PROJECT MANUAL

Issued for Bid

Kawartha Heights P.S.
Classrooms 4, 5, 6, & 7 Renovations
11 Kawartha Heights Boulevard
Peterborough, Ontario

CMV Group Architects
20 Camden Street
Toronto, Ontario
M5V 1V1

Tel: 416-506-1600

Project No. 23A123

March 13, 2024

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 A - Denotes documents prepared by Architect.

.2 E - Denotes documents prepared by Electrical Engineer.

.3 M - Denotes documents prepared by Mechanical Engineer.

.4 O - Denotes documents prepared by Owner.

.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:

Kawartha Pine Ridge District School Board
1994 Fisher Drive
Peterborough, Ontario
K9J 7A1

Tel: 705-742-9773
Fax: 705-742-7801

.2 Architect (the *Consultant*):

CMV Group Architects
20 Camden Street, Suite 101
Toronto, Ontario
M5V 1V1

Tel: 416-506-1600

.3 Mechanical Engineer:

The Mitchell Partnership Inc.
285 Yorkland Boulevard
Toronto, Ontario
M2J 1S5

Tel: 416-499-8000

.4 Electrical Engineer:

Hammerschlag + Joffe Inc.
43 Lesmill Road
Toronto, Ontario
M3B 2T8

Tel: 416-444-9263

END OF SECTION

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

Table of Contents

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

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

.1 *Contract Documents* conventions.

.2 *Contract Documents* for construction purposes.

.3 Law, notices, permits and fees.

.4 Documents at the *Place of the Work*.

.5 Use of premises and the *Place of the Work*.

.6 Items supplied by *Owner*.

.7 Electronic files.

.8 Incentives, Rebates, and Refunds.

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*.

.7 The use of the words “include” or “including”, or variations thereof, within the *Contract Documents* is not limiting.

.8 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*.

.9 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*.

.10 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 *Contract Documents* in accordance with GC 1.1.12.

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.

.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* documents in accordance with GC 1.1.13, supplemented with the following:

.1 Construction and submittal schedules.

.2 RFI responses and RFI log.

.3 Field test reports and independent testing reports.

.4 *Consultant's* field review reports and deficiency reports.

.5 Manufacturer's field review reports.

.6 Reports by authorities having jurisdiction.

.7 Building and other applicable permits, and related permit documents.

.8 Daily log including:

.1 Weather (precipitation, high and low temperatures, wind, and visibility).

.2 Pertinent conditions at the *Place of the Work* (muddy, flooded, frozen ground, water level).

.3 Number of workers actively working at the *Place of the Work* by each subcontract.

.4 *Subcontractors* working at the *Place of the Work*.

.5 Parts of the *Work* being worked on.

.6 Working hours worked at the *Place of the Work*.

.7 Activities with intermittent progress.

.8 Time lost and explanation for such time lost.

.9 Difficulties (work scheduled to start but did not with the reason why, delays, labour inefficiencies, labour shortage, weather).

.10 *Products* and materials delivered.

.11 Equipment mobilized and/or demobilized.

.12 Demolition conditions.

.13 Start and finish date of each part of the *Work*.

.9 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.

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 *Substantial Performance 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.

.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.

1.9 Incentives, Rebates, and Refunds

.1 The *Contractor* shall, at the request of the *Owner*, assist the *Owner* with, join in with the *Owner* for, or, at *Owner's* expense, make application on behalf of the *Owner* for, any exemption, recovery, rebate, or refund.

.2 Provide the *Owner* with copies, or originals (where required) of records, invoices, purchase orders, or other documentation as may be necessary to support such application.

.1 Such documentation shall be in the form and to the level of detail required by the authorities governing the incentive being targeted.

.3 Incentives being targeted include:

.1 SaveOnEnergy Lighting Incentive:

.1 Incentives are available to upgrade to LED lighting, with either a new fixture or retrofit kit. Occupancy sensors are also eligible.

.2 To complete the pre-project application, the following information and documentation is required and shall be prepared and submitted by the *Contractor*:

.1 Specified Luminaire model number, (if not specified, a complete model number can usually be determined if lumens and warmth is specified).

.2 Luminaire must be DLC listed.

.3 Number of Luminaires.

.4 Estimated cost (supply and installation).

.3 To complete the post-project submission, the following information and documentation is required and shall be prepared and submitted by the *Contractor*:

.1 Itemized invoice.

.2 Proof of payment.

.3 Disposal documentation.

.4 Reviewed shop drawings.

.5 Photo Documentation, including photos of removed luminaires. For additional requirements, see information sheet appended to Section 01 32 00.

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 disclose originals of all bids, quotations, and other price-related information received from potential *Suppliers* or *Subcontractors*.

.3 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).

.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 $5,000.00 which covers the following items:

.1 Independent inspection and testing per Section 01 45 00.

PART 2 - PRODUCTS
Not applicable.

PART 3 - EXECUTION
Not applicable.

END OF SECTION

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 a *Product* or manufacturer is specified by proprietary name(s), unless there is accompanying language indicating that Substitutions will not be considered.

.3 *Contractor* may propose a Substitution wherever a *Product* or manufacturer is specified by proprietary name(s) and accompanied by language such as "or equal", "or approved equal", or other similar words. Do not construe such language as an invitation to unilaterally provide a Substitution without *Consultant’s* prior acceptance in writing. 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*.

.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*.

.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.

.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.

.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 Schedule of labour rates.

.2 Schedule of equipment rates.

.3 *Supplemental Instructions*.

1.2 Schedule of Labour Rates

.1 Prior to the first application for payment, submit for the *Consultant's* review a schedule of labour rates for all trades and classifications of trades, such as journeymen, apprentices, and foremen that will be employed in the *Work*. Provide a breakdown of payroll burden component of labour rates.

.2 Labour rates shall reflect the salaries, wages, and benefits paid to personnel in the direct employ of the *Contractor*, *Subcontractors*, and sub-*Subcontractors*, stated as hourly rates, that will be used when:

.1 Preparing price quotations for *Change Orders*.

.2 Determining the cost of work attributable to *Change Directives*.

.3 Labour rates stated in the schedule of labour rates shall be consistent with rates that will actually be paid, and payroll burden costs that will actually be incurred, in the normal performance of the *Work*, during regular working hours. Labour rates shall not include any additional overhead and profit component.

.4 Where collective agreements apply, the labour rates shall not exceed those established by collective agreement.

.5 Obtain the *Owner's* written acceptance of the schedule of labour rates before submitting the first *Change Order* quotation.

.6 Accepted schedule of labour rates will be used solely for evaluating *Change Order* quotations and cost of performing work attributable to *Change Directives*.

.7 The *Contractor* may request amendments to the accepted schedule of labour rates if changes in the labour rates that will actually be paid, or payroll burden cost that will actually be incurred, in the normal performance of the *Work* can be demonstrated. Obtain the *Owner's* written acceptance of such changes.

1.3 Schedule of Equipment Rates

.1 Prior to the first application for payment, submit for the *Consultant's* review a schedule of equipment rates for *Contractor* owned *Construction Equipment*.

.2 Equipment rates shall reflect the rates that will be used when:

.1 Preparing price quotations for *Change Orders*.

.2 Determining the cost of work attributable to *Change Directives*.

.3 Equipment rates stated in the schedule shall be consistent with local equipment rental market rates and shall not include any additional overhead and profit component.

.4 Provide equipment rates for hourly, daily, weekly, and monthly use.

.5 Obtain the *Owner's* written acceptance of the schedule of equipment rates before submitting the first *Change Order* quotation.

.6 Accepted schedule of equipment rates will be used solely for evaluating *Change Order* quotations and cost of performing work attributable to *Change Directives*.

.7 The *Contractor* may request amendments to the accepted schedule of equipment rates if changes in local equipment rental market rates can be demonstrated. Obtain the *Owner's* written acceptance of such changes.

1.4 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.

PART 2 - PRODUCTS
Not applicable.

PART 3 - EXECUTION
Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

.1 Schedule of values.

.2 Cash flow projection.

.3 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 acceptable to *Consultant* and *Owner* and that includes the following:

.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 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 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 Project manager and 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 Project Manager and Superintendent

.1 Provide project manager, 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.

.2 The *Contractor* shall appoint project manager and 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 The project manager shall fulfill the role of supervisor in accordance with GC 3.5.

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 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:

.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 same as well as an 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

PART 1 - GENERAL

1.1 Section Includes

.1 Project meeting requirements.

1.2 Administrative

.1 The *Contractor* shall prepare agendas for meetings specified herein.

.1 Agendas shall include, as a minimum, the agenda items specified in the *Contract Documents*.

.2 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.

.3 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.

.4 Representatives of parties attending meetings shall be authorized to act on behalf of the parties they represent.

.5 *Subcontractors* and *Suppliers* shall attend meetings only when directed by the *Consultant*, or when specifically called for in the *Contract Documents*.

.6 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 *Consultant*.

.4 *Owner*.

.5 Independent inspection and testing company.

.3 Agenda to include the following:

.1 *Owner's* guidelines and policies.

.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 Review of waste management and disposal procedures and requirements.

.17 As-built documents.

.18 Operation and maintenance manuals.

.19 Take-over procedures, acceptance, warranties.

.20 Publication to be used for publishing certificate of substantial performance.

.21 Progress claims, administrative procedures, holdbacks.

.22 Insurances, transcripts of policies.

.23 *Contractor's* safety procedures.

.24 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*.

.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 as directed by the *Consultant*.

.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.

.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 30 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.

.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.

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 Recording actual site conditions on as-built documents.

.5 Schedule management.

.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 accordance with GC 3.4.1.

.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.

.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 in accordance with GC 3.4.1.

.2 *Consultant* will review format and content of initial schedule and request necessary changes, if any, within 10 *Working Days* after receipt.

.3 If changes are required, resubmit finalized initial schedule within 5 *Working Days* after return of review copy.

.4 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*.

.5 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.

.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.

.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.

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

RETROFIT PROGRAM

Photo Requirements

Type of photos required for each type of equipment** being replaced and installed

Photos Required	Details Required
Close-up	• Must contain the entire piece of equipment, including where the equipment meets the ground or wall • For lighting, the number of lamps per fixture must be identifiable and photos for each type of fixture are required • A time-stamp for the photo indicating the date it was taken*
Long-shot	• Must show spread of equipment in facility to verify quantity in application • A time-stamp for the photo indicating the date it was taken*
Nameplate* **	• Must include the model number • Must include the equipment specifications (i.e.,wattage, horsepower) • For lighting, a nameplate photo is required for each type of lamp if the wattage for the lamps are different between fixtures • A time-stamp for the photo indicating the date it was taken*

*If a time-stamp cannot be provided, the photos can be supplemented with confirmation by the participant identifying the date the photos were taken

**Only one set of photos is required for each type of equipment being replaced. For example, if there are 100 of the same lamps existing in a facility, then only one set of close-ups, long-shot and nameplate pictures would be required. There is no need to provide photos of every single lamp

***If the equipment is difficult or expensive to access, you may defer providing nameplate pictures. Ensure you collect the nameplate photographs during the decommissioning of the existing equipment and submit them during the Post-Project stage.

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RETROFIT PROGRAM

Photo Best Practices

The following best practices will help to ensure that all photos meet technical requirements and will reduce the risk that further photos are requested by the technical reviewer, which may delay approval of your application.

Please note that photos are required if your application meets the criteria as outlined in the QA/QC guideline. Note that some applications may be selected at random for QA/QC. In this instance, technical reviewers will request further documentation to support your application which will include photos. Therefore, it is advisable as a best practice to always take photos prior to starting your project.

Best Practices:

- Take extra photos to fully document the scope of work and make sure that you will not have to return to the facility site if more photos are required
- No people should be visible in the pictures
- Pictures that are supposed to capture numbers or words need to be in focus and legible (i.e., model numbers, performance specs)
- Double check the legibility of photos on your camera (by zooming in on the pictures) before leaving the site
- Be careful of shadows and bright reflections in the pictures. Try using different camera angles or enabling/disabling flash to fix these types of issues
- The exposure lock function of some phones/cameras can sometimes help to get a good exposure for the picture. Check your device's camera instructions for how to use this common feature

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POWER WHAT'S NEXT

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*.

