being requested in the Specifications and Drawings must be communicated to the Electrical Contractor and Engineer's Representative in advance and must be accompanied with a rationale and/or an alternate test method that demonstrates that the intent of the specified test would be met.
- .2 Each factory witness test is to include at a minimum:
 - .1 Introductions.
 - .2 A walkthrough of the latest Shop Drawing and review of latest Shop Drawing commentary with discussion on any remaining open items.

- .3 A walkthrough of the test script.
 - .4 A walkthrough of the Design Specifications and Drawings noting/reiterating any required deviations from the design documents in terms of testing requirements.
 - .5 Performance of tests
 - .6 At the conclusion of all factory witness tests, the manufacturer is to produce signed factory test results recording all noted results and documenting any remaining deficiencies. Report to include record of the testing instruments used along with calibration dates (where required) and serial numbers.
 - .3 Factory witness testing shall be attended by the persons as listed below, attendance at the witness testing is at the discretion of each representative and is to be confirmed by all parties prior to witness testing.
 - .1 One (1) Electrical Contractor Representative
 - .2 One (1) Engineer Representative
 - .3 One (1) Commissioning Agent Representative
 - .4 One (1) Technical Services Division Startup Service Representative
 - .4 Manufacturers to include for the complete cost of the attendees listed above to attend the factory witness testing for the equipment. Cost to include but not limited to all travel, food and lodging costs. Manufacturer to note, attendees may be coming from different locations within Canada.
 - .5 Manufacturer to provide factory witness test scripts to the Contractor as a formal Shop Drawing in advance of the factory witness test for review by the Contractor, Engineer and Commissioning Agent through the formal Shop Drawing review process. Factory witness test shall not be scheduled without a reviewed test script.
 - .6 Manufacturer to notify the attendees minimum two (2) weeks prior to the date the tests are to be performed. Where travel out of province is required, provide minimum four (4) weeks notice.
 - .7 Manufacturer to perform their own internal quality assurance and control check prior to any factory witness test such that the manufacturer is prepared to perform the complete demonstration of the equipment.
 - .8 Any deficiencies noted in the factory testing is to be corrected prior to shipment of the electrical equipment.
- 1.27.4. Site Startup
- .1 Manufacturer to include for the costs of technician(s) to perform initial system startup on site as required by the Specifications and Electrical Contractor. Extent of technician(s) involvement to be coordinated with the needs of the Specifications and the Electrical Contractor.
- 1.27.5. Site tests
- .1 Manufacturer to include for the costs of technician(s) to perform site tests as required by the Specifications and Electrical Contractor. Refer to tests identified in the individual Specification sections and include all personnel and equipment to perform testing.
- 1.27.6. Materials
- .1 The Contractor and Manufacturer shall provide all instrumentation and equipment necessary to conduct the tests as specified in the specifications. The Contractor shall ensure the instrumentation to be used are properly and adequately calibrated and if required by the Engineer's Representative or Commissioning Agent to provide the dates the instrumentation was last calibrated.

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- 1.28. TRAINING
- 1.28.1. The Manufacturer is to include for qualified technician(s) with project specific knowledge to perform in depth training for facility management team members.
- 1.28.2. Training may include up to ten (10) attendees and may be video recorded by others.
- 1.28.3. Training program to include:
- .1 One site 'in class' introduction session covering the basics of system operation.
 - .1 Manufacturer to submit a course outline before training commences.
 - .2 Manufacturer to provide course training documentation (if required) for attendees.
 - .2 On site 'hands on' session covering the specific equipment design and operation details, including:
 - .1 All operating procedures including automatic and manual intervention procedures.
 - .2 All regular maintenance procedures.
 - .3 Troubleshooting procedures.
 - .4 Spare parts required.
- 1.28.4. Timing of training to be coordinated with Electrical Contractor and Owner/Facility Management staff and is to be provided in advance of systems supporting critical loads to allow for full ability to operate the systems. The Electrical Contractor/Manufacturer to notify the Owner/Facility Management team a minimum two (2) weeks prior to the date of training.
- 1.29. LIFE SAFETY INTEGRATION TESTING
- 1.29.1. Provide testing of the integration of all life safety and fire protection systems.
- 1.29.2. The Integrated Testing Coordinator (ITC) will complete an Integration Testing Plan (ITP). Carry out the testing as described by the ITC in the ITP, and in accordance with CAN/ULC-S1001 as it relates to any electrical systems.
- 1.29.3. The ITC and development of the ITP are not the responsibility of this Contractor.
- 1.29.4. The testing of the integrated systems shall include, but not be limited to the following systems and all associated components:
- .1 Fire Alarm System
 - .2 Fire Signal Receiving Centre
 - .3 Mass Notification
 - .4 Elevators
 - .5 Emergency Generators and/or Inverters
 - .6 Audio/Visual Systems
 - .7 Lighting Control Systems
 - .8 Notification Systems (Public Address)
 - .9 Sprinkler Systems
 - .10 Standpipe Systems
 - .11 Fire Pumps
 - .12 Water Supplies
 - .13 Water Supply Control Valves

- .14 Heat Tracing for Life Safety Systems
- .15 Fixed Fire Suppression Systems
- .16 Cooking Equipment Fire Suppression Systems
- .17 Automatic Door Operators for Stair Relief
- .18 Hold-Open Devices
- .19 Electromagnetic Locks
- .20 Smoke Control Systems and Associated Dampers
- .21 Venting to Aid Firefighting
- .22 Smoke Alarms
- .23 Hazardous Protection Monitoring
- .24 Gas / CO Detection Systems
- .25 Prevention of Smoke Recirculation (AHUs)
- 1.29.5. Coordinate with all other trades to carry out the appropriate testing.
- 1.29.6. Be responsible for carrying out and coordinating the testing work associated with the ITP. All work shall be coordinated with the ITC and shall include but not be limited to:
 - .1 Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.
 - .2 Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.
 - .3 Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001 "Integrated Systems Testing of Fire Protection and Life Safety Systems."
 - .4 Provide fire alarm verification report along with all other documentation requested by the ITC as it relates to the electrical systems in conformance with CAN/ULC-S1001 "Integrated Systems Testing of Fire Protection and Life Safety Systems."
- 1.30. STATEMENT OF PRICES
- 1.30.1. To form a basis for progress payments the successful bidder shall submit a sample progress draw for the various portions of the work. The format of the sample progress draw shall be as shown in the example progress draw below. The sample progress draw shall include a breakdown which illustrates all categories shown on the example progress draw which are relevant to the project. The categories shall be broken down to clearly illustrate the value of the material being supplied as the first subcategory and the value of the labour being supplied as the second subcategory, as shown on the example progress draw. The electrical Engineer's Representative reserves the right to request that additional categories be added to the progress draw if the Engineer's Representative feels that doing so will aid in assessing the contractor's progress on site, thereby expediting contractor payment. Progress draws not including the categories shown on the example progress draw where relevant to the project and / or not providing separate labour value and separate material value subcategories will be rejected.
- 1.30.2. The total price of all portions of the work shall equal the total price of the work covered under the electrical division. Cost for as-built drawings and manuals to be carried as a separate line item.
- 1.30.3. Contractor to list and track all fixed per unit cost luminaires as part of Light Fixtures - Materials on the progress draw.

- 1.30.4. Contractor to list and track each of the approved changes on separate lines on the progress draw.
- 1.30.5. Costs of temporary facilities and utilities shall be amortized over the duration of the Work. Claims for 'mobilization', 'bidding costs', or similar lump sums at or before start of work are not acceptable.

EXAMPLE PROGRESS DRAW

Electrical Contractor Name
Billing Application Electrical Division
Project Name

Application Number – xx		Date – xxxx to xxxx						
<u>Description</u>	<u>Contract Value</u>	<u>%</u>	<u>Billed To Date</u>	<u>%</u>	<u>Prev. Billed</u>	<u>%</u>	<u>This Billing</u>	<u>Balance to Complete</u>
Permits / Mobilization	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Demolition & Removals	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Duct Banks – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Duct Banks – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Feeder Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Feeder Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Feeder Wire – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Feeder Wire – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Ltg. Branch Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Ltg. Branch Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Lighting Branch Wire – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Lighting Branch Wire – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Cable – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Cable – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Cable – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Cable – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Distribution Equipment – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Distribution Equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Generator / Inverter – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Generator / Inverter – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Light Fixtures – Material†	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Light Fixtures – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Lighting Controls – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx

Lighting Controls – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Equipment – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Wiring Devices – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Wiring Devices – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Hand Dryers – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Hand Dryers – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Commissioning / Training	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Demobilization / Clean-up	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Manuals / As-Built Drawings	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Subtotal	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Additions to Contract								
CO # / PC # / CCN #	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
Cash Allowance #	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
Subtotal	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
Total Contract	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Less Holdback			xxx,xxx.xx		xxx,xxx.xx		xxx,xxx.xx	
Total			xxx,xxx.xx		xxx,xxx.xx		xxx,xxx.xx	

[†] Inclusive of fixed per unit cost luminaires. Refer to luminaire schedule and/or electrical supplementary bid form for luminaire fixed unit costs.

1.31. METRIC CONVERSIONS

1.31.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, conduit and site services in both new and existing installations.

1.32. INTERRUPTION OF SERVICES

1.32.1. Any interruption of the electrical services to any part of the building shall come at a time agreeable to the Engineer's Representative. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.

1.32.2. Testing and operation of major equipment shall be approved by the Engineer's Representative to avoid excessive electrical utility charges. Such testing to be generally carried out after normal working hours or on weekends.

1.32.3. All such overtime work shall be carried out without additional cost to the Owners.

- 1.32.4. Modifications to existing electrical equipment, which will require shutdown, must be coordinated with the Owner and will only be permitted on weekdays from 10:00 pm to 6:00 am and on weekends from Friday at 7:00 pm to Sunday 6:00 pm. Exact weekends to be co-ordinated with the Owner. Consecutive weekends of shutdowns will not be allowed. Contractor to pay for all utility costs associated with shutdowns. Any work not associated with live equipment can be done during normal working hours. Work considered disruptive to the normal operation of the building will be done after normal business hours. Exact times to be co-ordinated with Owner.
- 1.32.5. Contractor to provide a minimum of 5 days written notice of a requirement for a shutdown. Contractor to include for separate meetings with the Owner and Engineer's Representative to discuss the shutdown in detail and to coordinate all the work being performed.
- 1.32.6. The Contractor is responsible for co-ordination and isolating of all existing services at all voltage levels required for the disconnections and connections to existing buildings. This includes shutting down and isolating existing low and medium voltage services. The owner will not perform any isolations for the contractor but will be present during the work. The contractor is to use qualified personnel for these shutdowns ensuring compliance with all applicable safety requirements.
- 1.32.7. The Contractor is responsible for any damages caused to existing systems when making connections.
- 1.32.8. The Contractor is to keep shutdowns of existing buildings to a minimum by scheduling the work and providing the required number of personnel to keep the shutdown to a minimum. This Contractor is to include for as many multiple teams of electricians as is feasible to keep the shutdown work to a minimum.
- 1.33. PRE-PURCHASED EQUIPMENT
- 1.33.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-purchased equipment and its associated equipment as if it had been purchased by the Contractor, with the single exception of payment.
- 1.33.2. The Electrical Trade shall provide a warranty for all pre-purchased equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-purchased equipment at no cost to the Owner during the warranty period.
- 1.33.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.
- 1.33.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-purchased equipment into a working system whether or not shown on the Drawings or specified herein.
- 1.33.5. The following list of equipment is pre-purchased:
.1
- 1.34. PRE-TENDERED EQUIPMENT
- 1.34.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-tendered equipment and its associated equipment as if it had been purchased by the Contractor, including payment.
- 1.34.2. The Electrical Trade shall provide a warranty for all pre-tendered equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-tendered equipment at no cost to the Owner during the warranty period.

- 1.34.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.
- 1.34.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-tendered equipment into a working system whether or not shown on the Drawings or specified herein.
- 1.34.5. The following list of equipment is pre-tendered: Insert the list of Owner Pre-tendered equipment or delete this if none are being included in the project
- .1
- 1.35. VALUATION OF CHANGES
- 1.35.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:
- .1 Estimate and acceptance in a lump sum, unless the Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.
- 1.35.2. Contractor shall provide the Engineer's Representative with a detailed cost analysis of the contemplated change indicating:
- .1 Quantity of each material.
- .2 Unit cost of each material.
- .3 Time involved.
- .4 Sub-trade quotations including a complete analysis of costs.
- .5 Mark-ups, if applicable.
- .6 Value of GST or HST, as applicable.
- .7 Proposed change in Contract Time.
- 1.35.3. The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.
- 1.35.4. The following shall not be included in the cost of the work but are covered by the hourly labour rate:
- .1 The Contractor's payroll, administrative, head office and site office expenses, including stationary, postage and other office supplies.
- .2 The costs of the Contractor's Project Manager, clerical and administrative personnel, and executive personnel.
- .3 Use of temporary offices, sheds, small/hand tools, storage, and site office consumables, etc., including but not limited to the cost of telephone, light, power, water and heat used therein.
- .4 Transportation and overnight room expenses for out of town labour, if local labour is unavailable.
- .5 Insurance premiums, all government payroll burdens, variable labour factors and union or association funds.
- .6 Licenses and permits, except when these are special for a particular item of work.
- .7 Printing charges for Proposed Changes, Change Orders and Drawings for Contractor's and Subcontractors' use in the work. Engineer's Representative will provide a PDF electronic copy of change notice documentation.