.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 Notify *Consultant* in writing of changes made on submittals from *Contract Documents*. *Consultant's* review of submittals shall not relieve *Contractor* of responsibility for changes made from *Contract Documents* not covered by written notification to *Consultant*.

.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.

.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 $1,000,000 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.

.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.

.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 x100 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.

.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.

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 though gypsum board wall assembly; single metallic pipe though 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:

.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 *Consultant's* 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.

.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.

.6 Noise Control.

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 In consultation with, and to acceptance of, the *Consultant* in the presence of the *Owner*, designate an entrance and a circulation route that workers shall use and that shall not be used by *Owner’s* staff, building occupants, or the public.

.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.

.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.

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 new or existing laundry and garbage chutes shall not be permitted.

.6 Use of existing containers and garbage bins shall not be permitted.

.7 Use of existing elevators shall not be permitted.

.8 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*.

.9 Sanitary facilities: in accordance with Section 01 52 00.

1.4 Existing Services

.1 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.

.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*.

.2 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.

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.

.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.

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.

.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 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.

.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*.

.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*.

.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*.

.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 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 7 days of each inspection.

.3 Distribute reports in accordance with GC 2.3.3, supplemented digitally to the following:

.1 *Owner*.

.2 *Consultant*.

.3 *Contractor*.

.4 Consulting engineers, as applicable.

.4 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*.

.5 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.

.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 Mock-ups may not become part of finished work, except with explicit, 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

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.

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 Solid fuel salamanders will not be permitted.

.4 Furnish other temporary heating as required by various sections of the *Specifications* or by *Product* manufacturers.

.5 Ventilate to the exterior of the building work areas as required when toxic materials are being utilized or cured.

.6 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 and computer.

.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 There is no reserved parking. Parking is on a first-come-first-served basis. 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 Provide and maintain temporary sanitary facilities for use by workers. The use of existing building’s sanitary facilities by workers shall be prohibited.

.2 Use of new sanitary facilities by workers is prohibited.

1.5 Temporary Site Offices

.1 Provide heated, lighted, air conditioned and ventilated site office, of sufficient size to accommodate site meetings for 12 people, and furnished with drawing layout table, filing cabinets, telephone, and computer as described below.

1.6 Temporary Telephone and Computer

.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.

1.7 Fire Protection

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

.2 Refer also to Section 01 35 13.

1.8 Temporary Site Storage

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

.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*.

1.9 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.

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 Protection of the public.

.4 Protection of the *Work*.

.5 Protection of foundations.

.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 Provide temporary weather-tight enclosures and protection for exterior openings in building as soon as walls, floors and roofs are built so as to protect the *Work* from weather and vandalism. Provide doors in enclosures as necessary to maintain fire exits.

.3 Erect, maintain, and relocate enclosures as required to facilitate construction operations and *Owner's* operational requirements.

.4 Temporary enclosure and protection shall be of finished appearance and painted to colour approved by *Owner*.

.5 Provide dust seal and sound resistant enclosures to protect existing building and operations as indicated. Include temporary doors, fastenings and keys.

.6 Insulate and airseal exterior enclosures to prevent condensation and drafts.

.7 Supplement these requirements in accordance with Section 01 35 13.

1.4 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.

1.5 Fire Routes

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

1.6 Protection of the *Work*

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

.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*.

.4 Provide plywood protection to precast stair treads, until *Ready-for-Takeover*.

.5 Protect historically important surfaces during the course of the *Work* and remove protection only for the purposes of cleaning or restoration work. Protect such surfaces from damage caused by impacts, moisture, weather, lubricants, corrosive materials, paint, weld spatter, exhaust fumes, and chemicals that could leave stains or residues. Ensure that historically important surfaces are protected from exposure to precipitation by providing temporary flashings at tops of walls and other locations where moisture may collect and enter masonry assemblies.

1.7 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.

END OF SECTION

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* and the *Work*, and for securing areas used for the storage of *Products* or construction machinery and equipment. 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.

.3 Refer also to Section 01 35 13.

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.

.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 and the *Owner*.

.10 Prevent abrasive-blasting, pressure-washing spray, and other extraneous materials from contaminating air beyond application area.

.11 Supplement these requirements in accordance with Section 01 35 13.

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

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.

.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.

.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 may be deemed as 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 This 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*, and *Products* or systems proposed for use in the work that are not the named basis of design follow procedures for product substitutions specified under 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.

.3 Setting out the *Work*.

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*.

.8 Work adjacent to public property:

.1 Verify before commencing portions of the *Work* adjacent to public and private properties, that no plans for altering clearances, set-backs, easements, grades, or otherwise have been established by authorities having jurisdiction, subsequent to issuance of the building permit.

.2 Notify *Consultant* of any such plans that will affect the *Work* and proceed as directed by *Consultant*.

1.3 Public Utilities and Services

.1 Prior to commencement of the *Work* at the *Place of the Work*, verify limitations imposed on the *Work* by presence of utilities and services, and cause no damage to them as a result of the *Work*.

.2 Before commencing excavation, drilling or other earthwork, establish or confirm location and extent of existing underground utilities and structures at the *Place of the Work*.

.3 Promptly notify *Consultant* if underground utilities, structures, or their locations differ from those indicated in *Contract Documents* or in available project information. *Consultant* will provide appropriate direction.

.4 Notify service authorities concerned so that they may protect, remove, relocate, or discontinue existing utilities and services, as they may require.

.5 Record locations of maintained, re-routed, and abandoned utility lines.

1.4 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 Contractor* 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 Inserts, anchors, and fasteners.

.2 Penetrations.

.3 Concealed services.

.4 Trademarks and labels.

.5 Interferences.

.6 Publicity releases and photographs.

.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.

.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 E1190-21 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.

.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.

.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. 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 Protect finished flooring from damage. Take special measures when moving heavy loads or equipment on them.

.6 Keep surfaces free of oils, grease or other materials that may damage or deface them or affect bond of applied *Products*.

.7 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:

.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

PART 1 - GENERAL

1.1 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.

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 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.

.2 Remove and replace defective and non-conforming work.

.3 Remove samples of installed work for testing if directed by *Consultant*.

.4 Provide openings in non-structural elements of the *Work* for penetrations of mechanical and electrical work.

.5 Perform work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

.6 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.

.7 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*.

.8 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*.

.9 Restore work with new *Products* in accordance with requirements of *Contract Documents*.

.10 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and with suitable allowance for deflection, expansion, contraction, and firestopping.

.11 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.

.12 Completely seal voids of penetrations of fire rated wall, ceiling, and floor constructions with firestopping and smoke seals.

.13 Execute cutting, patching, and remedial work in manner that does not jeopardize manufacturers' warranties.

.14 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.

.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.

.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, remove surplus *Products* and construction machinery and equipment not required for the performance of the remaining *Work* and clean in accordance with Final Cleaning paragraphs in Section 01 74 00 to the greatest extent practicable given work remaining to be completed. Cleaning shall be to a sufficient extent to permit the *Consultant's* review to be performed properly and reasonably.

.5 Final cleaning:

.1 Before final cleaning, arrange a meeting at *Place of the Work* to determine the acceptable standard of cleaning. Ensure that *Owner*, *Consultant*, and *Contractor* are in attendance.

.2 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*.

.3 Remove waste material and debris from crawlspaces and other accessible concealed spaces.

.4 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.

.5 Clean exterior and interior window glass and frames.

.6 Remove stains, spots, marks and dirt from decorative parts of the *Work*, electrical and mechanical fixtures, furniture fittings, walls, and floors.

.7 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.

.8 Clean floor finishes in accordance with manufacturer's written requirements.

.9 Remove non-permanent labels.

.10 Remove dirt and residue from surfaces.

.11 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.

.12 Remove protective coatings, clean surfaces and remove excess compounds and sealant materials. Make good defective, scratched or damaged work.

.13 Clean equipment and fixtures to a sanitary condition,

.14 Remove seal wrap and protective coverings from mechanical and electrical *Products* and materials and clean as required.

.15 Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment.

.16 Clean and/or replace lighting reflectors, lamps, light fixtures, lenses, bulbs, and other lighting surfaces, and grilles.

.17 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.

.18 Lock or otherwise restrict access to each room or area after completing final cleaning in that area.

.19 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.

.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

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 *Place of the Work*, 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 *Place of the Work*.

.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.

.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 *Place of the Work*.

.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*, as amended.

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.

.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.

.7 Return all Project documentation to *Owner* at completion of the *Contract*.

1.8 Warranty Period

.1 Provide on-going review and attendance to building call-back, maintenance and repair problems during the warranty periods.

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 Closeout Submittals USB Flash Drive File Structure

.4 Operation and maintenance manuals.

.5 Operation and maintenance book.

.6 *Project* data book.

.7 Shop drawing book.

.8 Warranty book.

.9 Posted operating instructions.

.10 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*.

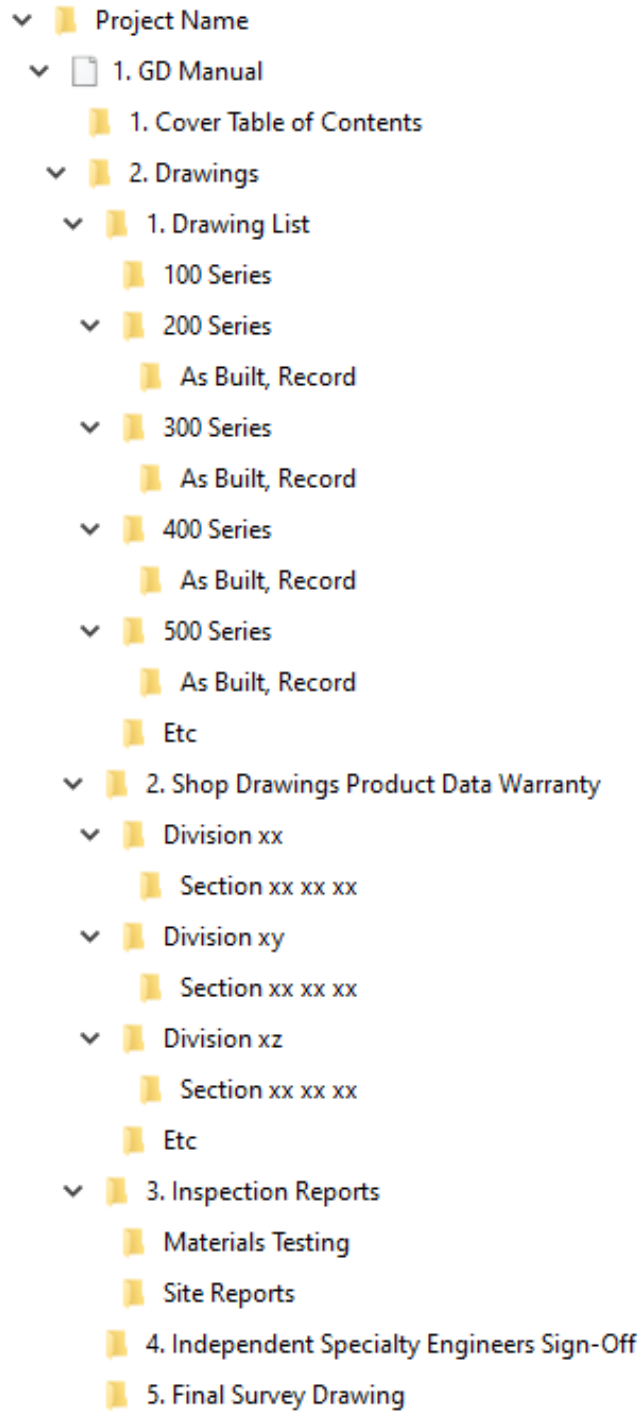
.3 For equipment put into use with *Owner's* permission during the *Work*, submit required closeout submittals within 10 *Working Days* after start-up.

.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.

.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*.