- .8 The cost of preparing As-Built, layout and working drawings and shop drawings. This includes any and all AutoCAD/BIM costs related to interference drawings or other associated drawings that may be required as part of the changes.
 - .9 The cost of clean-up and disposal of waste material.
 - .10 Parking, travel, coffee break/rest periods, warranties, safety training, WHMIS and health and safety committee, and non-productive time.
 - .11 Rentals, additional bonding, project financing.
- 1.35.5. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-2020 GC 6.2.
- 1.35.6. The Contractor shall inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.
- 1.35.7. Special equipment rental rates will be charged at cost. The Contractor shall provide an official quotation of the equipment rental with the Proposed Change quotation as backup, otherwise special equipment rentals will not be accepted by the Owner/Consultant.
- 1.35.8. The maximum percentage fee for mark-ups shall be as stated in the Division 0/1 specifications or the Contract Supplementary Conditions.
- 1.35.9. All changes, change notices, revisions to contract, Supplemental Instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.
- 1.35.10. The material costs used shall be a discount to nationally available pricing guides (i.e. Trade Service, Allpricer, etc.) to reflect a value with a fair and reasonable markup to the actual cost of the materials purchased from distributors. The Owner and/or Engineer's Representative reserve the right to negotiate material pricing to a value that is fair and reasonable to the Owner.
- 1.35.11. Labour Rate
- .1 During the duration of the electrical contract, extra work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour units column 1(one). No additional factors will be accepted.
 - .2 The hourly labour rate for all changes will be based on a Journeyman Electrician rate as listed on the Bid Form and/or Electrical Supplementary Bid Form. The Owner and/or Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be inclusive of overhead, markup and profit. The labour rate will be inclusive of all labour burden charges as stated in this 'Valuation of Changes' section above.
 - .3 The following labour burdens are not part of the hourly labour cost, but are covered under the NECA labour unit rates: safety measures and regulations; drawing and specification study; layout, measuring and marking the installation location; material unloading, jobsite storage and delivery to the installation area; inspection, uncrating and shipping support removal; tool acquisition and return to storage; clean-up of excess material; and testing circuits for continuity.
 - .4 At the request of the Owner or the Engineer's Representative, the Contractor is to submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The

Owner and the Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.

- 1.35.12. When pricing additional work for Proposed Changes, the Electrical Contractor shall only price new materials that are required for the Proposed Change. Where existing materials and/or infrastructure (i.e. homerun conduits back to electrical panels) can be re-used for the Proposed Change, the Electrical Contractor shall utilize these items in the valuation of the Change at no extra cost.
- 1.35.13. Where a Proposed Change includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.
- 1.35.14. When pricing Proposed Changes containing both additions and credits, and where no work and/or materials have been installed on site, the Electrical Contractor shall only price the net new materials and net new labour that are required for the Proposed Change. Per unit labour and material costs shall be equal for credits and additions.

PROPOSED CHANGE ORDER

Company Name:

Address:

City, Prov.:

Postal Code:

Telephone:

Fax:

E-Mail address:

CCN #

Date:

Project Name:

Project Number:

Page Number:

Change Order #:

Client Address:

Work Description

We reserve the right to correct this quote for errors and omissions.

This quote covers direct costs only.

This price is good for acceptance within 30 days from the date of receipt.

Itemized Breakdown

Description	Qty	Net Price U	Total Mat(\$)	Labor U	Total Hours
¾' EMT		xxx.xx C		5.00 C	
¾' EMT STL SS CONN		xx.xx C		10.00C	
¾' EMT STL SS CPLG		xx.xx C		5.00 C	
¾' EMT STRAO 1-H		xx.xx C		4.00 C	
#10 x 1" SELF TAPPING SCREW		x.xx C		5.50 C	

TOTALS

Description

Material

General Materials

Permitted Mark-up (@ xx.xx %)

Material Total

Labour

Journeyman (xx Hrs. @ \$xx.00)

Foreman @ 10% (xx Hrs. @ \$xx.00)

Labour Total

Material and Labour Total

Final Amount

1.36. DEMOLITION

- 1.36.1. The demolition drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services follow the service through to ensure other areas of the building are not affected.
- 1.36.2. Whenever existing services or equipment are to be removed, all electrical connections for such services shall be removed and securely terminated in an approved manner. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this division.
- 1.36.3. Whenever it becomes necessary to relocate any electrical services equipment to make possible installation of the work under this contract, such relocation shall be done by this division without additional cost to the Owner.
- 1.36.4. Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate the demolition.
- 1.36.5. If applicable, review the mechanical, architectural, and other related discipline drawings, and include for removing and making safe all power connections to demolished equipment and devices, back to the source panel, except where indicated otherwise on the drawings.
- 1.36.6. Ensure that all electrical, life safety services, and services for existing equipment, in areas outside the areas of this work, that are required to remain in service, shall do so.
- 1.36.7. Relocate any electrical feeders or equipment that are required to remain in service, that are secured to existing walls, floors or ceilings to be demolished or that are buried and required to be excavated for new work.
- 1.36.8. Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.
- 1.36.9. Disconnect and remove existing light fixtures, devices, outlets, CCTV, security devices, etc. which are not to be reused. Such items shall be packaged and turned over to the Owner at a place designated by the Owner. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an approved manner.
- 1.36.10. Ensure that all existing equipment which is to be reused and/or relocated is thoroughly reviewed and refurbished to ensure correct operation when put back into service and to meet the requirements of the local authorities having jurisdiction. All existing electrical equipment which is no longer required shall be removed and disposed of off-site.
- 1.36.11. Carry out the work with a minimum of noise, dust and disturbance.
- 1.36.12. Provide tools and clean up equipment. Obtain the Owner's permission for the use of electrical, plumbing or drainage outlets.
- 1.36.13. Where a device is shown to be relocated on the drawings, contractor to remove and re-install device and back box and re-feed the device with new conduit and wire from the nearest existing accessible junction box.
- 1.36.14. Electrical Contractor is responsible for the patching and re-painting the entire wall where a device and/or box has been added, removed or relocated.

1.37. CYBER SECURITY

- 1.37.1. Coordinate with Owner's Information Technology representatives, obtain a copy of Owner's cyber security policy and provide all applicable cyber security configurations.
- 1.37.2. Definitions

- .1 Cyber Assets: Systems (including hardware, software, and data) and communication networks (including hardware, software, and data).
- .2 Critical Cyber Assets: Cyber assets that perform critical system functions. The loss or compromise of these cyber assets would adversely affect the operational reliability of the system.
- .3 Cyber Attack: The use of electronic means to interrupt, manipulate, destroy, or gain unauthorized access to a computer system, network, or device.
- .4 Cybercrime: Any crime where cyber – the internet and information technologies, such as software, firmware, computers, tablets, personal digital assistants or mobile devices – has a substantial role in the commission of a criminal offence.
- .5 Cyber Hygiene: Practices and steps that users of computers and other devices take to maintain system health and improve online security. These practices are often part of a routine to ensure the safety of identity and other details that could be stolen or corrupted.
- .6 Cyber Incident: Any unauthorized attempt, whether successful or not, to gain access to, modify, destroy, delete, or render unavailable any computer network or system resource.
- .7 Cyber Security: Technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access.
- .8 Cyber Threat or Cyber Security Threat: Malicious act that seeks to damage data, steal data, or disrupt digital life in general. Cyber threats include computer viruses, data breaches, Denial of Service (DDoS / DoS) attacks and other attack vectors.
- .9 Cyber Threat Actors: Broad term for any states, groups, or individuals who, with malicious intent, aim to take advantage of vulnerabilities, low cyber Security awareness, and technological developments to gain unauthorized access to information systems in order to access or otherwise affect victims' data, devices, systems and networks.
- .10 IP Multicast: Technique for one-to-many and many-to-many real-time communication over an IP Infrastructure network.
- .11 Endpoint: Remote computing device that communicates back and forth with a network to which it is connected. Such as a server, desktop, or laptop.
- .12 Network Certificates: Also known as a Digital Certificates, which are an electronic "password" that allows a person or organization to exchange data securely over the internet using the public key infrastructure (PKI). Digital Certificates are also known as a public key certificate or identity certificate. There are 3 Main types of certificates:
 - .1 Secure Socket Layer Certificate (SSL) Digi-SSL
 - .2 Software Signing (Code Signing Certificate) Digi-Code
 - .3 Client Certificate (Digital ID) Digi-ID
- .13 Social Engineering: Exploitation methods that target human vulnerabilities, such as carelessness and trust.
- .14 Technical Vulnerabilities: Weaknesses or flaws in the design, implementation, operation, or management of an information technology system, device, or service.
- 1.37.3. Cyber Security Measures
 - .1 Implement at minimum the following multi-layered Cyber Security measures to limit and / or reduce the Owner's potential risk from a cyber threat event; such as a Cyber Security data breach or Cyber Security attack.
 - .2 Password Management
 - .1 Employ password management best practices such as:

- .1 Do not use default passwords.
- .2 Use strong and unique passwords for all applications. Use a minimum of 8 characters where there is no password policy inherent in the software; use a mixture of uppercase and lowercase letters, numbers, and include at least one special character (! @ # ?]).
- .3 Reset passwords at regular intervals.
- .4 Configure two-factor authentication for all accounts where possible in the system software.
- .5 Do not use System Admin logins for simple tasks; create separate User accounts with rights levels appropriate for the job function. Create and define user accounts as appropriate such as Role based, Individual logins or assigned roles.
- .6 Use different passwords for every account.
- .7 Enforce secure password policies within the business environment.
- .8 Have interface lock after a predefined # of failed login attempts for a pre determined time interval.
- .3 Port and Interface Management
 - .1 Employ Port Management techniques such as:
 - .1 Restrict access on network switch ports to assigned devices addresses.
 - .2 Lock down all open, unused and unsecure ports on the networking devices such as switches, routers, and firewalls.
 - .3 Shut off all unused communication services and hardware interfaces.
 - .4 Advise Owner on use of 3rd party port security monitoring.
- .4 Physical and Virtual Networks
 - .1 Provide a dedicated VLAN for network connected systems where a dedicated LAN has not been provided.
- .5 Encryption
 - .1 Use minimum TLS 1.2 for all network attached equipment and use TLS 1.3 where available.
- .6 Network Certificates
 - .1 Ensure Network Certificates are up to date and not expired for all equipment and systems.
- .7 Firmware & Software Update Management
 - .1 Use the latest stable Firmware / Software version on all devices / equipment as well as implement a Firmware / Software Update management process and procedure.
- .8 Manufacturer's System Hardening Guides
 - .1 Provide the Manufacturer's System hardening guides for the equipment being installed and implement as many recommendations / features as possible.
- .9 External Memory
 - .1 Restrict the use of external memory. Restrict or eliminate the use of devices such as external USB Thumb drives unless expressly allowed by the Owner's Information Technology representatives.
- .10 Log Off

- .1 Enable auto-log off timer for all software, websites and logins. Set auto-log off timer on local Workstation(s) being used to access the equipment with a reasonable timer in the case that an employee leaves the workstation unattended.
- .11 Anti-Virus Software
 - .1 Enable and configure anti-virus software on PC endpoints in accordance with the Owner's Information Technology requirements, unless it is to be installed and configured by the Owner.
- .12 Filtering Techniques
 - .1 Apply filtering techniques including the types listed below where possible:
 - .1 Web Filtering: A Web filter adds another layer to anti-phishing defences by blocking the web based component of phishing and malware attacks.
 - .2 Multicast Message Filtering: Filters the packets sent to multicast groups users are not subscribed to.
 - .3 Content Filtering: Is the use of a program to screen and / or exclude access to web pages or email deemed objectionable. A content filter will then block access to this content.
- .13 Back up Regularly
 - 1. Provide backup schedule in the closeout submittals and configure system for automatic backups wherever possible.
 - 2. Identify files that require manual backup and the backup procedure. This helps to protect against many types of data loss, especially if a Cyber Threat Actor gains access.
- 1.37.4. IT Devices and Systems
 - .1 Apply the Cyber security measures listed in the clauses above in part or in full, as possible, to a wide range of Information Technology (IT) Devices including:
 - .1 Firewalls
 - .2 Routers
 - .3 Network switches (Core and Edge Devices)
 - .4 Servers and databases
 - .5 Workstation computers
 - .6 Network connected system devices and controllers
 - .7 Wireless Access Points and wireless controllers
 - .8 Mobile phones and tablets
 - .9 Any IT System or endpoint connected to the network
- 1.37.5. Operational Technology (OT) Devices and Systems
 - .1 Apply the Cyber security measures listed in the clauses above, in part or in full, as possible, to a wide range of OT Network devices including:
 - .1 Industrial Control Systems such as:
 - .1 (PLC's) Programmable Logic Controllers are an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices.
 - .2 (SCADA) Supervisory Control and Data Acquisition is a control system architecture comprising of computers, networked data communications

- and graphical user interfaces (GUI) for high level process supervisory management.
 - .3 (DCS) Distributed Control System is a computerized control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system.
 - .4 (CNC) Computer numerical Control is the automated control of machining tools (Drills, boring tools, lathes) and 3D printers by means of a computer.
 - .2 Building Management Systems (BMS) and Building Automation Systems (BAS)
 - .3 HVAC equipment
 - .4 Lighting controls for both internal and external applications
 - .5 Energy monitoring and metering equipment
 - .6 Transportation and parking systems
 - .7 Scientific equipment
 - .8 Any other OT System or endpoint that can be connected to the network
 - 1.37.6. Report Cybercrime
 - .1 Advise the Owner and / or their representatives of any indication of a Cyber Incident of a criminal nature when performing any work on a network connected system.
 - 1.37.7. Cyber Security Report Letter
 - .1 Provide a Cyber Security Report Letter in the closeout documents to the client stating which Cyber Security measures have been implemented, when implementing any and / or all of the Cyber Security Measures mentioned in this Specification.
 - 2. Products
 - 2.1. NOT USED
 - 3. Execution
 - 3.1. NOT USED
- END OF SECTION

26 05 03.00 As-Built Drawings

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Refer to As-built Drawings in Section 01 70 00 (01 72 29.00) – CLOSEOUT SUBMITTALS.

1.3. RECORD OF REVISIONS ON SITE

1.3.1. Print and maintain two complete sets of white prints to mark the project progress, changes and deviations.

1.3.2. Maintain an updated copy of plans and schematics in the digital format for which the project is provided (i.e. AutoCAD or Autodesk Revit MEP) and be capable to produce documents in Adobe PDF upon request.

2. Products

2.1. AS-BUILT DRAWINGS

2.1.1. Request in writing from the Engineer's Representative all electrical AutoCAD drawings. Complete release form provided by Engineer's Representative and pay the Engineer's Representative directly the costs identified in this section below prior to receiving the drawings. After the final as-built drawings have been reviewed, send the Engineer's Representative a copy via electronic transfer for their records and send a minimum of one copy on USB key with each set of maintenance manuals. Provide additional copies if required under the General Conditions. Use the latest release of AutoCAD software, and provide electronic files saved in a version acceptable to the end user and engineer.

2.1.2. The contractor is to identify the cost of As-Built Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The following values are to be broken out:

\$5,000	For Electrical Contracts up to \$250,000
2% of Electrical Contract	For Electrical Contracts from \$250,000 to \$1,500,000
\$30,000	For Electrical Contracts over \$1,500,000

2.1.3. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received.

2.1.4. Final as-built prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Architect and Engineer must be deleted from the drawings.

2.1.5. Final as-built drawings to include all revisions made to the drawings during construction, including all approved changes. The as-built drawings are to also include the routing of all feeders except for branch circuits, all junction boxes to be shown, drawing legend to be updated to include all symbols and lines used to show as-built conditions, quantity of wires in each conduit, and circuit numbers of wires in each conduit. Include slab layout drawings in as-built drawing package.

2.1.6. CADD Requirements.

- .1 A complete list of layer names and brief description of each layer's use shall accompany all files.
- .2 Fonts for text shall be AutoCAD standard. Custom fonts, shape files, etc., are not to be used.
- .3 Final as-built drawings shall be returned on USB stick.
- .4 Each USB stick shall include a file containing Engineer's Representative and Owner, Contract number, file names and Drawing number. Provide a "readme.txt" file in ASCII format. A printed copy of the readme file shall accompany each USB stick.
- .5 All drawings shall be in the same units as issued on Bid Documents.
- .6 Provide a complete list of symbol (block) names with a description of each symbol.
- .7 Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.

2.1.7. Maintain records on site, as the job progresses, and record all changes and deviations from that shown on Contract Drawings. After review and approval of service lines in trenches, take "as-built" measurements, including all depths, prior to commencement of backfilling operations. Show the location of buried electrical ducts and conductors on the drawings and dimensioned from fixed points. Keep drawings up-to-date during construction and in addition to field measurements include Change Orders, Supplemental Instructions and all other changes.

2.1.8. On completion of the building, forward to the Engineer's Representative the digital drawings indicating all such changes and deviations for review by the Engineer's Representative.

2.1.9. If required, the Engineer's Representative will provide a quotation to this Contractor to transfer "As-Built" information from the mark-up documentation to the acceptable software.

- .1 Include a cost of \$400.00 per sheet for the transfer of marked up "As Built" information to AutoCAD and forwarding of the electrical information by the Engineer's Representative to the Owner

2.1.10. The Electrical Contractor may request from the Engineer's Representative the most current electrical drawings in AutoCAD sent via electronic transfer (at a nominal charge of \$500.00).

2.1.11. The AutoCAD as-built documents shall meet all the Owner's and Engineer's Representative's requirements.

3. Execution

3.1. NOT USED

END OF SECTION

26 05 04.00 Submittals/Shop Drawings

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
 - 1.2. RELATED WORK
 - 1.2.1. Comply with Div. 00 for submittal requirements and as amended below.
2. Products
 - 2.1. SHOP DRAWINGS
 - 2.1.1. Shop Drawings shall be organized by Specification Section. Ensure shop drawing package for a given Specification Section is complete, including all equipment, products, materials, and systems to be used as part of that Specification Section, and submit as a single shop drawing package. Do not submit numerous separate shop drawings for the same Specification Section. Do not combine more than one section into one submission. Incorrect submissions will be returned without review.
 - 2.1.2. Submittals/Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. SWBD-1A).
 - 2.1.3. Submit shop drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:
 - .1 S+A project number and Contractor Shop Drawing Identifier in Subject Line
 - .2 Attachments shall be limited to 10MB
 - .3 Provide FTP hyperlink for all attachments in excess of 10MB with appropriate information for downloading the file (as required)
 - .4 Shop Drawing Submission to the following email address:
 - .1 ContractAdmin.Toronto@smithandandersen.com
 - 2.1.4. Shop drawings submitted directly to Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.
 - 2.1.5. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
 - 2.1.6. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation – for example: lighting control sequence of operation – the Engineer's Representative may also request that this information be added to the maintenance and operating manual.

- 2.1.7. Provide a cover sheet with the project name, issue date, issue number, specification section number, and title of section with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

3. Execution

3.1. SUBMISSION

- 3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that he has checked the drawing for conformance with all requirements of the Drawings and Specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical and mechanical co-ordination is complete before submitting drawings for review.
- 3.1.2. Scanned PDF versions are not acceptable.
- 3.1.3. Equipment shall not be released for manufacture until the shop drawing has been reviewed by Engineer's Representative. Contractor shall assume responsibility and cost for field changes. Installation of any equipment shall not start until after final review of Shop Drawings by the Engineer's Representative has been obtained.
- 3.1.4. As part of the electrical Engineer's Representative's scope of the work, shop drawings shall be reviewed no more than twice. Should three or more reviews be required due to reasons of Contractor omissions causing resubmission requests, the Contractor shall reimburse the electrical Engineer's Representative for time expended in these extra reviews.

END OF SECTION

26 05 05.00 Mounting Heights

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. NOT USED

3. Execution

3.1. MOUNTING HEIGHTS

3.1.1. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

3.1.2. If mounting height of equipment is not specified or indicated, verify with the Consultant before proceeding with installation.

3.1.3. Unless indicated otherwise on the drawings or within the specifications, install electrical equipment at following heights.

.1 Local switches: 1050 mm.

.2 Wall receptacles:

.1 General: 450 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1200 mm.

.5 In equipment storage rooms: 900 mm.

.3 Receptacles for maintenance of equipment located on rooftops:

.1 Not less than 750 mm above the finished roof, per Electrical Code.

.4 Panelboards: 2000 mm to top of panel.

.5 Telephone and interphone outlets: 450 mm.

.6 Wall mounted telephone and interphone outlets: 1050 mm.

.7 Fire alarm stations: 1200 mm, measured to the top of the manual pull station.

.8 Wall Mounted Fire alarm audible devices: 2300 mm and not less than 150 mm from the ceiling, measured to the top of the device.

.9 Television outlets not mounted behind a wall mounted television: 450 mm.

.10 Wall mounted speakers: 2100 mm.

.11 Clocks: 2100 mm.

.12 Power Door Operator push buttons: 1050 mm.

- .13 Wall mounted Exit Signs
 - .1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.
 - .2 For all ceilings heights greater than 2500 mm: 2400 mm.
- .14 Wall mounted Battery Packs and Emergency Heads
 - .1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.
 - .2 For all ceilings heights greater than 2500 mm: 2400 mm.
- .15 Wall mounted occupancy sensors: 1050 mm.
- .16 Wall mounted visible signal devices: 2100 mm to centre of lens; or as allowed by CAN/ULC-S524 "Standard for Installation of Fire Alarm Systems" except where facility accessibility standards require otherwise.
- .17 Top of remote annunciator and passive graphic panels shall be no more than 1800 mm above finished floor.
- .18 Wall mounted emergency telephone (Fireman's Handset): 1350 to 1500 mm.

END OF SECTION

26 05 21.00 Wires and Cables Under 2000 V

1. General

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

1.2. REFERENCES

- 1.2.1. CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables, latest edition.
- 1.2.2. CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables, latest edition.
- 1.2.3. CSA C22.2 No. 51, Armoured Cables, latest edition.
- 1.2.4. CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables, latest edition.
- 1.2.5. CSA C22.2 No. 96, Portable Power Cables, latest edition.
- 1.2.6. CSA C22.2 No. 123, Metal Sheathed Cables, latest edition.
- 1.2.7. CSA C22.2 No. 124, Mineral-Insulated Cable, latest edition.
- 1.2.8. CSA C22.2 No. 131, Type TECK 90 Cable, latest edition.
- 1.2.9. CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations, latest edition.
- 1.2.10. CAN/ULC S139 / UL 2196 (Binational Standard), Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables, latest edition.
- 1.2.11. ASTM B800 - Standard Specification for 8000 Series Aluminium Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. BUILDING WIRES

- 2.1.1. Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- 2.1.2. Contractor to provide copper conductors on conductors sizes up to and including #8 AWG. Contractor to provide copper conductors for sizes larger than #8 AWG unless identified as aluminium or NUAL on the drawings.
- 2.1.3. All conductors to have size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 to CSA C22.2 No. 38 rated as follows:
 - .1 Insulation rated at 1000 V for 600 V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current.

- .2 Insulation rated at 600 V for the other 600 V and 347/600 V distribution systems not covered under item #1 above.
 - .3 Insulation rated at 600 V for all systems rated at 480 V and less.
- 2.1.4. All aluminium or NUAL conductors to be an aluminium alloy with CSA certified as an Aluminium conductor material (ACM) and meet the requirements of the Aluminium Association Inc. AA8030 and ASTM B800 standards. Provide an anti-oxidant compound, Ideal NOALOX, on all aluminum conductor terminations.
- 2.1.5. RWU90 wiring is to be used for underground installations.
- 2.2. TECK CABLE
 - 2.2.1. Cables to CSA C22.2 No.131.
 - 2.2.2. Conductors:
 - .1 Bonding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
 - 2.2.3. Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.
 - 2.2.4. Inner jacket: polyvinyl chloride material.
 - 2.2.5. Armour: interlocking aluminum.
 - 2.2.6. Overall covering: thermoplastic polyvinyl chloride material rated at a minimum of FT-4. Provide FT-6 jacket when TECK cables are run in return air plenum.
- 2.3. VARIABLE FREQUENCY DRIVE CABLES
 - 2.3.1. Variable frequency drives are also known as variable speed drives.
 - 2.3.2. Cables to CSA C22.2 No. 123 or No. 131, and to CSA C22.2 No. 174.
 - 2.3.3. Conductors:
 - .1 Three (3) bare copper bonding conductor sized to Table 16 of the electrical code.
 - .2 Circuit conductors: copper, size as indicated on Drawings.
 - .3 Profile of VFD Cable cross section shall be entirely symmetrical.
 - 2.3.4. Shield: Flat copper tape shield, or continuously corrugated and welded aluminum sheath, depending on cable construction.
 - 2.3.5. Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene (XLPE) with high dielectric strength to withstand repetitive high voltage spikes of 3.1 times the nominal system voltage rating due to VFD IGBT output.
 - .2 Type RW90 or RWU90 CSA rated for 1000 V, and suitable for voltage spikes mentioned in .1 above.
 - 2.3.6. Where compliant with CSA C22.2 No. 123, Armour: continuously corrugated and welded aluminum.
 - 2.3.7. Where compliant with CSA C22.2 No. 131, Inner jacket: polyvinyl chloride material.
 - 2.3.8. Where complaint with CSA C22.2 No. 131, Armour: interlocking aluminum.
 - 2.3.9. Overall covering: thermoplastic polyvinyl chloride (PVC) material rated at a minimum of FT-4.