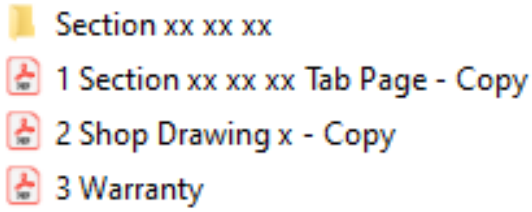
1.3 Closeout Submittals USB Flash Drive File Structure

.1 General Layout:

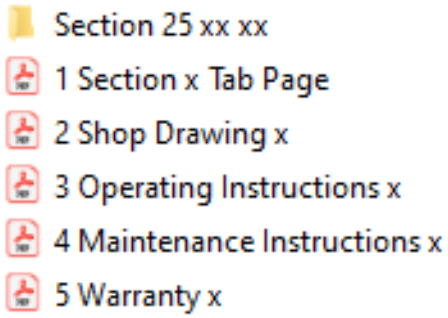


- 2. O & M Manual
  - 1. Cover Table of Contents
  - 2. Drawings
    - 1. Drawing List
    - 100 Series
      - As Built
      - Record
    - 200 Series
      - As Built
      - Record
    - 300 Series
      - As Built
      - Record
    - Etc
  - 3. Shop Drawings Product Data Warranty
    - 1. Contents
      - Division xx
      - Division xy
      - Division xz
      - Etc
    - 2. TAB Inspection Reports
      - Inspection Reports
        - Materials Testing
        - Site Reports
    - 3. Air Balancing
    - 4. Automated Control Systems Operation
    - Etc
  - 4. Spare Parts Listing
  - 5. Maintenance Materials Listing
  - 6. Special Tools Listing
- 3. Warranty Manual
  - 1. Cover Table of Contents
  - 2. Contractors
  - 3. Warrantees and Guarantees

.2 Typical shop drawing, *Product* data and warranty folder in GD Manual:



.3 Typical shop drawing, *Product* data and warranty folder in O & M Manual:



.4 File structure shall be edited to suit project requirements.

1.4 As-Built Documents

.1 Submit digital scanned copy (“PDF” files) of as-built documents. Submit using digital storage medium or transfer process acceptable to the *Consultant* and the *Owner*.

1.5 Record Drawings

.1 Once hard copy of as-built drawings have been accepted by *Consultant*, *Contractor* shall receive digital media in format compatible with currently licensed edition of AutoCAD software from the *Consultant*, to update drawings to reflect "As-Built" conditions as referenced above. Refer also to requirements of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

.2 Transcribe hard copy changes to the drawings into the electronic media.

.3 Mark revised *Drawings* as "RECORD DRAWINGS".

.4 After final acceptance by *Consultant*, submit electronic copies of record drawings to *Owner*.

1.6 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 digital copies (“PDF” files) of operation and maintenance manuals. Submit using digital storage medium or transfer process acceptable to the *Consultant* and the *Owner*.

1.7 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 Text: Manufacturer's printed data, or typewritten data.

1.8 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.

1.9 *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.

.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 Electrical authority certificate of inspection.

.8 Waste management and disposal reports, prepared in accordance with Section 01 74 00.

1.10 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.

1.11 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 List each warrantor with complete contact information.

.3 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.

.4 Include maintenance bond(s).

1.12 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.

.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.

1.13 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

PART 1 - GENERAL

1.1 Warranties

1.2 Extended Warranties

.1 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.

.2 The *Owner* shall promptly give the warrantor notice in writing of observed defects and deficiencies which occur during the warranty period.

.3 Extended warranties shall commence at date of *Ready-for-Takeover*.

.4 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*.

.5 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

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.

.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 Salvaging of designated items for reuse by *Owner*.

.2 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 Existing conditions documentation:

.1 Document existing conditions of adjoining construction and site improvements, including pre-existing damage to finish surfaces that might be misconstrued as damage caused by demolition operations.

.2 Comply with Section 01 32 00.

.3 Submit existing conditions documentation before demolition work begins.

.2 Inventory of items to be salvaged:

.1 Prepare typed inventory of units to be salvaged and cross-reference to drawing showing existing elevations.

.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 00.

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.

.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 Selective Demolition Procedures for Specific Materials

.1 Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

.2 Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

.3 Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.5 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.

3.6 Protection

.1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades and parts of existing building to remain. Make good damage caused by demolition.

.2 Take precautions to support affected structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify demolition engineer, *Contractor* and *Consultant*.

.3 Provide temporary weather enclosures in accordance with Section 01 50 00.

.4 Prevent debris from obstructing active services and drainage systems.

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

.6 Slopes of excavated areas after removal of footings shall be left in a stable condition and as required by authorities having jurisdiction.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Cementitious self-levelling underlayment throughout, to achieve flush and level floor finishes as specified in Division 09.

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 for approval a list of the system materials intended for use in the *Work* for each condition before installation commences.

.3 Certificates:

.1 Manufacturer's certification that the *Product* is Portland cement-based having an inorganic binder content which is a minimum 80% Portland cement when tested per ASTM C150/C150M-22 - Standard Specification for Portland Cement.

.2 Manufacturer's certification that *Product* specified is suitable for intended use when installed in accordance with manufacturer's written installation requirements.

1.4 Quality Assurance

.1 Qualifications:

.1 Applicators:

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

1.5 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 Materials

.1 Self-levelling cementitious underlayment system:

.1 Description: Primer and mix of special cements and binders which, when mixed with water, become highly liquid cement compound that seeks its own level and produces flat, smooth surfaces.

.2 Compressive strength: 5000 psi, minimum, at 28 days, to ASTM C109/C109M-21 (air cure only).

.3 Aggregate: well graded, washed gravel 3 mm to 6 mm (1/8" to 1/4") or larger for use when underlayment is installed over 38 mm (1-1/2") thickness.

.4 Each material used in the application of self-levelling cementitious underlayment shall be as approved or manufactured by *Supplier* of cementitious underlayment.

.5 Colour: Natural cement grey.

.6 Thickness: as required to level existing floors.

.7 Acceptable *Products*:

.1 Ardex Engineered Cements 'ARDEX K-15 Self-Levelling Underlayment Concrete'.

.1 Primer: 'ARDEX P-51' for standard absorbent concrete, and as recommended by cementitious underlayment manufacturer for other concrete porosities.

.2 Mapei 'Ultraplan 1 Plus'.

.1 Primer: Type as recommended by cementitious underlayment manufacturer for other concrete.

.3 Substitutions: in accordance with Section 01 25 00.

2.2 Mixing

.1 Mix in accordance with manufacturer's written requirements.

PART 3 - EXECUTION

3.1 Examination

.1 Verify that specified field conditions are achieved before commencing work of this section.

.2 Surfaces to receive cementitious underlayment shall be smooth, sound, dry, and free from conditions that will adversely affect execution, permanence, or quality of the work of this section and in accordance with manufacturer's written requirements.

.3 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 Substrate shall be sound, dry, and free of dust, dirt, paint, grease, oil or other foreign substances.

.2 Fill voids that allow the mix to run through the substrate.

.3 Keep other *Subcontractors* from area to be poured during day of pour. Keep heavy work off of cementitious underlayment for at least 2 to 4 hours following pour, in accordance with cementitious underlayment manufacturer's written requirements.

.4 Protect adjacent surfaces from damage resulting from work of this section. If necessary, mask and/or cover adjacent surfaces, fixtures, equipment, and the like by suitable means.

.5 Erect barriers to prevent entry and presence of personnel not performing work of this section during application of cementitious underlayment.

.6 Mechanically roughen and clean substrate, by shot blasting in accordance with cementitious underlayment manufacturer's written requirements.

3.3 Applications

.1 Verify that cementitious underlayment manufacturer's required conditions have been met at the *Place of the Work* prior to commencing application.

.2 Prime prepared substrate and apply cementitious underlayment in accordance with manufacturer's written requirements.

.3 Apply cementitious underlayment such that no laps, voids, or other marks or irregularities are visible and may telegraph through to finished flooring installed under Division 09.

.4 Do not cover or bridge expansion joints or control joints. Provide 3 mm (1/8") wide sawcut joints over concrete slab control joints.

.5 Feather cementitious underlayment to level with adjacent finished floor heights to within 3 mm (1/8”).

3.4 Field Quality Control

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

.1 Field tests and inspections:

.1 Test for moisture vapour transmission in accordance with ASTM F710-22 and ASTM F1869-22 or ASTM F2170-19a in accordance with manufacturer’s written flooring installation requirements. Results must not exceed 170 µg/m² (3 lb per 1,000 ft²) in 24 hours when tested to ASTM F1869-22, or exceed 75% when tested to ASTM F2170-19a.

.2 Test for surface pH. Levels of pH shall not exceed the written recommendations of the flooring manufacturer and adhesive manufacturer. Test in accordance with ASTM F710-22.

.3 For each test type: Conduct 3 tests for flooring applications up to 93 m² (1000 ft²) in area, and 1 additional test for each additional 93 m² (1000 ft²) of flooring area.

3.5 Adjusting and Cleaning

.1 Remove promptly as work progresses spilled or spattered cementitious underlayment materials from surfaces. Clean floors upon completion of the work of this section.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Concrete unit masonry assemblies.

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 shop drawings for masonry unit wall assemblies indicating:

.1 Types of masonry units, grade, typical dimensions, special shapes and shape dimensions.

.2 Layout/coursing for each type of masonry unit.

.4 Samples:

.1 2 of each type of concrete masonry unit specified.

.2 1 of each type of masonry reinforcement proposed for use.

.5 Test and evaluation reports: Submit test results confirming compliance of aggregates with CAN/CSA A179-14.

1.4 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 Aspects of the work of this section are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

1.5 Delivery, Storage, and Handling

.1 Deliver materials to the *Place of the Work* in dry condition.

.2 Keep materials dry until use.

.3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

.4 Handle and store cementitious materials protected against moisture.

.5 Handle and store mortar materials to prevent contamination by foreign materials, and damage by freezing or excessively high temperature.

1.6 Field Conditions

.1 Cold weather construction requirements:

.1 Comply with requirements of CAN/CSA A371-14, and as follows:

Air Temperature, °C	General requirements during construction
0 to 4	Sand or mixing water shall be heated to a minimum of 20ºC and a maximum of 70ºC.
-4 to 0	Sand and mixing water shall be heated to a minimum of 20ºC and a maximum of 70ºC.
-7 to -4	(1) Sand and mixing water shall be heated to a minimum of 20ºC and a maximum of 70ºC. (2) Source heat shall be provided on both sides of the walls under construction. (3) Windbreaks shall be employed when the wind speed exceeds 25 km/h.
-7 and below	(1) Sand and mixing water shall be heated to a minimum of 20ºC and a maximum of 70ºC. (2) Enclosures and supplementary heat shall be provided to maintain an air temperature above 0ºC. (3) The temperature of the unit when laid shall be not less than 7ºC.

.2 Place grout in masonry at a minimum temperature of 20ºC and a maximum temperature of 50ºC.

.3 Mortar temperature shall not exceed 50ºC to avoid flash set.

.4 Maintain dry beds for masonry and use dry masonry units only. Do not wet masonry units in winter.

.2 Cold weather protection requirements:

.1 Comply with requirements of CAN/CSA A371-14, and provide protection requirements for completed masonry or sections not in progress shall be as follows:

Mean daily air temperature, °C	Protection
0 to 4	Masonry shall be protected from rain or snow for 48 h
-4 to 0	Masonry shall be completely covered for 48 h
-7 to -4	Masonry shall be completely covered with insulating blankets for 48 h
-7 and below	The masonry temperature shall be maintained above 0 ºC for 48 h by enclosure and supplementary heat

.3 Hot weather construction requirements:

.1 Comply with requirements of CAN/CSA A371-14, and as follows:

.1 Limit spreading of mortar beds to 1.2 m, and set masonry units within 1 minute of spreading the mortar, when the air temperature is above:

.1 38ºC; or

.2 32ºC, with a wind velocity greater than 13 km/h.

.2 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

PART 2 - PRODUCTS

2.1 Mortar Materials

.1 Mortar: in accordance with CAN/CSA A179-14.

.2 Portland cement:

.1 In accordance with CAN/CSA A3001-13, GU (Type 10)/ASTM C150/C150M-22.

.2 For exposed mortar: maintain uniformity of cement manufacturer and batch for colour uniformity.

.3 Hydrated lime: in accordance with ASTM C207-18, Type S.