- 2.3.10. Cable to be complete with manufacturer's cable termination kits including terminating connectors for proper termination of shield to ground. Termination kits to ensure common mode stray currents are drawn away from the motor to extend motor life-span. Termination kits to include self-terminating connectors that provide 360 degree contact to the shield / sheath.
- 2.4. MINERAL-INSULATED CABLES
- 2.4.1. Conductors: solid bare soft-annealed copper, size as indicated.
- 2.4.2. Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.
- 2.4.3. Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 C.
- 2.4.4. Outer jacket: PVC applied over sheath, where installed in damp and wet locations.
- 2.4.5. Two (2) hour fire rating.
- 2.4.6. Conform to requirements of CSA C22.2 No. 124; and CAN/ULC S139.
- 2.4.7. All mineral-insulated cable larger than #6 AWG shall be single conductor. For conductors #6 AWG and smaller, multi-conductor mineral-insulated cable is acceptable.
- 2.5. FIRE RATED MC CABLE
- 2.5.1. Conductors: stranded annealed copper, size as indicated.
- 2.5.2. Insulation: low smoke silicon rubber.
- 2.5.3. Armour: continuously welded and corrugated copper sheath.
- 2.5.4. Outer Jacket: Provide black low smoke, zero halogen polyolefin, FT4 rated where installed in damp and wet locations.
- 2.5.5. Two (2) hour fire rating.
- 2.5.6. Conform to requirements of CSA C22.2 No. 123; and CAN/ULC S139 with hose stream.
- 2.6. ARMOURED CABLES
- 2.6.1. Cables to: CSA C22.2 No. 51.
- 2.6.2. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
- 2.6.3. Type: AC90 (BX).
- 2.6.4. Armour: interlocking type fabricated from aluminium strip.
- 2.6.5. Type: ACWU90 - PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.
- 2.7. ALUMINUM SHEATHED CABLE
- 2.7.1. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
- 2.7.2. Insulation: type RA90 rated 1000 V.
- 2.7.3. Sheath: aluminium applied to form continuous corrugated seamless sheath.
- 2.7.4. Outer jacket of PVC applied over sheath for direct burial or wet locations.

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- 2.8. DIESEL LOCOMOTIVE CABLES (DLO)
 - 2.8.1. Cable: to CSA C22.2 No. 96 Portable Power Cables, rated to 2000 V.
 - 2.8.2. Conductor: stranded tinned annealed copper, size and number as indicated
 - 2.8.3. Separator: paper or polyester tape separates the conductor from the rubber insulation to aid in stripping.
 - 2.8.4. Insulation: premium grade Ethylene Propylene Rubber (EPR), rated 90 deg. C.
 - 2.8.5. Jacket: black, heavy duty chlorinated polyethylene (CPE), sunlight resistant, rated at a minimum of FT-4.
 - 2.9. WIRING TERMINATION
 - 2.9.1. Lugs, terminals, screws used for termination of wiring to be to be dual rated for Copper/Aluminum (Cu/Al).
 - 2.9.2. Lugs, terminals, and screws used for termination of multiple wires must be rated for their intended use.
 - 3. Execution
 - 3.1. GENERAL
 - 3.1.1. Provide a minimum of one bonding conductor for each three ungrounded conductors on all conduit and cable runs. Provide separate bonding conductors for each ground fault circuit interrupter circuits. All bonding conductors to be copper and insulated with a green coloured insulation.
 - 3.1.2. Size bonding conductor to applicable tables of the:
 - .1 Ontario Electrical Safety Code.
 - 3.1.3. All equipment, junction boxes, pull boxes, liquid tight flex, etc. to be bonded to ground through bonding conductors.
 - 3.1.4. Provide separate neutral conductor for each 120 volt circuit for all circuits feeding receptacles and power outlets.
 - 3.1.5. Do not install cables or devices on the surface of, or within 100 mm of the underside of roof decks.
 - 3.1.6. Ensure slack is provided in wiring connections to equipment which contains moving parts.
 - 3.1.7. Provide a variable frequency drive (VFD) cable from each VFD unit to each motor. Wiring to be installed in accordance with the VFD and motor manufacturer instructions.
 - 3.1.8. All cable terminations to be compression type fittings for wire sizes greater than #8 AWG. All compression type fittings to be two-hole long barrel type with lug inspection / viewing window. Where mechanical screw type lugs are allowed by the Engineer's Representative, they will be suitable for quantity of parallel runs of wire that are to be terminated under.

- 3.1.9. Armoured Cable Type AC90 (BX) may only be used for individual drops from slab mounted junction box to recessed mounted light fixtures or where noted on the drawings where wiring is required to be installed within an existing wall. The maximum allowable distance of armoured cable is 3 m. Contractor to receive written approval from the Engineer's Representative to run armoured cable further than 3 m from junction box. Daisy chaining of fixtures is only acceptable in dry wall ceilings. Wiring in conduit is to be brought to a junction box to allow for the transition to armoured cable. Armoured cable is not to be installed directly into electrical panels or run in walls for receptacles.
- 3.1.10. Branch circuit wiring to be upsized as follows to address voltage drop when:
- .1 The entire length of the circuit wiring exceeds 25 m – branch wiring to be a minimum of No. 10 AWG.
 - .2 The entire length of the circuit wiring exceeds 40 m – branch wiring to be a minimum of No. 8 AWG.
 - .3 The entire length of the circuit wiring exceeds 60 m – branch wiring to be a minimum of No. 6 AWG.
- 3.1.11. Where feeders or branch circuits are run underground, upsize conductors to comply with the requirements of electrical code Rule 4-004, Ampacity of wires and cables, using Diagrams D8 to D11 and Tables D8A to D11B of the electrical code. Where conductors are upsized due to Tables D8A to D11B, upsize conduits to comply with the requirements of electrical code Rule 12-910, Conductors and cables in conduit and tubing.
- 3.1.12. Where one (1) hour or two (2) hour conductor fire rating is indicated on the Drawings, provide fire rated Mineral-Insulated cables or fire rated MC cables. Fire rated Mineral-Insulated and MC cables shall be installed in accordance with the manufacturer's installation instructions and the fire rated cable product listing in order to maintain their fire rating. Special attention shall be paid to cable supporting method and fire rating of the structure from which the cables are supported.
- 3.1.13. Where conductors supply power to emergency lighting and the emergency lights are located on a different floor level than the power source (i.e. panel), then the conductors shall be fire rated for at minimum one (1) hour using fire rated Mineral-Insulated cables. Conductors with two (2) hour fire rating shall be used where indicated on Drawings. Provide fire rated Mineral-Insulated cables or fire rated MC cables where conductors require fire ratings.
- 3.1.14. Where alternatives to fire rated cables are indicated on the Drawings, such as running conduits within concrete cast in place slabs, under concrete slabs on grade, or within fire rated shaft/riser, care must be taken to ensure that the required fire rating is maintained. Where drawings call for conduits to be run within concrete cast in place slabs, the slabs must be of sufficient thickness to achieve the required fire rating and be no less than 51 mm (2 in.) of concrete cover both above and below conduits where one (1) hour fire rating is required and 102 mm (4 in.) concrete cover both above and below conduits where two (2) hour fire rating is required. The contractor shall submit a letter confirming the concrete coverage or construction of fire rated assembly provides the sufficient fire rating of the enclosed conduits.
- 3.1.15. Wire Splicing
- .1 Splice up to and including No. 6 AWG with nylon insulated expandable spring type connectors.
 - .2 Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.

3.2. INSTALLATION OF BUILDING WIRES

- 3.2.1. Install all building wiring in conduit unless otherwise noted. Conduit to be sized to the electrical code unless noted on the drawings or in the specifications.
- 3.2.2. All conductors are to be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. INSTALLATION OF TECK 90 CABLE, VARIABLE FREQUENCY DRIVE CABLE, ARMoured CABLE OR ALUMINUM SHEATHED CABLE

- 3.3.1. Group cables wherever possible on channels.
- 3.3.2. Terminate cables in accordance with manufacturer's installation instructions.
- 3.3.3. Fastenings:
 - .1 One-hole steel straps to secure surface cables 53 mm and smaller. Two-hole steel straps for cables larger than 53 mm.
 - .2 Channel type supports for two or more cables.
 - .3 Galvanized threaded rods: 6 mm diameter minimum to support suspended channels.
 - .4 Pre-engineered support systems complying with CSA C22.2 No. 18.4 "Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239)."
- 3.3.4. Connectors:
 - .1 Watertight, approved for respective cables.
- 3.3.5. For single conductor cables, ground the sheath at the upstream (source) panel and provide insulated fibre plate at the load end, so as to prevent circulating sheath currents.

3.4. INSTALLATION OF MINERAL-INSULATED AND FIRE RATED MC CABLES

- 3.4.1. Handling:
 - .1 Cable shall be uncoiled by rolling or rotating supply reel. Do not pull from coil periphery or centre.
- 3.4.2. Bending:
 - .1 Not less than six (6) times the cable diameter for cable not more than 250 kcmil.
 - .2 Not less than twelve (12) times the cable diameter for cable diameter for cable more than 350 and 500 kcmil.
- 3.4.3. Splicing:
 - .1 Make all fire rated splices in the factory. In the event that a field splice is necessary, have the manufacturer's field technician make it in the field.
- 3.4.4. Terminations:
 - .1 Make field made terminations using the cable manufacturer's termination kits. Use stripping tools, crimping tools and compression tools, available from the manufacturer for proper cable termination.
 - .2 Connections to ferrous cabinets for single conductor cables shall incorporate brass plates. Install per manufacturer's drawing.
 - .3 At cable terminations, use thermoplastic sleeving over bare conductors.
- 3.4.5. Sheath induction reduction:
 - .1 When multi-phase circuits have paralleled single conductors, run cables in groups having one of each phase in each group.

- .2 Separate each set of paralleled conductors by at least two single cable diameters.
- 3.4.6. Exposed or Surface Installations:
 - .1 Cable shall be secured directly to fire rated building structure using:
 - .1 Straps: 13 mm wide x 38 mm long by 0.75 mm thick stainless steel or copper straps. Each strap shall contain two 5 mm-holes for securing with 5 mm by minimum 44 mm long steel anchors.
 - .2 Support 2 hr fire rated cables at 1 m intervals.
- 3.4.7. Wall or floor penetrations:
 - .1 Provide approved fire stopping of all penetrations.
 - .2 Neatly train and lace cable inside boxes, equipment, and panelboards.
 - .3 Where cables are buried in cast concrete or masonry, sleeve for entry of cables.
 - .4 When penetrating a fire rated wall or fire rated floor, the cable must extend a minimum of 305 mm beyond the fire rated wall or fire rated floor. The 305 mm dimension can be in any direction as 305 mm of cable length is required to allow for proper heat dissipation such that cable terminations do not overheat.
- 3.5. FIELD QUALITY CONTROL
 - 3.5.1. Prior to energizing wires/cables, measure insulation resistance of each wire/cable. Ensure readings are acceptable per installation recommendations. Tabulate and submit for approval as a submittal.
 - 3.5.2. All Wires and Cables to be tested on site as defined in Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE and herein. Contractor to oversee all testing and correct any deficiencies noted.
- 3.6. INSTALLATION OF CONTROL CABLES
 - 3.6.1. Install control cables in conduit.
 - 3.6.2. Ground control cable shield.

END OF SECTION

26 05 26.00 Grounding + Bonding

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 41– Grounding and Bonding of Equipment, latest edition.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

1.2.4. IEEE Standard 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, latest edition.

1.3. DESCRIPTION

1.3.1. Provide system grounding to meet requirements of current applicable codes.

1.4. SHOP DRAWINGS AND PRODUCT DATA

1.4.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.4.2. Submit shop drawings for ground bars and ground rod inspection wells for engineer's review prior to manufacture.

1.4.3. Submit main system ground test report as a shop drawing for engineer's review. Include final reviewed report in the project O&M manuals.

2. Products

2.1. GROUNDING & BONDING EQUIPMENT

2.1.1. Meet standard of CSA C22.2 No. 41 – Grounding and Bonding of Equipment, latest edition.

2.2. CONDUCTORS

2.2.1. Bare or insulated, stranded, soft drawn annealed copper wire, for: ground bus, electrode interconnections, metal structures, ground connections, telephone ground.

2.3. LUGS

2.3.1. All grounding connections to be made with compression type fittings and lugs with lug inspection / viewing window.

3. Execution

3.1. INSTALLATION

- 3.1.1. Install complete permanent, continuous, system and circuit, equipment, grounding and bonding systems including, conductors, connectors, and accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.
- 3.1.2. Provide main station ground grid as shown on drawing but the ground grid shall consist of a minimum of four (4) driven ground rods. Copper ground rods shall be not less than 3 m long and 19 mm in diameter and where practicable located adjacent to the equipment to be grounded (i.e. main electrical room). Interconnect all ground rods underground with a #2/0 AWG bare ground conductor.
- .1 If main ground grid cannot be installed directly below the main electrical room, then provide a remote ground grid by installing the ground rods at the lowest floor level of the building and provide two grounding conductors of a minimum of #4/0 AWG copper to connect the ground grid to the main electrical room equipment. Run the two conductors through separate routes separated by a minimum of 5 m.
- 3.1.3. Supply and install a new ground bus system consisting of a length of copper bus, 25 mm thick ebony pad with chamfered edges as shown on the drawings. A minimum of two 1200 mm ground bars are to be provided in transformer vault(s), main electrical room(s) and generator room(s). Where a perimeter ground bus is shown on the drawings, supply and install a 50 mm x 6 mm copper bus on all walls attached at 1.5 m intervals on 13 mm standoffs. The perimeter ground bus shall be continuous around the room and shall be continued above or below all openings such as doors and vents.
- 3.1.4. Interconnect the ground bars to the ground grid with a minimum #2/0 AWG bare copper ground conductor if the ground grid is adjacent to the main electrical room(s). Where the ground grid is remote, connect the ground bars to the remote ground grid as described in 3.1.2.(1) above.
- 3.1.5. Supply and install inspection box for each ground rod. Inspection box is to be suitable for installation in heavy traffic areas and is to come complete with a lockable lid and security key.
- 3.1.6. Connect to the ground bus all metal equipment enclosures, as well as all other metal parts such as mechanical pipes, ducts, waste lines, door frames, railings, grilles, fences, etc. with minimum #2/0 AWG bare copper conductors.
- 3.1.7. For solidly grounded systems, transformer neutrals, main service entrance switchboard neutrals and all similar bonding connections, the bonding conductors shall be sized in accordance with Table 16 of the Electrical Code.
- 3.1.8. Provide cable grips to receive all grounding conductors. Identify all grounding conductors at the ground pad using lamaroid nameplates. Ground bus system to be provided in rooms as shown.
- 3.1.9. Terminate the following conductors at the ground bus system:
- Service neutral -as indicated on drawings

- Telecommunications ground

-as per TIA Standard 607, latest edition

TBB/GE linear length m (ft)	TBB/GE size (AWG)
less than 4 (13)	6
4 – 6 (14 – 20)	4
6 – 8 (21 – 26)	3
8 – 10 (27 – 33)	2
10 – 13 (34 – 41)	1
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
20 – 26 (67 – 84)	3/0
26 – 32 (85 – 105)	4/0
32 – 38 (106 – 125)	250 kcmil
38 – 46 (126 – 150)	300 kcmil
46 – 53 (151 – 175)	350 kcmil
53 – 76 (176 – 250)	500 kcmil
76 – 91 (251 – 300)	600 kcmil
Greater than 91 (301)	750 kcmil

where,

TBB = Telecommunications Bonding Backbone

- Main system ground -#2/0 AWG or 2 x # 4/0 AWG for remote ground grids
- Bonding conductor -as per Table 16 of CSA C22.1

- 3.1.10. Ground all metallic water, gas, and waste systems with a minimum #6 AWG copper in accordance with code requirements.
- 3.1.11. Install bonding connections to typical equipment included in, but not necessarily limited to, following list: frames of motors, starters, control panels, building steel work, elevators, distribution panels and outdoor lighting.
- 3.1.12. Commission an approved certified testing Agency to perform a main system ground test. Submit the main system ground test report as a shop drawing for engineer's review. Provide a copy of the report in the maintenance manual. (Refer to Part 3.2).
- 3.1.13. Install connectors in accordance with manufacturer's instructions.
- 3.1.14. Ground rods to be interconnected by grounding grid conductors (sized as per sections above) and buried to a maximum depth of 600 mm below the rough station grade and a minimum depth of 150 mm below the finished station grade.
- 3.1.15. Protect exposed grounding conductors from mechanical damage.
- 3.1.16. Install bonding conductor for flexible conduit and connect at both ends to grounding bushing with solderless lug, clamp or cup washer and screw. Neatly cleat bonding conductor to exterior of flexible conduit.
- 3.1.17. Provide separate, insulated bonding conductor within each feeder and branch circuit raceway.
- 3.1.18. Interface with the lightning protection system, if one is installed for this building.
- 3.2. TESTING
 - 3.2.1. The contractor shall pay for the testing and verification of the entire building ground system using a certified testing Agency. Tests shall include main ground grid and ground rods, and grounding connections between all electrical and communication rooms. The agency shall provide complete test reports indicating test methodology and results. All costs shall be included in contract bid.

3.2.2. Following are acceptable methods of testing the ground grid. Testing shall be in accordance with IEEE Standard 81 (latest edition).

- .1 Two-Point Method
- .2 Three-Point Method
- .3 Ratio Method
- .4 Staged Fault Tests
- .5 Fall-of-Potential Method

END OF SECTION

26 05 29.00 Hangers and Supports

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

1.2.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2.2. Conduit and equipment provided under the Electrical division shall be complete with all necessary supports and hangers required for a safe and workpersonlike installation.

2. Products

2.1. MATERIALS

2.1.1. Provide “U” type support Strut as manufactured by Unistrut.

3. Execution

3.1. INSTALLATION

3.1.1. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.

3.1.2. Auxiliary structural members shall be provided under the electrical section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested.

3.1.3. Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.

3.1.4. Approved type expansion shields and bolts may be used for conduit up to 103 mm diameter where the pre-setting of concrete inserts is not practical. Submit Shop Drawings.

3.1.5. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer's Representative. Drawings of the proposed method of suspension must be submitted for review.

3.1.6. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413 – Parking Structures (latest edition) and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval.

3.1.7. Suspending one hanger from another shall not be permitted.

3.1.8. All hangers, supports, brackets and other devices used outside the building wall shall be galvanized. If galvanized components cannot be used submit samples of proposed substituted for review before installation.

3.2. HORIZONTAL RUNS ON THE ROOF

- 3.2.1. Where conduit or cables are run horizontally across a roof, conduit or cable shall be supported from pre-manufactured UV resistant sleepers with closed cell foam base.
- 3.2.2. Sleepers shall be "E-Z Sleeper" product from Pipe-Ease Inc. or approved equivalent.
- 3.2.3. Wood Blocks are not acceptable.

END OF SECTION

26 05 31.00 Splitters, Junction, Pull Boxes and Cabinets

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 53.00 – IDENTIFICATION.

1.1.4. Section 26 05 63.00 – ACCESS DOORS AND ACCESSIBILITY.

1.2. REFERENCE

1.2.1. Ontario Electrical Safety Code, latest edition.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings and product data for cabinets in accordance with specification Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. SPLITTERS

2.1.1. Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Provide CSA Type 1 enclosures in non-sprinklered environments and CSA Type 4/12 in sprinklered environments.

2.1.2. Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated. Lugs to be dual rated for Copper/Aluminum (Cu/Al).

2.1.3. At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2. JUNCTION AND PULL BOXES

2.2.1. Welded steel construction with screw-on flat covers for surface mounting.

2.2.2. Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3. CABINETS

2.3.1. Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

2.3.2. Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface or flush mounting. The plywood backboard is to have a fire-resistant coating on the front. Do not paint over plywood fire rating certification stamp.

3. Execution

3.1. SPLITTER INSTALLATION

- 3.1.1. Install splitters and mount plumb, true and square to the building lines.
- 3.1.2. Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2. JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- 3.2.1. Install pull boxes in inconspicuous but accessible locations.
- 3.2.2. Mount cabinets with top not higher than 2000 mm above finished floor.
- 3.2.3. Install terminal block as indicated in Type T cabinets.
- 3.2.4. Only main junction and pull boxes are indicated. Install pull boxes as follows:
 - .1 A conduit run exceeds 30 m and;
 - .2 360 degree of combined bends between pull boxes for power conduits or 180 degree of combined bends between pull boxes for communication and low voltage conduits.

3.3. IDENTIFICATION

- 3.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.
- 3.3.2. Install identification labels indicating system name, voltage, and phase.

END OF SECTION

26 05 32.00 Outlet Boxes, Conduit Boxes and Fittings

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. Ontario Electrical Safety Code, latest edition.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

2. Products

2.1. OUTLET AND CONDUIT BOXES GENERAL

2.1.1. Size boxes in accordance with the electrical code.

2.1.2. Square or larger outlet boxes as required for special devices.

2.1.3. Gang boxes where wiring devices are grouped.

2.1.4. Blank cover plates for boxes without wiring devices.

2.1.5. 347V outlet boxes for 347 V switching devices.

2.1.6. Combination boxes with barriers where outlets for more than one system are grouped.

2.2. SHEET STEEL OUTLET BOXES

2.2.1. Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 mm x 50 mm x 38 mm or as indicated. 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

2.2.2. Provide cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles connected to rigid conduit.

2.2.3. Provide electro-galvanized steel utility boxes for surface mounted boxes connected to surface-mounted EMT conduit, minimum size 100 mm x 54 mm x 48 mm.

2.2.4. Square or octagonal outlet boxes for lighting fixture outlets.

2.2.5. Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3. MASONRY BOXES

2.3.1. Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4. CONCRETE BOXES

2.4.1. Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5. FLOOR BOXES

- 2.5.1. Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.
- 2.5.2. Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16 mm and 21 mm conduit. Minimum size: 73 mm deep.

2.6. OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- 2.6.1. Electro-galvanized, sectional, screw ganging steel boxes, minimum size 75 mm x 50 mm x 63.5 mm with two double clamps to take non-metallic sheathed cables.

2.7. FITTINGS - GENERAL

- 2.7.1. Bushing and connectors with nylon insulated throats.
- 2.7.2. Knock-out fillers to prevent entry of debris.
- 2.7.3. Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- 2.7.4. Double locknuts and insulated bushings on sheet metal boxes.

2.8. SERVICE FITTINGS

- 2.8.1. 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for duplex receptacles. Bottom plate with two knockouts for centered or offset installation.
- 2.8.2. Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate Amphenol jack connectors.

3. Execution

3.1. INSTALLATION

- 3.1.1. Support boxes independently of connecting conduits.
- 3.1.2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- 3.1.3. For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- 3.1.4. Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- 3.1.5. Non-combustible electrical outlet boxes that penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating, do not require fire stops provided,
 - .1 they do not exceed:
 - .1 100 cm² each in area, AND
 - .2 an aggregate area of 650 cm² in any 9.3 m² of surface area, AND
 - .2 The annular space between the membrane and the box does not exceed 3 mm.
- 3.1.6. Where the conditions of clause 3.1.5 are not met, provide fire stops for the outlet boxes.

- 3.1.7. Opposing outlets on non-fire rated partition walls shall have a minimum 150 mm horizontal separation. Outlets shall not be mounted back to back.
- 3.1.8. Conform to the fire stopping requirements of the building code: unless provided with a fire stop in accordance with CAN/ULC-S115, "Fire Tests of Fire Stop Systems", electrical outlet boxes on opposite sides of a vertical fire separation required to have a fire-resistance rating shall be separated by a horizontal distance of not less than 600 mm, or be installed in adjacent stud cavities.

END OF SECTION

26 05 34.00 Conduits, Conduit Fasteners and Fittings

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 31.00 – SPLITTERS, JUNCTION, PULL BOXES AND CABINETS

1.1.3. Section 26 05 32.00 – OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1.2. REFERENCES

1.2.1. CAN/CSA C22.2 No.18- Outlet Boxes, Conduit Boxes, and Fittings, latest edition.

1.2.2. CSA C22.2 No.45.1- Electrical Rigid Metal Conduit - Steel, latest edition.

1.2.3. CSA C22.2 No.56- Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, latest edition.

1.2.4. CSA C22.2 No.83- Electrical Metallic Tubing, latest edition.

1.2.5. CSA C22.2 No.211.2- Rigid PVC (Unplasticized) Conduit, latest edition.

1.2.6. CAN/CSA C22.2 No.227.3- Flexible Non-metallic Tubing, latest edition.

1.2.7. CSA C22.2 No.227.1 - Electrical Non-Metallic Tubing, latest edition.

2. Products

2.1. CONDUITS

2.1.1. Electrical rigid metal conduit: to CSA C22.2 No.45.1, galvanized steel or aluminum threaded.

2.1.2. Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.

2.1.3. Electrical metallic tubing (EMT): to CSA C22.2 No.83, with couplings.

2.1.4. Rigid PVC conduit: to CSA C22.2 No.211.2.

2.1.5. Flexible metal conduit: to CSA C22.2 No.56, steel or liquid-tight flexible metal.

2.1.6. Electrical non-metallic tubing (ENT): to CSA C22.2 No. 227, with couplings.

2.2. CONDUIT FASTENINGS

2.2.1. One-hole steel straps to secure surface conduits NPS 2 and smaller. Two-hole steel straps for conduits larger than NPS 2.

2.2.2. Beam clamps to secure conduits to exposed steel work.

2.2.3. Channel type supports for two or more conduits at 1 m on centre.

2.2.4. Hot dipped galvanized threaded rods, 6 mm dia. minimum, to support suspended channels.

2.2.5. For non-fire rated applications, pre-engineered support systems complying with CSA C22.2 No. 18.4 "Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239)."

2.3. CONDUIT FITTINGS

- 2.3.1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- 2.3.2. Factory 90 degree elbow where 90 bends are required for 1" and larger conduits when a hydraulic bender is not used.
- 2.3.3. Connectors, and couplings for EMT conduit are to be set-screw steel type. Below the level of suspended ceilings, in a sprinklered environment, provide watertight fittings and "O" rings on all conduit runs and when conduit is terminated at any piece of electrical equipment.
- 2.3.4. Provide plastic bushings for all connectors, rigid nipples and rigid conduit 35 mm or larger.

2.4. EXPANSION FITTINGS FOR RIGID CONDUIT

- 2.4.1. Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

2.5. FISH CORD

- 2.5.1. Fish cord to be made of polypropylene.