.4 Sand: in accordance with CAN/CSA A179-14.

.5 Maintain uniformity of mortar material manufacturers, mortar materials and source of aggregate throughout the *Work*.

.6 Mortar types:

.1 Foundation walls and other exterior masonry at or below grade: Type S.

.2 Exterior masonry above grade:

.1 Loadbearing: Type S.

.2 Non-loadbearing: Type N.

.3 Interior masonry:

.1 Loadbearing: Type S.

.2 Non-loadbearing: Type N.

.4 Mortar colour: Grey.

2.2 Grout

.1 Grout following masonry components:

.1 Lintels and bond beams.

.2 Grouted walls and piers.

.2 Place and grout reinforcing and bearing in accordance with CAN/CSA A371-14 and structural drawings. Use concrete of minimum 20 MPa compressive strength unless otherwise indicated.

.3 Grout for block cores: in accordance with CAN/CSA A179-14.

2.3 Reinforcing and Connectors

.1 Conform to minimum requirements of CAN/CSA A370-14 unless otherwise indicated, and to requirements for seismic reinforcement of partition walls as indicated on the drawings.

.2 Corrosion protection; metal materials: in accordance with building code and CAN/CSA A370-14:

.1 Hot dipped after fabrication to ASTM A1064/A1064M-22, and ASTM A153/A153M-09 Class B2 (457 g/m^2).

.2 For metal located exterior to the air barrier membrane: Stainless steel Type 304/316.

.3 Joint reinforcement:

.1 Acceptable manufacturers:

.1 Blok-Lok.

.2 Substitutions: in accordance with Section 01 25 00.

.2 Exterior wall assemblies: 4.75 mm (3/16") wire, welded rod, ladder design unless otherwise indicated.

.3 Interior wall assemblies: 9 gauge mill galvanized wire ladder reinforcement.

2.4 Masonry Accessories

.1 Deflection space filler (non-fire rated walls):

.1 Acceptable *Products*:

.1 Johns Manville ‘MinWool Sound Attenuation Fire Batts’.

.2 Rockwool ‘AFB’.

.3 Substitutions: in accordance with Section 01 25 00.

.2 Deflection space filler (fire rated walls): in accordance with Section 07 84 00.

.3 Movement (control) joint filler; concrete block wythes: PVC, designed to fit into sash grooves.

.1 Acceptable *Products*:

.1 Blok-Lok ‘VS Series’.

.2 Substitutions: in accordance with Section 01 25 00.

.4 Slip-sheet flashing membrane (for lintel bearing locations):

.1 Minimum 0.5 mm (0.020”) thick, PVC membrane, low temperature flexible to 40°C below zero.

.2 Acceptable *Products*:

.1 Blok-Lok ‘Flex-Flash’.

.2 Lexcor F20.

.3 Substitutions: in accordance with Section 01 25 00.

2.5 Concrete Masonry Units

.1 In accordance with CAN/CSA A165 SERIES-14.

.2 Include shapes, such as end, bond, sash groove, ledge and lintel units, required to complete the *Work*, with uniform appearance.

.1 Provide open end blocks where vertical reinforcing occurs in walls.

.2 Provide knock-out blocks where horizontal reinforcing bars occur in walls.

.3 Provide bullnose units at interior partition outside corners and where indicated.

.4 Solid concrete masonry units may be used where grouted block is indicated, whenever reinforcing is not indicated, in lieu of grouted solid installation method.

.5 Size: metric, to match existing.

.3 Light weight units:

.1 Hollow units: H/15/C/M.

.2 Semi-solid units: SS/15/C/M.

.3 Full solid units: SF/15/C/M.

.4 Colour: grey.

.5 Profiles: as indicated.

PART 3 - EXECUTION

3.1 Preparation

.1 Prior to commencing masonry work, verify that conditions at the *Place of the Work* will allow construction of masonry within required limitations for wall heights, wall thicknesses, openings, bond, anchorage, lateral support, and compressive strengths of masonry units and mortars.

.2 Provide protection where required at mixing areas to prevent damage attributed to mortar materials.

3.2 Workmanship

.1 Build masonry plumb, level, and true to line, with vertical joints in proper alignment. Lay masonry to tolerances specified in CAN/CSA A371-14.

.2 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

.3 Masonry mortar and grout work in accordance with CAN/CSA A179-14 except where specified otherwise.

.4 Masonry work in accordance with CSA S304-14, CAN/CSA A370-14, and CAN/CSA A371-14 except where specified otherwise.

3.3 Measurement and Mixing

.1 Mix mortars as specified in CAN/CSA A179-14. Use only dry aggregate. Test for bulking to determine accurate proportioning.

.2 Fine grout: mix one part Portland cement and three parts sand with water.

.3 Coarse grout: ready mixed high slump pea gravel concrete.

.4 Adjust water in mortar mix to suit absorption rates of masonry units.

3.4 Laying Masonry Units

.1 Lay concrete masonry units in bond pattern to match existing, unless otherwise indicated.

.2 Units shall be cut only upon acceptance of *Consultant*. Walls are to be laid-up with full size masonry units.

.3 Where masonry surfaces serve as substrate for thin-set tile and direct applied coatings, build to tolerance of 1:500 (1/8" in any 6'-0") (3 mm in any 1.83 m) under a straight edge.

.4 Remove loose and foreign materials from supporting bed surfaces to ensure bonding.

.5 Stop off horizontal runs of walls by racking back a half unit in each horizontal course. Do not tooth.

.6 Do not install defective, cracked, and broken masonry units.

.7 Do not install masonry units with face or faces exhibiting chips, blemishes, texture variation, and other imperfections detracting from appearance when viewed from distance of 4600 mm (15 ft.).

.8 Do not lay concrete masonry units that will appear smooth or slick where exposed to view, whether painted or not finished.

.9 Maintain bracing of walls and piers continuously during construction until structure provides support.

.10 Locate bearings and piers as indicated. Provide solid masonry units at bearings. Grout under bearing plates installed on masonry with non-shrink grout.

.11 Extend walls and partitions to deck, slab or structural members, as applicable, except where otherwise noted in the *Contract Documents*. Incorporate both lateral support and deflection space at termination of walls as required by this section.

.12 Lay masonry level, true to line, square, plumb, and as indicated. Lay masonry courses in vertical alignment to ensure vertical joints align for full height of masonry and full height of building face.

.13 Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.

.14 Fully bond intersections, and external corners.

.15 Do not adjust masonry units after laying. Where resetting of masonry is required, remove, clean units and reset in new mortar.

.16 Extend masonry to construction above, except where otherwise indicated. Cut and fill around obstructions.

.17 Build chases, do not cut them.

.18 Lay hollow concrete masonry units so that shell rest and align.

.19 Exposed cuts shall be made clean and true with a suitable masonry saw.

.20 Exposed corners at interior partitions shall use units with bullnose corners.

3.5 Jointing

.1 Form tooled mortar joints whenever exposed to view, and behind cabinets, fitments, and wall accessories. Tool when mortar is thumb-print hard by tools having long bearing surface to avoid uneven depressions. Close cracks and crevices.

.2 Concealed masonry: strike flush joints concealed in walls and joints in walls to receive plaster, acrylic stucco, tile, insulation, resilient base, or other applied material except paint or similar thin finish coating. Ensure that no mortar protrudes from joints on wall surfaces to receive materials and coatings.

.3 Tool with round non-staining pointing tool to provide smooth, compressed, uniform joints to match existing, except if specified or shown otherwise.

.4 Joint thickness:

.1 Maintain mortar joint thickness to match existing, unless otherwise specified or indicated.

.2 At masonry cut around obstructions: maximum joint size to match existing.

.5 Make joints of uniform thickness with vertical joints in alignment.

.6 Trowel point joints in unparged masonry in contact with earth.

.7 Form reglets where indicated for metal flashing in masonry.

.8 Remove loose or defective mortar when masonry is removed and replace.

.9 Rake out joints at junctions of masonry with concrete walls and columns, and at intersection of masonry walls and partitions where joint reinforcement is installed. Seal these joints by Section 07 92 00.

.10 Cut out defective mortar joints and repoint.

3.6 Joining of Work

.1 Where necessary to temporarily stop horizontal runs of masonry, and in building corners;

.1 Step-back masonry diagonally to lowest course previously placed.

.2 Do not "tooth" new masonry.

.3 Fill in adjacent courses before heights of stepped masonry reach 1220 mm (48").

3.7 Cutting

.1 Cut out neatly using a wet diamond blade saw for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges.

3.8 Built-In Work

.1 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.2 Coordinate and cooperate in the provisions for setting, anchorage and alignment of built-in work.

.3 Metal door frames:

.1 Build masonry around metal door frames supplied and set in accordance with the various parts of the *Contract Documents*.

.2 Secure anchors solidly, and verify that frames are true and plumb.

.3 Fill back void of frames with mortar unless otherwise indicated.

.4 Protect frame with protective covering and leave no mortar on exposed frame faces.

3.9 Support of Loads

.1 Use 20 MPa concrete where concrete fill is used in lieu of solid units.

.2 Install building paper below voids to be filled with concrete; keep paper 25 mm (1") back from faces of units.

3.10 Reinforced Masonry

.1 Conform to requirements of CAN/CSA A371-14.

.2 Grouting beneath bearing plates: Completely fill voids beneath steel bases bearing on masonry with an approved non-shrink grout having a compressive strength at 28 days of at least 35 MPa. Where grout is exposed to view or weather, use non-ferrous expansion agents.

.3 Reinforced block lintels:

.1 Install reinforced block lintels over doorways, other openings and recesses as indicated.

.2 Support masonry units of reinforced block lintels built in place. Provide a level platform, true to the proper elevation and of sufficient strength to support the load without visible deflection. Maintain supports in place for a minimum of 7 days and for a period sufficient to permit the concrete to cure and gain sufficient strength to safely support all loads.

.4 Lay masonry units with full mortar coverage on all abutting edges with joints shoved tight. Where masonry construction is continued above the lintel, place the first course of masonry units on the lintel in a full mortar bed.

.5 Reinforce masonry lintels and bond beams as indicated. Make joints in lintels and bond beams to match adjacent walls.

.6 Reinforce masonry walls as indicated.

.7 Grouted reinforced masonry: Construct masonry to meet indicated requirements.

.8 Place 100% solid block at each jamb under lintels.

3.11 Provision for Movement

.1 Deflection space:

.1 Incorporate deflection space between tops of non-load-bearing walls/partitions and structure to prevent transference of structural loads to masonry.

.1 Exterior masonry wall deflection space: 12.7 mm (1/2").

.2 Interior masonry partition deflection space: 25 mm (1").

.2 Coordinate work of this section with installation of lateral supports.

3.12 Deflection Space Filler

.1 Non-fire rated walls: Fill deflection space with deflection space filler. Where deflection space is exposed, tamp filler into deflection space 25 mm (1").

.2 Fire-rated walls: Refer to requirements of Section 07 84 00.

3.13 Loose Steel Lintels

.1 Set and level lintels, centred over opening width, on a slip-sheet membrane, placed over bed or mortar.

.2 Allow suitable movement joint at ends of lintels for expansion and contraction movement at exterior lintels.

3.14 Lateral Supports

.1 In addition to requirements of *Contract Documents*, provide horizontal and vertical wall and partition lateral support anchors in accordance with CAN/CSA A370-14.

3.15 Horizontal Reinforcing

.1 Joint reinforcement:

.1 Install joint reinforcement in cavity walls, solid walls and partitions.

.2 Place reinforcement continuously in horizontal joints at 400 mm (16") on centre, beginning with course 400 mm (16") above bearing, unless otherwise indicated.

.3 Do not carry reinforcement through intersections where lateral support anchors are installed, at intersections of walls and partitions with solid piers and at block movement joints.

.4 For stack bond assemblies, joint reinforcing is required in every course.

3.16 Bolts and Anchors

.1 Embed bolts and anchors solidly in mortar or grout to develop maximum resistance to design forces.

3.17 Structural Reinforcement

.1 Install to indicated requirements.

3.18 Temporary Bracing

.1 Provide temporary bracing to masonry walls.

3.19 Field Quality Control

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

.1 Source quality control: Perform tests on masonry units to determine compressive strength as required by jurisdictional authorities in accordance with CAN/CSA A165 SERIES-14.

.2 Field tests and inspections:

.1 Provide mortar for strength testing in accordance with CAN/CSA A179-14 and Section 01 45 00.

3.20 Adjusting and Cleaning

.1 Protect masonry and adjacent work from damage from cleaning work.

.2 Clean masonry in accordance with masonry manufacturer's written requirements. Remove masonry and install new masonry, if masonry is damaged by cleaning work.

.3 Test cleaning agent and procedures by cleaning small, inconspicuous sample location prior to commencement of overall cleaning work. Review cleaning test area with *Consultant* and obtain acceptance in writing prior to cleaning remainder of areas requiring cleaning.

.4 Soak wall with clean water and flush off loose dirt and mortar.

.5 Apply specified cleaning agent in accordance with the manufacturer's direction, working from top to bottom.

.6 Rinse areas thoroughly with clean water to remove cleaning solutions, dirt, and mortar residue.

.7 Remove mortar from exposed masonry face immediately and prior to full set to avoid mortar staining of masonry units. Remove masonry and install new masonry, if mortar staining cannot be removed without damaging masonry work.

.8 Remove efflorescence and mortar deposits from surfaces to receive coatings and surfaces which are exposed to view. Remove efflorescence and mortar deposits from surfaces to receive coatings or surfaces which are exposed to view, occurring within a time period of 1 year after date of *Substantial Performance of the Work*

.9 Use proprietary PH-neutral cleaning solution with water as approved by manufacturer of masonry units in accordance with manufacturer's written directions. Use clean water to remove excess cleaning solution.

.10 Remove mortar droppings from flashings and other materials immediately to prevent damage and discolouration.

3.21 Protection

.1 Protect other materials and finishes from contamination by mortar droppings.

.2 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

END OF SECTION

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 Wood grounds, nailers, blocking and sleepers.

1.2 Submittals

.1 Submit required submittals in accordance with Section 01 33 00.

.2 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 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:

.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.

2.2 Panel Materials

.1 Softwood plywood (CSP): in accordance with CSA O151-09.

.2 Douglas Fir plywood (DFP): in accordance with CSA O121-08.

.3 Fire rated plywood: shall be pressure impregnated with fire-retardant chemicals to CAN/CSA O80 and have Flame Spread Value (FSV) of not more than 25 to CAN/ULC-S102-10.

2.3 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.

.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.

2.4 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 Do not rip or mill fire retardant treated lumber. Only end cuts, drilling holes, and joining cuts are permitted.

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.

3.3 Miscellaneous Plywood Blocking

.1 Provide minimum 19 mm (3/4") softwood plywood blocking for attachment of miscellaneous fitments as indicated.

.2 Wood blocking within gypsum board metal stud assemblies under work of Section 09 22 00.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Work of this section includes architectural woodwork including, but not limited to, the following:

.1 Cabinetry and hardware.

.2 Classroom control panels.

.3 Plastic laminate countertops.

.4 Factory and site finishing of architectural woodwork.

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, audio-visual, 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.

.5 Architectural woodwork specified under this section includes woodwork items which are closely integrated with both prefinished and field painted architectural metalwork, glass, and built-in electrical components, and consequently requires close coordination with such allied trades. This section is responsible for ensuring correct installation procedures and results.

.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 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.

.4 Selection samples:

.1 Casework hardware, one unit of each type and finish.

.5 Verification samples:

.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 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 sets of each type actually installed.

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 Requirements of regulatory agencies: the work of this section that functions to resist forces imposed by dead and live loads shall conform to requirements of jurisdictional authorities.

.4 Mock-ups:

.1 Edge and joint types.

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. Note that building humidity control is not in operation 24 hours per day or 365 days per year and system is intermittent during winter and summer months. As a result, fabrication of wood components should anticipate major changes in humidity levels.

1.8 Warranty

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

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.

2.2 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.

.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.

2.3 Wood Materials

.1 Lumber:

.1 Hardwood for concealed blocking and framing: Custom grade, any species that, when painted, will not show any defects.

.2 Hardwood for exposed blocking: species and grade to match panel veneer.

.3 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%.

.4 Solid hardwood for transparent finish.

.1 Species: Birch.

.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 Hardwood veneer; for transparent finish:

.1 Species: White Birch.

.2 Veneer cut: Plain/Flat.

.3 Veneer leaf matching: Book or to match existing.

.4 Veneer assembly matching: Balance and Centre or to match existing.

.5 Veneer end matching: Continuous or to match existing.

.3 Edgebanding:

.1 Solid wood edge banding: Unless otherwise indicated, exposed panel edges shall be finished with 6 mm (1/4") thick solid hardwood unless otherwise indicated.

2.4 Panel Materials

.1 Panel material schedule; except where indicated otherwise:

.1 Thickness: 19 mm (3/4") minimum except as follows:

.1 At back panels and drawer: 13 mm (1/2”) minimum.

.2 Core at veneered and plastic laminate work: unless otherwise indicated or scheduled.

.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-1-2009.

.2 Softwood plywood: to US Plywood Standard APA PS-1-19 Structural Plywood (with Typical APA Trademarks).

.2 Marine grade plywood: 19 mm (3/4") nominal thickness, to CSA O121-08, marine grade DFP, sanded both sides.

2.5 Plastic and Composite Materials

.1 High pressure decorative laminate:

.1 General purpose grade: in accordance with ANSI/NEMA LD 3-2005, Horizontal General Purpose Grade (HGS), except as follows:

.1 Where indicated:

.1 Post forming grade: in accordance with ANSI/NEMA LD 3-2005, Horizontal Performable Grade (HGP).

.2 Provide double-radius front edges at countertops and backsplashes.

.2 Classroom control panels, countertops and backsplash:

.1 PLAM-1:

.1 Colours, finishes, and patterns: Blackstone 271-58, Matte finish.

.2 Acceptable Product:

.1 Formica.

2.6 Insulation Materials

.1 Insulation board:

.1 Thickness: as indicated.

.2 Acceptable manufacturer: Reflectix Insulation.

2.7 Fasteners and Adhesives

.1 Fasteners shall comply with North American Architectural Woodwork Standards 4.0.

.2 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.

2.8 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 Hardware for 19 mm thick cupboard doors:

.1 Hinges: Hettich 'Selekta Pro 2000', C15 finish.

.2 Catches: Richelieu '807V C2G'.

.3 Pulls: Richelieu '30135170, 153 x 28mm'.

.4 Flush Pulls: Knape &Vogt '819x' ANO finish.

.5 Pulls at Barrier-Free Work Stations: Richelieu '0141128170' (ADA compliant).

.6 Cupboard lock: Hafele '235.08.358' polished nickel complete with lock cores '210.04.606' and cylinder rosettes '210.04.062'.

.7 Strike Plates; black:

.1 Gable catch: Hafele '329.61.319'.

.2 Bottom slot: Hafele '239.08.705'.

.8 Elbow Latch and Strike: Richelieu '55401.8' Nickel finish.

.9 Resilient silencers: Clear hemispherical polyurethane self-adhesive bumpers.

.3 Hardware for drawers:

.1 Slides: Knape & Vogt '6505' (length to suit) Zinc finish.

.2 Pulls: Richelieu '30135170, 153 x 28mm'.

.3 Flush Pulls: Knape & Vogt '819x' ANO finish.

.4 Pulls at Barrier-Free Work Stations: Richelieu '0141128170' (ADA compliant).

.5 Drawer locks: Hafele '235.08.303' polished nickel complete with lock cores '210.04.606' and cylinder rosettes '210.04.062'.

.6 Strike Plate: Hafele '239.08.705' black finish.

.4 Hardware for Adjustable Wood Shelves:

.1 Pilaster Strips: Knape & Vogt '255 ZC Steel' Zinc finish.

.2 Shelf Clips: Knape & Vogt '256 ZC Steel' Zinc finish.

.5 Hardware for 38 mm thick cupboard doors:

.1 Hinge: Stanley 'F179 114x102'.

.2 Locksets: Lockset Complete with Interchangeable Cylinder Supplied by Finishing Hardware Supplier.

.3 Closet rods & flanges:

.1 Knape & Vogt '660 SS 30mm OD rod'.

.2 Knape & Vogt '730 end caps' ANO finish.

.3 Knape & Vogt '734 & 735 end supports' CHR finish.

.4 Knape & Vogt '760 intermediate support' ANO finish.

.4 Roller Catches: Richelieu '504XV'.

.5 Surface Bolts: Richelieu '39208' 646/ANV finish.

.6 Door Stop/Holder: Rixson "Checkmate" 10 Series Adjust. Standard Duty Surface Mounted.

.7 Coat Hooks: Ives '571', cast brass, Coat & Hat Hook.

.8 Strike Plate: Richlieu 'M3204' SS finish.

.6 Specialty Hardware

.1 Grommets: Richelieu '20692170'.

.7 Keying:

.1 Locks in a room to be keyed alike.

.2 Provide locks on casework.

.3 Provide 6 extractor keys.

.8 Grilles; locations as indicated:

.1 Price 'LBPH Linear Bar Grille'.

.1 Size: 100 mm x 1500 mm (4" x 59").

.2 Core style: 25C.

.3 Finish: aluminum.

.4 Border: style 750.

.5 Fastening: style A.

.2 Price 'LG50 Lattice Grille'.

.1 Size: 100 mm x 1200 mm (4" x 47").

.2 Finish: aluminum.

.3 Colour: black.

.4 Fastening: style H, straight holes.

.9 Classroom control panel components:

.1 Refer to Drawings and Electrical Drawings and Specification.

.2 Coat and Hat Rack:

.1 Acceptable *Products*:

.1 ASI 'SCR 1001 Student Coat & Hat Rack with Hook' as supplied by Global School Products, complete with tube shelf, bracket, channel mount, and coat hooks.

.2 Colour: Black.

2.9 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.

.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 solid wood:

.1 Comply with requirements indicated below for finish system, staining, and sheen.

.1 Sheen: Semigloss.

.1 Sheen range measurements in accordance with North American Architectural Woodwork Standards 4.0.

.2 Factory finish with transparent, Catalyzed Vinyl System 7 in accordance with the North American Architectural Woodwork Standards 4.0, Section 5.

.1 Transparent finish:

.1 Clear (natural).

.2 Stain: Stain colour: as selected by *Consultant*.

2.10 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.

.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 Solid wood edging: No end grain shall be visible; mitre external corners; house internal corners.

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.

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

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 Repair or replacement of existing damaged joint firestopping and smoke seals.

.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 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.

.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:

.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.

.3 Aspects of the work of this section are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

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.

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 NUCO Inc.

.4 STI Firestop.

.5 Tremco Commercial Sealants & Waterproofing.

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.

.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.

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.

.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 Glazing system assembly sealants.

.2 Mechanical and electrical sealants.

1.2 Administrative Requirements

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

.1 The following items shall be addressed at the pre-installation meeting:

.1 Analysis of the work and weather conditions.

.2 Shape factor of the joint.

.3 Recommendations for priming joints.

.4 Inspection of surfaces and joints.

.5 Compatibility of materials.

.6 Backing materials.

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 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.

.4 Test and evaluation reports:

.1 Test sealant in contact with samples of materials to be sealed to verify adhesion will be achieved and no staining of the material will result. Prepare sample joints at the *Place of the Work* of each type of sealant for each joint condition.

.1 Submit test results to *Consultant* prior to application of sealants.

.2 Test sealant in contact with samples of porous materials to be sealed to ensure that no staining of the material will result in accordance with ASTM C1248-22.

.1 Submit test results to *Consultant* prior to application of sealants.

1.4 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.

1.5 Quality Assurance

.1 Qualifications:

.1 *Subcontractor*:

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

.2 Installer to comply with quality assurance articles referenced in ASTM C1193-16(2023) for installation of joint sealants.

.2 Mock-up:

.1 Submit 2440 mm (96") long sealant joint mock-up.

1.6 Field Conditions

.1 Conform to sealant manufacturer's specifications and recommendations.

.2 Do not proceed with installation of joint sealants under the following conditions:

.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.

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 Single source responsibility: Obtain joint sealant from a single manufacturer for each joint sealant type.