3. Execution

3.1. INSTALLATION

- 3.1.1. All conduits on project to be surface mounted. Conduits are not allowed in cast in-place concrete or concrete slabs unless written consent is received from the Engineer's Representative and Owner. Only once approved by the Engineer's Representative and Owner do the clauses contained within this section and the respective sections relating to conduits in cast in-place concrete or concrete slabs apply.
- 3.1.2. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- 3.1.3. Do not install conduits, associated raceway system, or devices on the surface of, or within 100 mm of the underside of roof decks.
- 3.1.4. Conceal conduits except in mechanical and electrical service rooms or in unfinished areas. Conduits to have their own support system and are to be supported independently of the ceiling grid or ceiling support system.
- 3.1.5. Where vertically run conduit passes through a slab, Contractor to provide a 100 mm high concrete pad with the pad extending 100 mm on all sides of the conduit.
- 3.1.6. Use electrical metallic tubing (EMT) conduit except where specified otherwise.
- 3.1.7. Use epoxy coated conduit in corrosive areas.
- 3.1.8. Use rigid galvanized steel threaded conduit where conduit is subject to mechanical damage.
- 3.1.9. Use rigid PVC conduit underground or in corrosive areas and where indicated.
- 3.1.10. Use flexible metal conduit for connection to motors or vibrating equipment in dry areas, connection to recessed luminaires without a prewired outlet box, connection to surface or recessed luminaires and work in movable metal partitions. Ensure slack is provided in wiring connections to equipment which contains moving parts.

- 3.1.11. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations. Use only liquid tight fittings when using liquid tight flexible metal conduit. Liquid tight flexible metal conduit to have a jacket with an FT6 rating when used in plenums otherwise provide a minimum FT4 rating. Ensure slack is provided in wiring connections to equipment which contains moving parts.
- 3.1.12. Use explosion proof flexible connection for connection to explosion proof motors.
- 3.1.13. Install conduit sealing fittings in hazardous areas. Fill with compound.
- 3.1.14. Minimum conduit size for lighting and power circuits: NPS 21 mm, unless otherwise noted on the Drawings.
- 3.1.15. Minimum conduit size for data / voice cabling: as indicated on drawings, otherwise 27 mm.
- 3.1.16. Install EMT conduit from a raised floor branch circuit panel to outlet boxes located in sub floor.
- 3.1.17. Install EMT conduit from a raised floor branch circuit panel to junction box in sub-floor. Run flexible metal conduit from junction box to outlet boxes for equipment connections in sub-floor.
- 3.1.18. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- 3.1.19. Mechanically bend steel conduit over 21 mm diameter.
- 3.1.20. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- 3.1.21. Install fish cord in empty conduits.
- 3.1.22. Run two 27 mm spare conduits up to ceiling space and two 27 mm spare conduits down to sub-floor space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes or in case of an exposed concrete slab, terminate each conduit in flush concrete or surface type box.
- 3.1.23. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- 3.1.24. Dry conduits out before installing wire.
- 3.1.25. All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Landlord and/or structural Engineer's Representative before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Landlord. Check and verify the location of existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all tenant areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebar to minimize cutting of rebar when core drilling. Provide x-ray study before drilling or cutting where required by the Landlord and/or structural Engineer's Representative.
- 3.1.26. Provide sleeves for all new conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.
- 3.1.27. Where cables and conduits pass through partitions and through floors that are not fire rated, provide an air-tight seal around the cables and conduits.
- 3.1.28. Where cables and conduits pass through floors and fire rated walls, pack space between conduit (or cable) and sleeve with an approved fire stop as specified in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 3.1.29. Prior to installation of any wire or cable in the ducts, pull through each duct a flexible mandrel not less than 300 mm long and size for the internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Provide photo and video evidence of compliance with this clause and send to Engineer's Representative for review within 24 hours of Work occurring.

3.2. SURFACE CONDUITS

- 3.2.1. Run parallel or perpendicular to building lines.
- 3.2.2. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- 3.2.3. Run conduits in flanged portion of structural steel.
- 3.2.4. Group conduits wherever possible on suspended or surface mounted channels.
- 3.2.5. Do not pass conduits through structural members, except as indicated.
- 3.2.6. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- 3.2.7. Conduits must not be used to support other conduits.

3.3. CONCEALED CONDUITS

- 3.3.1. Run parallel or perpendicular to building lines.
- 3.3.2. Do not install horizontal runs in masonry walls.
- 3.3.3. Do not install conduits in terrazzo or concrete toppings.

3.4. CONDUITS IN CAST-IN-PLACE CONCRETE

- 3.4.1. Locate to suit reinforcing steel. Install in centre one third of slab.
- 3.4.2. Protect conduits from damage where they stub out of concrete.
- 3.4.3. Install sleeves where conduits pass through slab or wall.
- 3.4.4. Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- 3.4.5. Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- 3.4.6. Encase conduits completely in concrete with minimum 25 mm concrete cover.
- 3.4.7. Organize conduits in slab to minimize cross-overs.

3.5. CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- 3.5.1. Run conduits 27 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.6. CONDUITS UNDERGROUND

- 3.6.1. Slope conduits to provide drainage.
- 3.6.2. For all non-PVC conduits run underground, provide waterproof joints with heavy coat of bituminous paint.

END OF SECTION

26 05 53.00 Identification

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. Ontario Electrical Safety Code.

1.2.2. Ontario Building Code.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. EQUIPMENT IDENTIFICATION

2.1.1. Identify electrical equipment with nameplates as follows:

- .1 Lamacoid 3 mm thick plastic engraved sheet, black or red face, white core, mechanically attached with self-tapping screws or rivets.
- .2 White letters 12 mm high for major switchboards, panelboards and power transformers.
- .3 White letters 12 mm high for terminal boxes, junction boxes, grid boxes, splitter boxes, disconnect switches starters and contactors.
- .4 Allow for an average of fifty (50) to one hundred (100) letters per nameplate.
- .5 Identification to be in English.
- .6 Black nameplates for normal power.
- .7 Red nameplates for emergency power.
- .8 Blue nameplates for UPS Power.
- .9 Sample:

SWITCHBOARD AA
3000A, 600/347V, 3 PH, 4W, 50kA
FED FROM SWITCHBOARD AAA
MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-####

- .10 Wording on nameplates to be approved by Engineer's Representative prior to manufacture.

- .11 Nameplates for splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.
- .12 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .13 Transformers: indicate capacity, primary and secondary voltages, and upstream source where Transformer is fed from.
- .14 Mechanical equipment: indicate equipment name and full circuit number including panel board identification.
- .15 Switchboards, Distribution Panels, and Panelboards: Name designation, rated ampacity, voltage, number of phases, and number of wires, if neutral is rated for 200%, interrupting capacity in units of kA, upstream source from which panelboard is fed, month and year manufactured, and serial number.
- .16 Automatic Transfer Switches (ATS): Name designation, rated ampacity, voltage, transfer switch arrangement (e.g. 3 pole with no neutral, 3 pole with solid neutral, 3 pole with overlapping neutral, 4 pole), withstand rating in units of kA, upstream normal power source from which ATS is fed, upstream emergency power source from which ATS is fed, month and year manufactured, and serial number.
- .17 Generators:
 - .1 Indicate kW rating, kVA rating, voltage, number of phases, number of wires, generator neutral grounding arrangement, year and month manufactured, and engine and alternator serial number.
 - .2 Indicate Maximum Site Design Load (as defined in CSA C282) in units of kW; engineering firm responsible for Maximum Site Design Load calculation; drawing number, issuance title (e.g. Issued for Construction, Electrical Contactor As-Built, Issued for CCN-E01, etc.), and issuance date which Maximum Site Design Load is based on. It is very important for future renovations and load additions that it is clear when the Maximum Site Design Load is from and what drawing it is based on.
 - .3 Sample nameplate:

Generator G1
600 kW / 750 kVA
600/347V, 3 PH, 4W, Wye solidly grounded
Connected to ATS-PHXA
MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-####
Maximum Site Design Load 420 kW

- .18 Provide nameplates on all electrical equipment including:
 - .1 Splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes
 - .2 Disconnects, starters and contactors, and Mechanical equipment
 - .3 Transformers
 - .4 Switchgear, Switchboards, Distribution Panels, and Panelboards
 - .5 Automatic Transfer Switches
 - .6 Generators

- .7 UPS equipment
- .8 Lighting control systems

2.1.2. Labels:

- .1 A printed label, similar to a Brady label 6 mm high letters unless specified otherwise, for internal components, such as relays, fuses, terminal blocks.

2.2. WIRING IDENTIFICATION

- 2.2.1. Identify wiring with permanent legible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- 2.2.2. Maintain phase sequence and colour coding throughout.
- 2.2.3. Colour code: in conformance with the electrical code.
- 2.2.4. Use colour coded wires in communication cables and control wiring, matched throughout system.

2.3. CONDUIT AND CABLE IDENTIFICATION

- 2.3.1. Colour code conduits, boxes and metallic sheathed cables.
- 2.3.2. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- 2.3.3. Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour:
 - .1 up to 250 V Normal Power = Green
 - .2 up to 600 V Normal Power = Blue
 - .3 up to 250 V Emergency Power = Black
 - .4 up to 600 V Emergency Power = Orange
 - .5 High Voltage, greater than 750 V = Large independent label clearly identifying the voltage
 - .6 Telephone/Data = White
 - .7 Fire alarm = Red
 - .8 Other security systems = Yellow
 - .9 Controls = Purple

2.4. RECEPTACLE IDENTIFICATION

- 2.4.1. For health care projects, conform to requirements of Section 26 05 21.01 – PATIENT CARE WIRING.
- 2.4.2. All receptacles including systems furniture receptacles and whip connections are to be labelled with the respective circuit numbers with a printed label, similar to a Brady label, with 12 mm characters. Circuit number to include full circuit number including panel board identification.
- 2.4.3. Label to be placed on wall above cover plate or on cover plate. Location of label to be consistent throughout project.

2.5. MANUFACTURERS AND CSA LABELS

- 2.5.1. Visible and legible after equipment is installed.

2.6. WARNING SIGNS

- 2.6.1. Provide warning signs, as specified, and/or to meet the requirements of the Inspection Authorities.

2.7. FUSE SIZE LABELLING

- 2.7.1. Contractor to install a label on all equipment with fuses to identify the fuse sizes and class that are installed in the respective equipment.
- 2.7.2. Contractor to also install a label on all equipment with fuses to identify the maximum allowable fuse size based on the size of the respective feeders.

3. Execution

3.1. NOT USED

END OF SECTION

26 05 83.00 Sleeves

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. Sleeves passing through stud partitions shall be 0.75 mm 22 US Gauge steel.

2.1.2. Sleeves passing through masonry walls shall be Schedule 40 steel pipe.

2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal or factory fabricated reusable type.

2.1.4. Where a housekeeping pad cannot be installed, sleeves passing through floors with waterproof membrane shall have a flashing collar, 50 mm wide at the membrane level. Flashing collar shall be continuously welded to sleeve. Sleeves shall extend 50 mm above the finished floor and shall be Schedule 40 steel pipe.

2.1.5. Where conduits pass through exterior foundation walls 6 mm thick steel sleeve of inside diameter not less the 75 mm greater than the outside diameter of the pipe shall be used and shall be complete with anchor collar. Thunderline Link-Seal wall seal or approved equal shall be used for the annular space between the sleeve and the conduit. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.

2.1.6. Provide adequate bracing for support of sleeves during concrete and masonry work.

2.1.7. Unless otherwise specified on the drawings, sleeves passing through the roof shall be liquid tight flexible conduit flashing consisting of a gooseneck shaped aluminum flashing sleeve with an integral deck flange, EPDM end cap seal and EPDM base seal.

3. Execution

3.1. INSTALLATION

3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Electrical Division for the Electrical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.

3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer's Representative.

3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers. At non-rated barriers fill the annular space between the service and the sleeve with fire rated insulation as specified for rated separations and caulk around the edges with a minimum 12 mm thick of fire rated compound or acoustic non-setting mastic.

- 3.1.4. Through all fire or smoke separations, after testing, the annular space between conduit sleeves shall be fire stopped.
- 3.1.5. Where-holes are to be installed in existing structure, contractor is to core drill the-holes required. Contractor is required to scan all areas prior to coring and confirm layout with structural engineer prior to completing work. When installing sleeves in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.
- 3.1.6. All sleeves are to extend 150 mm above finished floor to accommodate a 100 mm concrete pad. Contractor to pour the concrete pad with the pad extending 100 mm on all sides of the sleeve.

END OF SECTION

26 05 88.00 Cutting and Patching

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Div. 00, and Section 26 05 01.00, and shall be carried out by experienced workers.

2.1.2. Include for all cutting and patching for all Electrical services.

3. Execution

3.1. INSTALLATION

3.1.1. Cut all openings no larger than is required for the services. Core drill for individual services.

3.1.2. Obtain approval from the structural Engineer's Representative before cutting or core drilling any openings or-holes in slabs or structural elements.

3.1.3. Locate all openings in structure elements requiring cutting and patching, and x-ray the structure to obtain Structural Engineer's Representative's approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar, and completely avoiding electrical conduit.

.1 Cut-holes through slabs only.

.2 Do not cut-holes through beams.

.3 Holes to be cut are 200 mm (Diameter) or smaller only.

.4 Maintain at least 100 mm clear from all beam faces. Space at least 3-hole diameters on Centre.

.5 For-holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.

.6 For-holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.

3.1.4. X-ray scanning:

.1 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity. The company shall be licensed by the Canadian Nuclear Safety Commission (CNSC), and all radiography work shall be performed in accordance with the Nuclear Safety and Control Act.

.2 Follow any safety requirements stipulated by the property manager.

.3 Minimum requirements: All people must be evacuated within a radius of 10 m from each exposure location. Prior to conducting exposures verify this "safe zone". If the 10 m

radius includes public areas such as a sidewalk, lobby, or elevator, these areas must be controlled (e.g. elevators shut down or prevented from stopping on floors at which exposures are taking place). In addition, if exposure locations are near the walls of adjacent tenants, ensure the notification and evacuation of people within the 10 m radius. The 10 m radius applies to the camera floor and the floor directly below only. The qualified technician shall ensure adequate precautions for the additional floors above and below the camera floor.

- 3.1.5. Patch all openings after services have been installed to match the surrounding finishes.
- 3.1.6. In existing areas all cutting, and core drilling for individual services except where specifically noted, is part of this division work.
- 3.1.7. The cost of x-ray scanning, cutting, patching and finishing is included in this division contract.

END OF SECTION

26 27 26.00 Wiring Devices

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 05.00 – MOUNTING HEIGHTS.

1.1.4. Section 26 05 53.00 – IDENTIFICATION.

1.1.5. Section 26 51 13.00 – LIGHTING EQUIPMENT.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 42, General use receptacles, attachment plugs, and similar wiring devices, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. SWITCHES

2.1.1. 20 A, single pole, double pole, three-way, or four-way specification grade switches. Voltage rating of the switch to be as per the contract documents.

2.1.2. Manually-operated general purpose switches with following features:

- .1 Terminal-holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 Decora Style specification grade Rocker switch.
- .6 Colour to be selected by Architect/Engineer's Representative.

2.1.3. Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2. RECEPTACLES

2.2.1. All receptacles to be specification grade.

2.2.2. Duplex receptacles, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

- .1 Thermoplastic with impact-resistant nylon face moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Eight back wired entrances, four side wiring screws.

- .4 Triple wipe contacts and riveted grounding contacts.
- 2.2.3. Duplex receptacles with USB charging outlets, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
 - .1 Thermoplastic with impact-resistant nylon face moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Six back wired entrances, four side wiring screws.
 - .4 Triple wipe contacts and riveted grounding contacts.
 - .5 One USB A charging outlet and one USB C charging outlet, 5 V DC, 6 A shared between the two ports.
- 2.2.4. Hospital grade receptacles: As indicated in Section 26 05 21.01 – PATIENT CARE WIRING.
- 2.2.5. Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
- 2.2.6. Other receptacles with ampacity and voltage as indicated.
- 2.2.7. Receptacles to be coloured as follows:
 - .1 Normal Power – Colour to be selected by Architect/Engineer's Representative.
 - .2 Emergency/Essential Power – Red.
 - .3 Isolated Ground – Orange.
 - .4 Switched – Gray.
 - .5 UPS – Blue.
- 2.2.8. All dwelling receptacles of CSA configuration 5-15R and 5-20R shall be tamper resistant receptacles and shall be so marked; receptacles dedicated for microwaves, refrigerators, freezers or those receptacles located in an attic or crawl space shall not be required to be tamper-resistant.
- 2.2.9. All dwelling receptacles rated 125V, 20A or less shall be provided with arc-fault protection, except for the following:
 - .1 Bathroom and washroom basin receptacles.
 - .2 Kitchen counter receptacles
 - .3 Refrigerator receptacles
- 2.2.10. Arc-fault protection for dwelling unit receptacles shall be provided by:
 - .1 A combination-type arc-fault circuit interrupter
 - .2 An outlet branch-circuit interrupter installed at the first outlet on the branch circuit, where the wiring method for the portion of branch circuit between the branch circuit overcurrent device and the first outlet consists of metal raceway, armoured cable, or non-metallic conduit or tubing.
- 2.2.11. Electrical Contractor shall coordinate with furniture supplier to identify switched circuits prior to installation.
- 2.3. MANUFACTURERS
- 2.3.1. The switches and wiring devices shall be of one manufacturer throughout the project.
- 2.3.2. The following are acceptable manufacturers:

- .1 Legrand.
- .2 Hubbell.
- .3 Cooper.
- .4 Leviton.

2.4. DIMMERS

2.4.1. Dimmers shall be 600 W, 1500 W, 2000 W.

- .1 Full range, continuously variable control of light intensity.
- .2 Vertical slider allowing the light level to be set by the user.
- .3 Slide to Off.
- .4 Capable of operating at rated capacity.
- .5 Power failure memory.
- .6 Dimmers shall be available for direct control of incandescent, magnetic low voltage, electronic low voltage, fluorescent, and LED.

2.4.2. Electronic (solid-state) Low Voltage (ELV) transformer dimmers (incandescent).

- .1 Circuitry designed to control the input of Electronic (solid state) Low Voltage transformers.
- .2 Control up to 600 W of Electronic Low Voltage load.
- .3 Reset-able overload protection when capacity is exceeded.

2.4.3. LED dimmers.

- .1 Slide to Off only. Must match driver and LED requirements.

2.4.4. Manufacturers

- .1 Lutron Maestro Series.
- .2 Leviton True Touch Series.

2.5. SPECIAL WIRING DEVICES

2.5.1. Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type.

2.6. COVER PLATES

2.6.1. Cover plates for wiring devices.

2.6.2. Cover plates from one manufacturer throughout project.

2.6.3. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

2.6.4. Provide stainless steel cover plates, suitable for the respective device, for all devices mounted in flush-mounted outlet boxes located in finished areas.

2.6.5. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.6.6. Weatherproof rain tight while-in-use metal cover, complete with gaskets for duplex receptacles located outside or as indicated.

2.6.7. Weatherproof rain tight while-in-use metal cover, complete with gaskets for single receptacles or switches located outside or as indicated.

3. Execution

3.1. INSTALLATION

3.1.1. Switches:

- .1 Install single throw switches with handle in "UP" position when switch closed.
- .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .3 Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.
- .4 Mount toggle switches at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated.

3.1.2. Receptacles:

- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Mount receptacles at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

3.1.3. Dimmers:

- .1 Install dimmers as indicated. Provide suitable clearances in multi-gang boxes as recommended by the manufacturer to maintain the dimmer rating.
- .2 Coordinate the dimmer selection with the ballast/driver to be controlled, to ensure compatibility.
- .3 Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.

3.1.4. Cover plates:

- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.1.5. Labelling

- .1 Provide labels with panel name and circuit number on all receptacles in conformance with Section 26 05 53.00 – IDENTIFICATION.

END OF SECTION

26 51 13.00 Lighting Equipment

1. General

1.1. WORK INCLUDED

- 1.1.1. Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.
- 1.1.2. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.3. Section 26 05 04.00 – SUBMITTALS – SHOP DRAWINGS.

- 1.1.4. Section 26 05 21.00 – WIRES AND CABLES UNDER 2000 V.
- 1.1.5. Section 26 06 05.16 – LUMINAIRE SCHEDULE.
- 1.2. REFERENCES
 - 1.2.1. CSA C22.2 No. 74 – Equipment for Use with Electric Discharge Lamps, latest edition.
 - 1.2.2. The Consortium of Energy Efficiency (CEE) guidelines, latest edition.
 - 1.2.3. IESNA LM-79 – Approved Method: Electric and Photometric Measurements of Solid-State Lighting Products, latest edition.
 - 1.2.4. IESNA LM-80 – Approved Method: Measuring Lumen Maintenance of LED Light Sources, latest edition.
 - 1.2.5. The Certified Ballast Manufacturers Association (CBM) standards, latest edition.
 - 1.2.6. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts, latest edition.
- 1.3. SUBSTITUTION
 - 1.3.1. The lighting equipment for this project and specified herein has been carefully selected for its ability to meet the project's luminous environment requirements. Manual and computer calculations have been performed to ensure that the lighting equipment that has been specified complies with established criteria. The Engineer's Representative reserves the right not to accept any alternates or substitutions in accordance with the requirements of the Luminaire Schedule. If alternates or substitutions are entertained, then it is the responsibility of the Contractor/Supplier to provide: a comparison table showing the specified and the proposed luminaire performance information, IES files for the proposed luminaires, the information required herein, and detailed layouts and lighting calculations demonstrating that the performance of the alternate luminaire meets or exceeds the original lighting design while not consuming any additional energy. An extra review fee, per luminaire submitted, will be charged to the Contractor (with no additional costs to the Project Owner). Reviewed alternates may be rejected, regardless of the payment fee received, when alternates do not meet the project requirements. Invoices must be paid prior to Consultant's review starting or changes in the design documents to incorporate the proposed alternates after their review. The Contractor/Supplier is responsible to ensure the light levels provided in the alternate submittal package will achieve the design light levels. Where the light levels are not achieved, the Contractor is responsible to replace the luminaire with a luminaire that will meet the required levels with no increase in energy use at no cost to the Owner. Rather than replacing the luminaires, the Engineer's Representative may accept the installation of additional luminaires by the Contractor at no cost to the Owner in order to achieve the required light levels.
 - 1.3.2. Accompanying the request for a luminaire or lamp substitution, the contractor shall submit a complete lighting calculation report with photometric modeling of the space showing light levels including average, maximum, minimum and max to min values.
- 1.4. SHOP DRAWING AND PRODUCT DATA
 - 1.4.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
 - 1.4.2. Submit a shop drawing for each luminaire specified, including lamp.

- 1.4.3. Luminaire submittals are to consist of a physical description, manufacturer's specification sheets, dimensioned drawings, and complete photometric data from an independent test laboratory in the form of IES computer files of the equipment being submitted and hard copy of the photometric report. Coordinate ceiling types to ensure proper supports and luminaire framing.
- 1.4.4. Lamp submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, rated life, colour temperature, base type, lamp shape, CRI, and voltage.
- 1.4.5. LED submittals are to consist of manufacturer's technical data for diodes and drivers with respective luminaire shop drawing. Submittal to include operating wattage, voltage, maximum distance from drivers, wiring diagrams and lumen output at time of delivery.
- 1.4.6. Ballast submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, input voltage, ballast efficiency, maximum distance for remote ballasts, power factor, and operating temperature.
- 1.4.7. Where samples are indicated on the luminaire schedule, they are to be provided with shop drawings at time of shop drawing submittals unless noted otherwise.
- 1.4.8. Where luminaires consist of multiple field assembled components, include manufacturer supplied installation manual detailing the assembly procedure.
- 1.5. OPERATION AND MAINTENANCE DATA
 - 1.5.1. Provide operation and maintenance data for lighting equipment in accordance with Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS for incorporation into the manual.
 - 1.5.2. Operation and maintenance instructions shall include documentation related to warranty claim process.
- 1.6. FIXED PER UNIT COST LUMINAIRES
 - 1.6.1. Listed in the luminaire schedule are a fixed per unit cost for certain luminaire types. Electrical Contractor is responsible for completing a take-off of the drawings to determine quantity of each luminaire type and use the listed fixed unit price to calculate the total cost per luminaire type. The total cost for all luminaires shall be carried in the bid for the electrical contract. Provide a breakdown of the total cost, per luminaire type, that is carried under the electrical contract. All luminaires are to be included in the electrical contract including all luminaires identified with fixed unit costs. The Electrical Contractor is to include fixed per unit cost luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
 - 1.6.2. The fixed per unit cost excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost luminaires. Show the applicable taxes as a separate line item.
- 1.7. CASH ALLOWANCE LUMINAIRES
 - 1.7.1. Listed in the luminaire schedule are 'cash allowance' fixtures for certain luminaire types. A complete take-off of the drawings has been done to determine the quantity of each 'cash allowance' luminaire type and the total cost has been carried in the Div-0/1 cash allowance value. The total cost for all 'cash allowance' luminaires are NOT to be carried in the bid for the electrical contract.

- 1.7.2. After tender award to the successful Electrical Contractor, the Consultant shall provide the Electrical Contractor the exact manufacturer/model number(s) of all 'cash allowance' luminaires and the Electrical Contractor shall be responsible for purchasing the fixtures through the monies from the cash allowance.
- 1.7.3. Provide a breakdown of the total cost, per luminaire type, that is carried under the base electrical contract. All luminaires are to be included in the base electrical contract excluding all luminaires identified as 'cash allowance' luminaires. However the Electrical Contractor is to include 'cash allowance' luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS once the Consultant provides the Electrical Contractor with the exact manufacturer/model number(s).
- 1.7.4. The cash allowance value carried excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all 'cash allowance' luminaires. Show the applicable taxes as a separate line item.
- 1.8. WARRANTY
- 1.8.1. The manufacturer shall provide a warranty against defects in material and workpersonship, starting at substantial completion. Parts warranty shall be 5 years and labour warranty shall be 1 year.
- 1.8.2. LED's, Drivers, Lamps and ballasts showing signs of premature failure shall be replaced at no cost to the owner.
- 1.8.3. LED Drivers must have a 5 year warranty.
2. Product
- 2.1. GENERAL
- 2.1.1. All products must be CSA or CUL approved.
- 2.2. LAMPS AND LEDS
- 2.2.1. All Lamps are to meet the standards of the Consortium of Energy Efficiency (CEE) guidelines.
- 2.2.2. Refer to luminaire schedule for project specific details, and lamps required.
- 2.2.3. Lamps are to be in accordance with the lamp specifications detailed in the Luminaire Schedule and as noted below. Luminaire schedule shall take precedence where differences occur.
- 2.2.4. All lamps are to be new and are to be from the same manufacturing batch to avoid colour differences. Replace all lamps that exhibit colour shift, or exhibit premature lumen intensity decline, at no cost to the owner.
- 2.2.5. Light Emitting Diodes (LED)
 - .1 LEDs shall meet the standards of IESNA LM-79 and LM-80.
 - .2 All LED drivers shall be tested and comply with the maximum in-rush current limits as stated in NEMA 410.
 - .3 LED's shall be manufactured by Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, or Samsung. Colour temperature shall be as indicated on the luminaire schedule. Lamps

are to be binned with no visible colour variance (+/- 100K from specified colour temperature). Rated life for 1 watt white LED shall be 50,000 hours. Lumen output to be maximum based on latest technology at time of delivery.