.2 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.

.3 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.

.4 For sealants to be applied to porous substrates:

.1 Provide products that have undergone testing in accordance with ASTM C1248-22 and have not stained porous joint substrates indicated for *Work*.

.5 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 C834-10Type 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; gap filler: at movement paintable 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 NP100'.

.2 Sika 'Sikaflex 15LM'.

.3 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 C920-14, 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'.

.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.

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.

.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.

.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.

.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: as indicated.

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.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Solid core doors with high pressure plastic laminate.

.2 Fire rated wood doors.

.3 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.

.6 Indicate fire ratings for fire rated doors.

1.4 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.

1.5 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.

1.6 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 Baillargeon by Masonite Architectural.

.2 Lambton Doors.

.3 Masonite Architectural.

.4 VT Industries.

.5 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.

.2 Doors and frames shall function as intended, including but not limited to:

.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 Performance/Design Requirements - Fire Rating Requirements

.1 Fire rated labelled doors tested to 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 rated doors in accordance with NFPA 80-2013.

2.4 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.

2.5 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 particle board core, high pressure decorative laminate faced, 20 minute fire rated wood door construction:

.1 Type PC-HPDL-5, particle core to ANSI A208.1-2009 LD-2.

.4 Bonding:

.1 Solid core: 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 High pressure decorative laminate faced doors:

.1 For vertical edges (stiles) and exposed horizontal edges (rails). (Exposed horizontal edges are those edges that can be viewed from floors above.):

.1 High pressure decorative laminate finish, face and cross bands are covered.

.6 Blocking:

.1 Provide hardware blocking for doors as follows:

.1 Non-rated or 20 minute fire 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.

2.6 Plastic Laminate Faced Doors

.1 Type: Grade 10 General Purpose, to ANSI/NEMA LD3-2005.

.2 Surface finish: as selected by *Consultant*.

.3 Acceptable *Product*:

.1 Formica.

.1 Colour/pattern: 346-58 Natural Oak, matte finish.

.2 Substitutions: in accordance with Section 01 25 00.

2.7 Accessories

.1 Wood glass stops; 20 minute fire rated: Solid hardwood, species to match face finish, and referenced quality standard.

.1 Acceptable *Product*:

.1 VT Industries ‘Heritage Collection’, 20 minute fire rated.

.2 Finishing hardware: in accordance with Section 08 71 00.

2.8 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 Comply with NFPA 80-2013 for fire-rated doors. Attach labels to suit required fire-protection ratings.

.4 Bevel fire-rated doors 3-1/2 degrees (1/8 inch in 2 inches) at lock edge; trim stiles and rails only to extent permitted by labelling agency.

.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.

.4 Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes.

.5 Factory cut and trim openings.

2.9 Factory Finishing

.1 Finish work in factory in accordance with North American Architectural Woodwork Standards 4.0 and referenced quality standard.

.2 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.

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

3.3 Installation - Doors

.1 Install fire rated doors in accordance with NFPA 80-2013.

.2 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”).

.4 At door assemblies having fire-protection rating not less than 20-minutes provide clearance not more than 6 mm (1/4”) at the bottom and not more than 3 mm (1/8") at the sides and top.

.3 Seal top and bottom edges of wood doors. Re-seal field cuts in accordance with manufacturer’s written requirements.

.4 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.

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, including finish hardware covered by cash allowance, 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.

.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.

.2 Extended warranty:

.1 Manufacturer's standard extended warranties.

.2 Closers:

.1 Duration: 5 years.

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 Door 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 Take delivery of finishing hardware and install, except hardware specified as part of work of another section. Check each item as received.

.5 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.

.6 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.

.7 Pre-drill kickplates and doors prior to installation of kickplates. Apply with water-resistant adhesive and countersunk stainless steel screws.

.8 Set thresholds on two continuous beads of polyurethane caulking fastened with a minimum of 4 countersunk screws.

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 Locks shall be keyed by the *Owner*.

.2 Lock cylinders and key way to match the school's existing system. Conventional cylinders to be supplied.

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.

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

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Glass and glazing.

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 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.

.4 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.

.5 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.

.6 Submit sample glazing warranty.

.7 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

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 glass and glazing for incorporation into the operating and maintenance manuals.

1.4 Quality Assurance

.1 Qualifications:

.1 Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and 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.

1.5 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.

1.6 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.

1.7 Warranty

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

.2 The glazing systems shall perform properly to the extent that the design and *Contract Documents* permit such performance for the duration of the warranty period.

.3 Special product warranty for tempered glass products:

.1 Warrant that tempered glass will not break spontaneously as a result of Nickel Sulfide (NiS) inclusions at a rate exceeding 0.8% (8/1000) for a period of five years from the date of manufacture. Warranty shall be manufacturer's standard form in which tempered-glass manufacturer agrees to replace tempered-glass units.

.2 Duration: 5 years from date of manufacture for fully tempered glass.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 General:

.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 Regulatory requirements:

.1 Fire rated glass:

.1 Each lite shall bear permanent, non-removable label by accredited and recognized independent testing agency certifying it for use in tested and rated fire protective assemblies.

.3 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.

.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.

.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 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 Fire-Rated Glass

.1 Fire-resistive rated, impact safety resistant glass, non-wired:

.1 In accordance with CAN/ULC-S104-15/CAN/ULC-S106-15, CPSC 16 CFR 1201 (Cat. I and II).

.2 Film faced and non-film faced glazing:

.1 Fire-protective-rated and impact safety-rated, transparent glazing material and listed for use in doors, sidelites, transoms, and borrowed lites in both interior and exterior applications, not functioning as a barrier.

.2 Surface finish:

.1 Premium Grade: transparent glass, polished for superior optical clarity.

.3 Acceptable *Product*:

.1 Safti First ‘SuperLite II-XL’.

.2 Saint Gobain ‘Keralite Select F’.

.3 Schott ‘Pyran Platinum F’.

.4 Technical Glass Products ‘FireLite NT’.

.3 Non-film faced glazing:

.1 Fire-protective-rated and impact safety-rated, transparent glazing material with no exposed film facing, and listed for use in doors, sidelites, transoms, and borrowed lites in both interior and exterior applications, not functioning as a barrier to heat.

.2 Surface finish:

.1 Premium Grade: transparent glass, polished for superior optical clarity.

.3 Acceptable *Product*:

.1 Safti First 'SuperLite II-XL'.

.2 Saint Gobain 'Keralite Select L'.

.3 Schott 'Pyran Platinum L'.

.4 Technical Glass Products 'FireLite Plus'.

2.5 Fire Rated Glazing Accessories

.1 Glazing tape; fire-rated glass (non-wired):

.1 Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapour seal.

.2 Silicone sealant: One-part neutral curing silicone, medium modulus sealant, to ASTM C920-14, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.

.1 Acceptable *Products*:

.1 DOWSIL '795'.

.2 Momentive 'Silglaze-II 2800'.

.3 Tremco 'Spectrem 2'.

.3 Setting blocks: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.

.4 Cleaners, primers, and sealers: Type recommended by manufacturer of glass and gaskets.

2.6 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.

.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 Install fire rated glazing in accordance with fire rated glazing *Product* manufacturer's written requirements and with current fire-resistance listing for each *Product*. Field cutting or tampering is not permissible.

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 Field Quality Control

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

3.6 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 74 00.

END OF SECTION

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*.

.3 Test and evaluation reports:

.1 Submit certified test results for each required fire resistance rated assembly for work of this section.

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 Performance/Design Requirements - Fire Resistance Rated Assemblies

.1 Where gypsum board systems with fire resistance ratings are indicated or required, provide materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to authorities having jurisdiction.

2.2 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.

.2 Heavy duty corrosion protection where scheduled or indicated: Z275 (G90) 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.

2.3 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.

.1 Steel studs at impact 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.

2.4 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’.

.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.

2.5 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.

2.6 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.

.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 of 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.

.2 Maximum allowable deflection for tiled partitions: L/360.

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.

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:

.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/m^2 (5 lb/ft^2) 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.

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.

3.9 Field Quality Control

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

.1 Field tests and inspections:

.1 Independent inspection and testing company will perform random load tests for ceiling anchor installation.

.2 Allow for testing of 1 in 20 anchors.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Gypsum board; paper-faced.

.2 Gypsum board; fire-rated, paper-faced.

.3 Gypsum board; impact resistant.

.4 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.

.3 Fire-rated assembly listings and STC assembly ratings:

.1 Submit fire-rated assembly listings for each required fire resistance rated assembly for work of this section.

.2 Submit STC assembly ratings for each required STC rated assembly for 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, discoloration, 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 Fire resistance rating:

.1 Construct fire resistance rated assemblies in accordance with listing and CAN/ULC S101-14.

.3 Paper-faced gypsum board: in accordance with ASTM C1396/C1396M-17.

.4 Fire rated in accordance with listed assemblies where indicated: Type X or Type C.

2.2 Gypsum Board Panels

.1 Gypsum board; paper faced:

.1 Acceptable *Products*:

.1 CertainTeed ‘Regular Gypsum Board’.

.2 CGC ‘Sheetrock Brand Gypsum Panel’.

.3 Georgia-Pacific ‘ToughRock Gypsum Board’.

.2 Gypsum board; fire-rated, paper faced:

.1 Acceptable *Products*:

.1 CertainTeed ‘Type X and Type C’.

.2 CGC ‘SHEETROCK Brand Firecode X and Firecode C’.

.3 Georgia-Pacific ‘ToughRock Fireguard X Gypsum Board and ToughRock Fireguard C Gypsum Board’.

.4 PABCO Gypsum ‘QuietRock ES’.

.3 Gypsum board; impact resistant:

.1 Mould and moisture resistant: in accordance with ASTM D3273-21, with a panel score of 10.

.2 Paper-faced:

.1 Impact 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 3.

.4 Hard Body Impact resistance: in accordance with ASTM C1629/C1629M-23, App.1, Level 3.

.2 Acceptable *Products*:

.1 CGC ‘Sheetrock Brand Panels Mold Tough VHI Firecode X’.

.2 CertainTeed ‘Extreme Impact Resistant Gypsum Board with M2Tech’.

.3 Substitutions: 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.

.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.

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.

.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.

.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 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/m^3 (2.5 lbs/ft^3).

.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: in accordance with Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

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.

.4 Install work of this section in accordance with the 2012 Wall and Ceiling Specifications Standard Manual.

.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.

.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.

.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 Install expanded security mesh in accordance with manufacturer’s written installation requirements.

3.4 Impact Resistant Board Application

.1 Install impact resistance gypsum board in accordance with gypsum board manufacturer's written requirements.

.2 Where both impact 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.

.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.

.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 Center 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.

.5 Where new partitions align with existing gypsum board, apply required amount of skim coats to make transition inconspicuous from a distance of 914 mm (36”).

.6 Completed installation at interface between new and existing construction shall provide an inconspicuous joint.

.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.

.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 Fire Separations

.1 Install fire-rated assemblies in accordance with assembly listing requirements in order to obtain fire ratings indicated and as required by authorities having jurisdiction.

.2 Vertical bulkheads in ceiling spaces over fire rated partitions, doors and the like shall have same fire rating as the partition over which they occur. Such bulkheads shall be of gypsum board construction unless otherwise indicated.

.3 Use fire rated gypsum wallboard as specified.

.4 Where lighting fixtures, diffusers, and the like are recessed into fire rated ceilings or bulkheads, provide enclosure to maintain required fire rating. Form removable panel to give access to fixture outlet box.

.5 Where fire hose cabinets or other fixtures or equipment are recessed in fire rated walls or partitions, provide gypsum board enclosure or backing to maintain required fire rating, unless otherwise detailed.

3.8 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.

.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.

3.9 Adjusting and Cleaning

.1 Remove debris and rubbish from wall and ceiling cavities before enclosing with board.

.2 Clean up and remove surplus materials and rubbish resulting from the work of this section upon completion.

.3 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 Acoustical tile ceiling systems; ACT.

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 Independent inspection and testing company shall attend the pre-installation meeting.

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:

.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*.

.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.