- .4 All LED luminaires that present signs of failure on site, within the warranty period, must be replaced at no cost to the owner. If temporary luminaires are required to replace any failed LED luminaires, during the waiting time for parts (i.e. drivers, boards, heat sinks, etc.), the labour cost including installation, temporary luminaire supply, temporary luminaire removal and reinstallation of the LED luminaire must be provided at no cost of the owner. Additional electrical costs, associated with higher Wattage temporary luminaires, must be reimbursed with interest to the owner by the manufacturer.
- .5 In case of failure of an LED luminaire, complete or part thereof, an independent third party testing Laboratory (approved by Smith + Andersen) shall be commissioned by the manufacturer or vendor to perform tests on samples taken from the failed luminaires installed on corresponding site. All reporting including the test results must be submitted to Smith + Andersen for evaluation and final approval.
- .6 Any additional time involved by Smith + Andersen will be billed at our hourly rates to the manufacturer or vendor.

2.3. DRIVERS

- 2.3.1. All drivers are to be tested and comply with maximum in-rush current limits within NEMA 410 standards. This is to be clearly indicated on shop drawing submittal.
- 2.3.2. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
- 2.3.3. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
- 2.3.4. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
- 2.3.5. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
- 2.3.6. Total Harmonic Distortion less than 20 % percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
- 2.3.7. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
 - .1 Adjustment of forward LED voltage, supporting 3 V through 55 V.
 - .2 Adjustment of LED current from 200 mA to 1.05 A at the 100 percent control input point in increments of 1 mA.
 - .3 Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
- 2.3.8. Driver must be able to operate for a (+/- 10%) supply voltage of 120 V through 277 VAC at 60 Hz.

- 2.3.9. Driver must be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
- 2.3.10. Driver shall include ability to provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts or less in this standby. Control deadband between 0.5 V and 0.65 V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.
- 2.3.11. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 % relative light output, or 100 – 1 % light output and step to 0 % where indicated. Driver shall respond similarly when raising from 0 % to 100 %
- .1 Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
- 2.3.12. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels
- 2.3.13. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
- 2.3.14. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:
- .1 LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
- .2 Base specification: Flicker index shall less than 5% at all frequencies below 1000 Hz.
- .3 Preferred specification: Flicker index shall be equal to incandescent, less than 1% at all frequencies below 1000 Hz.
- 2.3.15. Control Input
- .1 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
- .1 Must meet IEC 60929 Annex E for General White Lighting LED drivers
- .2 Connect to devices compatible with 0 to 10 V Analog Control Protocol, Class 2, capable of sinking 0.6 mA per driver at a low end of 0.3 V. Limit the number of drivers on each 0-10 V control output based on voltage drop and control capacity.
- 2.3.16. Must meet ESTA E1.3 for RGBW LED drivers
- 2.3.17. Provide drivers manufactured by Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, Samsung, or Edoleds.
- 2.4. BALLASTS
- 2.4.1. All Ballasts shall comply with CSA C22.2 No. 74 and are to meet or exceed the standards of the Certified Ballast Manufacturers Association (CBM).
- 2.4.2. All ballasts shall be tested and comply with maximum in-rush current limits as stated in NEMA 410.
- 2.4.3. Not all ballasts could be used, refer to luminaire schedule for project specific details.

- 2.4.4. All ballasts shall be manufactured by Osram/Sylvania, Philips, Advance, GE, Lutron or Magnetek unless indicated otherwise. Ballasts shall operate at voltage and control lamps as noted in the Luminaire Schedule.
- 2.4.5. Ballasts shall contain no PCB's and audible rating will be class A or better.
- 2.4.6. Racks are to be provided for remote ballasts.
- 2.4.7. Ballasts with unacceptable noise levels are to be replaced at no cost to the owner.

2.5. LUMINAIRES

- 2.5.1. All luminaires are to be complete with mounting brackets, transformers, supports, trims, louvers, lenses and other accessories as required to make luminaire operational and allow it to be installed in the respective location.
- 2.5.2. Luminaires shall be suitable for the environment where installed, include seals and gaskets, and corrosion resistant baked-on finish as required and as specified.
- 2.5.3. Louvers, lenses and diffusers must be of suitable thickness to prevent sagging.
- 2.5.4. Where drawings show luminaires mounted end-to-end, luminaires shall be suitable for continuous, seamless and tandem mounting.
- 2.5.5. All poles are to come complete with internal vibration dampeners to accommodate wind conditions to avoid damage due to wind-induced vibrations.
- 2.5.6. All concrete bases for poles and bollards shall be designed to accommodate the height, weight, etc. of the pole/bollard and its accessories for the soil conditions for which it is installed. Engineered shop drawings shall be provided that is signed by a structural engineer registered in the local jurisdiction.
- 2.5.7. Where cameras are shown to be installed on poles, the poles shall be stiffened to reduce vibration and sway, and shall be rated for video recording cameras.
- 2.5.8. The supply and installation of fixed per unit cost and 'cash allowance' luminaires shall comply with all standards set forth in Electrical Specifications. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost and 'cash allowance' luminaires.
- 2.5.9. The following is a list of generic type designation for luminaires. The project specific luminaire schedule is to be referenced for the specific types and designations and the respective specifications.
 - .1 Designations beginning with the letter 'L' denote LED type.
 - .2 Designations beginning with the letter 'X' denote exit sign.

3. Execution

3.1. INSTALLATION

- 3.1.1. It is the responsibility of the contractor to obtain the information related to the luminaire and luminaire trim finishes/colours from the Interior Designer or Architects prior to the fabrication of luminaires. The Contractor shall provide adequate time for the design team to review and comment on luminaire and luminaire trim finishes.

- 3.1.2. The contractor will provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and other related lighting equipment as specified herein. Lamps for all equipment will be provided and installed by the contractor according to equipment manufacturer's instructions.
- 3.1.3. The Electrical Contractor shall be responsible for the supply and installation of all concrete bases for poles and bollards. Unless otherwise shown on the drawings, concrete bases to be ArtForm style or Approved Equal and shall extend a minimum 900 mm above grade in parking lots and a minimum 150 mm above grade in pedestrian walkways.
- 3.1.4. Poles and bollards are to be installed on independent concrete bases unless indicated otherwise on the drawings or schedules. Coordinate brackets for cameras and supports for banners with pole manufacturer.
- 3.1.5. Install remote ballasts in racks and wire luminaires to ballasts in conduit. Provide wiring as per manufacturer's recommendations.
- 3.1.6. Locate luminaires in accordance with the Architect's Drawings. Coordinate exact locations on site. Refer to Architect's drawings for dimensions of coves and valences.
- 3.1.7. Install in accordance with Manufacturer's Instructions, Local Codes, Electrical Division Drawings and Specifications.
- 3.1.8. All suspended luminaires shall have cables and support stems vertically aligned.
- 3.1.9. Suspend luminaires in mechanical rooms after all the mechanical equipment and ductwork are installed. Luminaires are not to be suspended from mechanical pipes, ductwork or other building services.
- 3.1.10. All luminaires shall be installed underneath other services located within ceiling space. Contractor is responsible for interference drawings to ensure all services in ceiling are coordinated.
- 3.1.11. Any dimensions provided in the drawings or schedules are intended as general guidelines. For exact dimensioning refer to the Architectural drawings. The detailed information shall be cross referenced with the electrical specifications and the Luminaire Schedule applying the most stringent requirement.
- 3.1.12. It is the responsibility of the Electrical Contractor to coordinate luminaire trims and mounting system with ceiling finishes. Luminaires delivered on site with the wrong ceiling mounting system shall be replaced without additional costs for the owner. Restocking fees will not be accepted.
- 3.1.13. For suspended ceiling installations support luminaires from structural slab in accordance with local inspection requirements.
- 3.1.14. Where luminaires are mounted in tandem, align luminaires mounted in continuous rows to form straight uninterrupted line.
- 3.1.15. Align luminaires mounted individually parallel or perpendicular to building grid lines.
- 3.1.16. Ensure light leakage does not occur from openings and trim rings. Contractor is responsible to repair the ceiling at no cost to the Owner if cut-out is too large.
- 3.1.17. Connect luminaires to lighting circuits.
- 3.1.18. Provide all wiring in conduit with junction boxes on a grid pattern to limit the run of flexible armoured cable drops from the ceiling mounted junction box to each luminaire to a maximum of 3 m in length unless approved otherwise in writing from the Engineer's Representative.
- 3.1.19. Modular wiring systems shall be employed only where indicated or with approval of the Engineer's Representative.

- 3.1.20. Luminaires are not to be used as temporary construction lighting. After being tested to ensure acceptable operation, luminaires will not be used until substantial completion unless permission is received from the owner, architect or Engineer's Representative.
- 3.1.21. Lamps are to be installed after luminaire is cleaned.
- 3.1.22. Clean all luminaires, inside and out at time of substantial completion. Replace all scratched or damaged luminaires, lenses, louvers and diffusers at no cost to the owner.
- 3.1.23. Installation of exit signs
 - .1 Rough-in and installation of exit signs shall be carefully coordinated on site such that after installation of all equipment/services, including equipment/services from other trades (i.e. sprinkler lines, plumbing pipes, way-finding signs, etc.), shall not interfere with the line-of-sight visibility of the exit sign(s) from approach of the intended egress pathway(s).
 - .2 If exit sign(s) have been installed and do not meet the satisfaction of the Engineer's Representative/Architect, the Contractor shall lower, raise or relocate the exit sign(s) such that proper and adequate visibility of the exit sign(s) is achieved at no additional cost to the Owner.

END OF SECTION

28 31 01.00 Fire Alarm System

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CAN/ULC-S524, Installation of Fire Alarm Systems – latest edition.

1.2.2. CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems – latest edition.

1.2.3. CAN/ULC-S537, Verification of Fire Alarm Systems – latest edition.

1.2.4. OBC - Ontario Building Code – latest edition.

1.2.5. CAN/ULC-S1001 - Integrated Systems Testing of Fire Protection and Life Safety Systems – latest edition.

1.3. SYSTEM DESCRIPTION

1.3.1. The fire alarm system and devices shall be installed according to CAN-CSA latest edition and the requirements of the local authorities having jurisdiction.

1.3.2. All wiring shall be installed in conduit and to conform to the requirement of the Ontario Electrical Safety Code, 25th edition or local code having jurisdiction. Provide a ground wire in all conduits.

1.3.3. Confirm the exact location of all system components with the architectural consultant prior to roughing-in.

1.3.4. Contract base building fire alarm contractor to install all devices and make final connections to fire alarm panel.

1.3.5. Ensure that the nomenclature of annunciator's identification nameplates, are verified with the owner and authorities prior to ordering.

1.3.6. All work on the fire alarm system to be performed by a certified fire alarm technician.

1.3.7. When the fire alarm system is complete, obtain the services of base building fire alarm manufacturer to make a complete inspection and verifications of all installed fire alarm equipment and devices.

1.3.8. Perform any changes necessary as a result of the above verification and inspection in accordance with the manufacturer's directions.

1.3.9. On completion of the verification, inspection and testing obtain the verification certificate and inspection reports from the manufacturer and forward to the owner.

1.3.10. Fire alarm signaling devices to be installed and tested in compliance with Ontario Building Code (latest edition) section 3.2.4.20. (audibility).

.1 For speakers, set at 0.5 watt tap and modify up if required to achieve audibility. Tap setting shall not be set at or increased to cause the sound pressure level to be more than 100 dBA when measured 3m from the device.

.2 For horns with adjustable volume settings, set at mid volume and modify up if required to achieve audibility. Volume setting shall not be set at or increased to cause the sound pressure level to be more than 100 dBA when measured 3m from the device.

Audibility testing shall be performed with all walls, windows, ceilings, ceiling tiles, etc. installed in the space/area. If audibility is determined to be insufficient at time of occupancy, the Contractor shall be responsible for all costs associated with increasing the tap settings of the signalling device to achieve Code minimum audibility. Include for all costs in tender.

- 1.3.11. Ensure that all costs for the above testing, verification, inspection are included in the tender price.
- 1.3.12. Where the integrity of the existing life safety input and output devices are affected due to relocations, ceiling demolitions and/or re-installations onto new suspended ceiling, electrical contractor shall be responsible to maintain the system operation at all times. All suspension accessories required for the installation (e.g., mounting channels and frames, etc.) and verification of the system shall be included in the tender prices.
- 1.3.13. Testing and commissioning of the integration of all life safety and fire protection systems shall be required. Follow the guidelines as outlined in the CAN/ULC-S1001 standard. Where applicable, the testing of the integrated systems shall include, but not limited to the following systems:
 - .1 Fire Alarm
 - .2 Emergency Lighting

The Contractor shall be responsible for performing and providing a commissioning report of all the applicable systems installed, that they have been tested as a whole to ensure the proper operation and inter-relationship between the systems. Include for all costs in the tender prices.

END OF SECTION