.2 Mock-ups:

.1 Construct in locations acceptable to *Consultant* a typical sample ceiling installation 10 m^2 (108 ft^2) in area, complete with round column collars perimeter wall trim, and cut tegular tile demonstrating rectified edge. 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.

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:

.1 Classification: Type III, Form 2, Pattern CE in accordance with ASTM E1264-23.

.2 Size: 610mm x 1220mm (24” x 48”).

.3 CAC: 40 minimum.

.4 NRC: 0.70 minimum.

.5 Material: Mineral fibre.

.6 Edge: Square lay-in.

.7 Colour: White.

.8 Flame spread:

.1 Maximum values in accordance with CAN/ULC-S102-10:

.1 Flame Spread Value (FSV): 25.

.2 Smoke Developed Value (SDV): 50.

.9 Acceptable *Products*:

.1 Armstrong ‘School Zone Fine Fissured, Item no.1714’.

.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 Readi-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.

.5 Standard suspension system, non fire-rated:

.1 Intermediate 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*:

.1 Armstrong ‘Prelude XL 15/16" Exposed Tee Systems’.

2.5 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: Flat 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.

.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 and as follows:

.1 Field tests and inspections:

.1 Independent inspection and testing company shall perform random load tests for ceiling anchor installation.

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 Resilient base; BASE-1.

.2 Resilient floor transition trims; TRANS-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 Samples:

.1 Selection samples:

.1 Submit manufacturer's range of pattern and colours available for *Consultant's* selection.

.2 Samples for verification: Submit 3 samples of the following:

.1 305 mm (12") long samples of each colour and type of base material. Include sample of outside corner of base.

.2 100 mm (4") long samples of each colour and type of floor transition trims.

.4 Test and evaluation reports:

.1 Submit and adhesive bond test results.

.5 Manufacturer's instructions:

.1 Submit manufacturer's installation instructions for *Products* proposed for use in the work of this section.

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 minimum 2% of each colour, pattern and type of resilient base required for this project.

.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 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.

.2 Mock-up:

.1 Resilient base mock-up shall include at least one inside corner, one outside corner plus 20 m (65'-0") of straight run.

.2 Locate at the *Place of the Work* as part of final installation.

.3 Location of installation shall be determined by *Consultant*.

1.6 Field Conditions

.1 Ambient conditions:

.1 Install materials of this section only when surfaces and air temperatures have been maintained between 21°C and 29.4°C for 7 days preceding installation, and will be so maintained during installation and for 48 hours thereafter. Maintain a minimum temperature of 13°C after above period.

.2 Verify that adequate ventilation is provided during installation and curing of materials of this section.

.3 Applications exposed to intense or direct sunlight, protect *Products* during the conditioning, installation, and adhesive curing periods, by covering the light source.

.4 Allow coiled material to lay flat for at least 24 hours at 18°C prior to installation, and maintain this temperature during installation.

PART 2 - PRODUCTS

2.1 General

.1 Single source responsibility: Obtain each type of resilient *Product* 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.

2.2 Resilient Base

.1 BASE-1; Rubber base types:

.1 Manufactured from thermoplastic rubber formulation meeting ASTM F1861-21, Type TP, Group 1 (Solid).

.2 Basis of design:

.1 Tarkett 'Traditional Duracove Rubber Wall Base', 3.2 mm (1/8") thick, complete with preformed inside and outside corners with 100 mm (4") returns.

.1 Profile: Coved.

.2 Height: 100 mm (4") high.

.3 Colour: black, to match existing.

2.3 Resilient Floor Transition Trims

.1 TRANS-1; Resilient strip:

.1 Colour: to later selection by *Consultant* from manufacturer's full range.

.2 Acceptable *Product*:

.1 Tarkett 'CTA-XX-J'.

.2 Substitutions: in accordance with Section 01 25 00.

2.4 Accessories

.1 Concrete 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 resilient product manufacturer for substrate conditions.

.2 Primers and adhesives: Types as recommended by resilient product manufacturer compatible with materials and to suit substrate types.

.3 Sealant:

.1 Medium-modulus, neutral-curing silicone sealant; complying with ASTM C920-14, Type S, Grade NS.

.2 Colour: Clear.

.3 Acceptable Manufacturers:

.1 Dowsil.

.2 Momentive.

.3 Tremco.

PART 3 - EXECUTION

3.1 Examination

.1 Verify that field conditions have been provided as requested and specified.

.2 Substrates shall be firm, structurally sound, sufficiently porous, and dry.

.3 Examine substrate to ensure clean lines, correct level and freedom from cracks, ridges, dusting, scaling and carbonation.

.4 Examine substrates in advance of application of products to ensure that substrates are protected against entry of water and moisture.

.5 Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

.6 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.

.7 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 Substrates shall be free of 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.

.2 Fill gaps, voids, and cracks, and remove ridges, or other defects which will ghost or telegraph through finished product installation.

.3 Expansion joints, isolation joints, and other movement joints in substrates shall not be filled with patching or levelling compound.

.4 Sweep and vacuum clean substrates minimum 24 hours prior to alkalinity, moisture, and adhesion testing. Do not use sweeping compounds.

.5 Notify *Consultant* of any substrate or levelling compound defects or installation conditions that may result in unsatisfactory performance.

.6 Adhesion bond testing:

.1 Perform adhesive bond test.

.2 Proceed with installation only after substrates pass testing. Document tests performed and submit in writing to *Consultant*.

.7 Do not install products until they are same temperature as space where they are to be installed.

.8 Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. Do not use sweeping compounds.

.9 Where flooring adjoins thicker floor materials, apply levelling screed, feather out to make up difference in level between materials.

.10 Spray paints, permanent markers and other indelible ink markers shall not be used to write on the back of the resilient material or used to mark the substrate as they could bleed through and permanently stain the resilient material. If such contaminants are present on the substrate they shall be mechanically removed prior to the installation of the resilient material.

3.3 Installation of Resilient Base

.1 Spread adhesive to ribbed surface (back) of wall base with a 3 mm (1/8") square-notched trowel; allow slight set-up, then bring base into contact with substrate. Ensure full adhesion of base to substrate. Adhesive should cover 80% of back surface. Leave a 6 mm (1/4") uncovered space at the top of the wall base to prevent the adhesive from oozing onto the wall above the base when installed.

.2 Position wall base on wall surface and roll with hand roller. Always roll back to starting point to prevent stretching the wall base.

.3 Set base to ensure installation over finished flooring material is free of gaps.

.4 Install base in longest lengths possible, minimum 2440 mm (8’). Adhere toe of base to substrate, and ensure edge of toe is straight.

.5 Scribe and fit to door frames and other obstructions.

.6 Joints shall be tightly fitted, straight and vertical, and not less than 610 mm (24") from corners.

.7 Provide joints in base over substrate control joints.

.8 Install factory preformed inside corners.

.9 Install factory preformed outside corners.

3.4 Installation Transition Trim

.1 Coordinate transitions with work of other sections and install transition trim to transitions between different flooring types.

.2 Locate thresholds directly beneath the door (in a closed position).

.3 Set to ensure installation is free of gaps.

.4 Install in longest lengths possible.

.5 Scribe and fit to obstructions.

.6 Fit joints tightly, straight and vertical as applicable. Transition trim joints shall be not less than 610 mm (24") from corners.

.7 Mitre corners.

3.5 Installation Tolerances

.1 Resilient base: Install straight and level to variation of 3 mm (1/8") over 3 m (10’-0”).

.2 Transition trim: Install straight to variation of 3 mm (1/8") over 3 m (10’-0”).

3.6 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.

.2 Adhesions tests shall be completed in accordance with product manufacturer's written requirements.

.2 Manufacturer's field review to be in accordance with Section 01 45 00.

3.7 Adjusting and Cleaning

.1 Remove adhesive from surfaces as work progresses in manner described by manufacturer.

.2 Thoroughly clean surfaces in accordance with manufacturer's written requirements.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Luxury vinyl tiles (LVT-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 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 x 150 mm (6" x 6") of each different colour and pattern of floor covering required.

.2 Transition trim: Manufacturer's standard size samples, but not less than 100 mm (4") long, of each colour required.

.4 Test and evaluation reports:

.1 Submit moisture and alkalinity test results.

.2 Submit CAN/ULC-S102.2 Standard Method of Test for Surface Burning Characteristics test results.

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 Submit 2% of each colour, pattern and type flooring material required for this project for maintenance use.

.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-up:

.1 Prior to commencing flooring installation for this section, prepare full room mock-up (room size at least 10 m^2 (100 ft^2) in area) for acceptance by the *Consultant*.

.2 Do not proceed with flooring specified in this section until mock-up has been accepted by *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.

1.7 Field Conditions

.1 Ambient conditions:

.1 Install materials of this section only when surfaces and air temperatures have been maintained between 18°C and 32°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.

.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.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 Slip resistance: Floors shall meet R11 slip resistance.

.2 Flame spread:

.1 Maximum values in accordance with CAN/ULC-S102.2:

.1 Flame Spread Value (FSV): 155.

.2 Smoke Developed Value (SDV): 450.

2.2 Luxury Vinyl Tile Flooring

.1 LVT-1:

.1 Size: 250 mm x 1000 mm (9.8445” x 39.38”).

.2 Thickness: 4.5 mm (0.18”).

.3 Installation method: as directed by the *Consultant*.

.4 Finish: Ceramor.

.5 Colours: to later selection by *Consultant* from manufacturer’s full range.

.6 Acceptable *Products*:

.1 Interface ‘Studio Set’.

.2 Substitutions: in accordance with Section 01 25 00.

.7 Base: in accordance with Section 09 65 13.

.8 Metal Edge Trim:

.1 Aluminum or brass alloy with lip of edge strip extending under and with shoulder finishing flush with top of resilient floor.

2.3 Accessories and Accessory Materials

.1 Primers and adhesives: Type as recommended by flooring manufacturer compatible with materials and to suit substrate.

.2 Moisture control system:

.1 Performance and Physical Properties: Meet or exceed the following values for material cured at 70° F+/-3°F (21° C+/-3°C) and 50% +/-5% relative humidity:

.1 Application: Manual.

.2 Material Requirements on CSP 3 Prepared Concrete: Approx. 170 – 190 sq. ft. (16 – 18 m2) per unit for 14 mils.

.3 Permeability (ASTM E96): 0.06 perms.

.4 14 pH solution (ASTM D1308): No effect.

.5 Working Time: 20 minutes.

.6 Pot Life: 20 minutes.

.7 VOC: 19.9 g/L, A+B, ASTM D2369Walkable: Minimum of 4 hours.

.8 Prime and Install Underlayment: Minimum 4 hours, maximum 24 hours.

.2 Acceptable *Products*:

.1 Ardex ’MC Rapid’.

.2 Substitutions: in accordance with Section 01 25 00.

.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 or ASTM C472.

.3 Gypsum based compounds are not acceptable.

.4 Acceptable manufacturers:

.1 Mapei.

.2 Ardex.

.3 Substitutions: in accordance with Section 01 25 00.

.5 Acceptable product: type as recommended by flooring manufacturer for existing substrate conditions.

.4 Concrete underlayment: in accordance with Section 03 53 00.

.5 Cleaning solution:

.1 Acceptable *Products*: type as recommended by flooring manufacturer for existing substrate conditions.

.6 Transition strips:

.1 Resilient transition trims: in accordance with Section 09 65 13.

.7 Temporary protection material: Install suitable protection sheeting, lap joints of material by 150 mm (6") and seal with non-asphaltic tape.

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.

.5 Examine floors in advance of application of flooring to ensure that floors are protected against entry of water and moisture. Perform compatibility test with primer/adhesive and substrate.

.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 my 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 Moisture reduction barrier:

.1 Apply moisture reduction barrier at following locations:

.1 To below-grade and on-grades slabs where slab moisture content is above recommended RH level by floor covering manufacturer after performing pre installation testing

.2 To suspended slabs, regardless of pre-installation moisture testing results.

.3 Concrete Substrate: Prepare concrete to manufacturer’s instructions.

.4 Apply moisture emissions barrier system in accordance with manufacturer’s recommendations.

.5 Do not proceed with work until unsatisfactory conditions have been resolved.

.6 Fill surface cracks, holes, score marks, depressions, and grooves, and repair surface spalls with Portland cement patching or levelling compound.

.7 At door opening locations where finished flooring is adjacent to weather-stripping or automatic door bottoms provide trowel-applied levelling compound to provide full contact between finished flooring and weather-stripping or automatic door bottoms. Taper trowel-applied levelling compound to transition with adjacent flooring substrate to provide smooth and seamless transition at maximum slope of 3:1000 (height to distance) ratio.

.8 Expansion joints, isolation joints, and other movement joints in substrates shall not be filled with patching or levelling compound.

.9 Remove bumps, high spots, peaks and ridges to produce a uniform and smooth substrate.

.10 Prepare substrates so that installation of flooring shall not show telegraphing of substrate.

.11 Remove chalking and dusting and loose material from concrete surfaces with wire brushed or by scraping.

.12 Sweep and vacuum clean substrates minimum 24 hours prior to alkalinity and moisture testing. Do not use sweeping compounds.

.13 Notify *Consultant* of any substrate or levelling compound defects or installation conditions that may result in unsatisfactory performance.

.14 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.

.15 Alkalinity and moisture testing:

.1 Test substrates in accordance with paragraph 3.5 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*.

.16 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.

.17 Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. Do not use sweeping compounds.

.18 Where flooring adjoins thicker floor materials, apply levelling screed, feather out to make up difference in level between materials.

.19 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 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 Mark a chalk line through centre of room to ensure that tile installation is square to walls.

.3 Mix vinyl tiles from a minimum of 3 boxes.

.4 Adjust chalk line to eliminate small vinyl tiles so that no small vinyl tiles are laid at perimeter of room and at thresholds to adjacent flooring. Minimum plank strip cut length shall be 150 mm (6") and minimum plank strip cut width shall be 75 mm (3").

.5 Prime floor where recommended by adhesive manufacturer. Allow to dry.

.6 Apply adhesive uniformly using recommended trowel and with recommended rate in accordance with the adhesive manufacturer's requirements.

.7 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. Do not install flooring to floor drains occurring within finished floor areas.

.8 Roll the flooring in both directions using 68 kg (150 lb) three-section roller.

.9 Cut plank and fit neatly around fixed objects.

.10 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 Coordinate transitions with work of other sections and install transition trim to transitions between different flooring types.

.2 Locate thresholds directly beneath the door (in a closed position).

.3 Set to ensure installation is free of gaps.

.4 Install in longest lengths possible.

.5 Scribe and fit to obstructions.

.6 Fit joints tightly, straight and vertical as applicable. Transition trim joints shall be not less than 610 mm (24") from corners.

.7 Mitre corners.

3.5 Field Quality Control

.1 Conduct quality control in accordance with Section 01 45 00 and as follows:

.1 Field tests and inspections:

.1 Test for moisture vapour transmission in accordance with ASTM F710-22 and ASTM F1869-22 or ASTM F2170-19a in accordance with manufacturer's written flooring installation requirements. Results must not exceed 170 µg/m^2 (3 pounds per 1,000 square feet) in 24 hours when tested to ASTM F1869-22, or exceed 75% when tested to ASTM F2170-19a.

.2 Test for surface pH. Levels of pH shall not exceed the written recommendations of the flooring manufacturer and adhesive manufacturer. Test in accordance with ASTM F710-22.

.3 For each test type: Conduct 3 tests for flooring applications up to 93 m^2 (1000 square feet) in area, and 1 additional test for each additional 93 m^2 (1000 square feet) of flooring area.

.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 flooring as work progresses.

.2 Thoroughly clean surfaces in accordance with vinyl tile manufacturer's written requirements.

.3 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 Initial cleaning shall be performed a minimum 2 days after installation.

.3 Dust mop and vacuum flooring.

.4 Allow flooring to dry prior to applying protection.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Patch, repair and make good existing terrazzo flooring and coved base to match existing.

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 Samples:

.1 Submit 200 mm x 300 mm (8" x 12") samples, on rigid backing, of each material and system proposed for use in the work of this section, demonstrating colour/recipe and showing successive applications of each coat, for verification by *Consultant* of match with existing.

.4 Certificates:

.1 Manufacturer's representative shall inspect surfaces and substrate preparations prior to material installation and submit written confirmation that substrates have been prepared in a manner which will not affect *Product* performance or warranty.

.2 Floor coating system manufacturer shall submit certificate of acceptance that installation meets their requirements.

.5 Qualification data: Shall submit 2 copies of qualification data for installation *Subcontractor*.

.1 Include list of projects indicating name and location of project, name of *Owner*, name and contact information for general contractor, and name and contact information for *Consultant*.

.2 Include letter from TTMAC with the name of the *Project* and name of member installer, stating current member status.

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 minimum 10 years experience.

.2 Manufacturer shall be a member in good standing with the Terrazzo, Tile and Marble Association of Canada, providing materials meeting the minimum standards of TTMAC.

.2 Installers / applicators / erectors:

.1 A contractor Member of TTMAC whose work has resulted in construction with a record of successful in-service performance.

.1 Installer shall have completed terrazzo installations within the past 5 years of scale and complexity similar to the proposed installation.

.2 Execute work of this section only under full time supervision of qualified *Subcontractor's* site supervisor.

1.6 Delivery, Storage, and Handling

.1 Deliver materials to job site in sealed undamaged containers clearly labelled with name and batch number.

.2 Store materials at site in an area specifically set aside for purpose that is locked, ventilated, and maintained at temperatures recommended in manufacturer's literature.

.3 Comply with health and fire regulations in storage area, and during handling and application.

1.7 Field Conditions

.1 Maintain ambient temperature of not less than 13°C13 °C and below 29°C , and a floor temperature of not less than 16°C from 7 days before installation to at least 48 hours after completion of work of this section. Maintain relative humidity of not higher than 40% during same period.

.2 Ensure substrate is sound, dry, free of dust, dirt, paint, grease, oil or other foreign substances that may adversely affect proper adhesion of the coating.

.3 Protect adjacent surfaces from damage resulting from work of this section.

.4 Commencement of installation implies acceptance of concrete surface as suitable to receive coating system.

PART 2 - PRODUCTS

2.1 Performance/Design Requirements

.1 Terrazzo, Tile and Marble Association of Canada (TTMAC) - TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual.

.2 Terrazzo standards: Terrazzo Contractor shall furnish materials and install terrazzo according to TTMAC's "TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.2 Materials

.1 Source limitations for aggregates: Terrazzo *Subcontractor* shall obtain each colour, grade, type, and variety of granular materials from sources capable of providing materials of consistent quality in appearance and physical properties.

.2 Materials shall be sourced from one manufacturer unless otherwise specified.

.3 All components and *Products* of the matrix terrazzo shall be manufactured and supplied by a single manufacturer.

.4 Cement: to CSA A3001-13, Type 10.

.5 Sand: Clean, washed, and locally available, CSA-A23.1-14.

.6 Water: potable.

.7 Marble chips:

.1 Size: Grade chips in accordance with TTMAC gradation standards.

.2 Abrasion and impact resistance: Not more than 40 percent loss when tested in accordance with ASTM C131/C131M-14.

.3 Chips shall contain no deleterious or foreign matter.

.8 Terrazzo cleaner:

.1 Ph factor between 7 and 10, where applicable.

.2 Biodegradable and phosphate free.

.9 Sealer:

.1 Ph factor between 7 and 10, where applicable.

.2 Shall not discolour or amber.

.3 Flash point; ASTM D56, 80F minimum, where applicable.

.4 Finish: Slip Resistant.

.10 Cleaners, sealers and floor finish: to TTMAC standard 1001, 1002, 1003, 1004, 2001, 2002, and 3001 as applicable, or as recommended by terrazzo flooring manufacturer.

.11 Divider strips: White alloy zinc, ‘L’ shaped, depth to match flooring system thickness, to locations as indicated.

.12 Termination and transition strips: Termination strips: White alloy zinc, ‘L’ shaped, depth to match flooring system thickness, to locations as indicated.

.1 Transition strips: Schluter 'Schiene-AE'.

.13 Control joints: Control joints: Back to back white alloy zinc strips with black neoprene filler.

.14 Anti-fracture membrane:

.1 100% solids polyurethane, 500 microns (20 mils) DFT, as recommended by epoxy resin manufacturer.

.2 Joint filler as recommended by floor system manufacturer.

2.3 Mixes

.1 Terrazzo mix:

.1 To match existing.

.2 Proportions:

.1 Underbed: 1 part Portland cement to 4 parts sand by volume and sufficient water to provide workability at as low a slump as possible. Use no more than 18 litres (4.8 gal) of water per bag of cement for underbed mix.

.2 Scratch coat: 1 part Portland cement to 3 to 4 parts sand and sufficient water to provide workability at as low a slump as possible.

.3 Terrazzo topping: as per manufacturer's installation requirements**,** colour pigment if scheduled, and sufficient potable water to produce a workable mix.

.3 Mixing:

.1 Underbed:

.1 Charge and mix sand and Portland cement.

.2 Add water and mix.

.2 Terrazzo topping:

.1 Charge and mix marble chips and colour pigment if scheduled.

.2 Add water and mix to a uniform workable consistency.

PART 3 - EXECUTION

3.1 Examination

.1 Verify that specified environmental conditions are ensured before commencing work of this section.

.2 Examine surfaces to receive floor coatings. They shall be smooth, sound, dry, and free from conditions that will adversely affect execution, permanence, or quality of work. Test surfaces for moisture content to ensure that they are suitable for application, and fully cured. Moisture content of the concrete shall be checked using a Delmhorst moisture meter. Moisture content shall be within the limits set by the flooring manufacturer prior to commencing work of this section.

.3 Surfaces to receive coating shall be equivalent to a light steel trowel finish for new or patched concrete surface.

.4 Ensure that surfaces to receive floor coatings have been provided as specified in the work of other sections, that they will not adversely affect execution, permanence, or quality of work of this section, and that they can be put into acceptable condition by means of preparation specified in this section.

.5 Examine concrete slab surfaces for slope to drain irregularities which could create non-sloping or ponding conditions on the flooring system surface.

.6 Defective work resulting from application to unsatisfactory surfaces will be considered the responsibility of those performing the work of this section.

.7 Ensure that floor drains are installed flush with top of floor slabs.

3.2 Preparation

.1 Removal of Existing

.1 Strip existing flooring in areas requiring patching or repair to nearest existing divider strip, unless directed otherwise by *Consultant*.

.2 After acceptance of surfaces, prepare them as required by the work of this section. Remove projections and other conditions that may affect the installation of the flooring system.

.3 Fill open control joints, and other cracks and voids with sealant material compatible with floor coating materials.

.4 Clean surfaces by steel shotblast, sandblast, or other method approved by manufacturer. Thoroughly vacuum clean floors upon completion of blast operation. Prime and seal surfaces as recommended by floor coating manufacturer. Substrate to be approved in writing by manufacturer prior to application of coating.

.1 Submit written report to *Consultant* following procedures for manufacturer's field review in accordance with Section 01 45 00.

.5 Cover or mask surfaces adjacent to those receiving floor coating to protect work of others and property from damage and soil.

3.3 Floor Levelling

.1 Install in accordance with manufacturer's and TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual recommendations and guidelines.

.2 Underbed: Apply over prepared substrate and screed level making allowances for applicable terrazzo topping. Permit underbed to cure minimum 24 hours prior to receiving terrazzo topping.

3.4 Anti-Fracture Membrane

.1 Install in accordance with flooring manufacturer's and TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual recommendations and guidelines.

.2 Concrete joints and cracks shall be routed, cleaned and filled with joint filler. Provide 150 mm (6") wide membrane, centred on joints, applied in accordance with manufacturer's written requirements.

3.5 Installation

.1 General:

.1 Apply coatings with care to ensure that no laps, voids, or other marks or irregularities are visible, and with an appearance of uniform colour, sheen and texture, all within limitations of materials and areas concerned.

.2 Match colours and textures of approved samples.

.3 Make clean true junctions with no visible overlap between adjoining applications of coatings.

.4 Place cloths and other disposable coating materials, that are a fire hazard, in closed metal containers and remove from building every night.

.5 Erect barriers to prevent the entry and presence of personnel not performing work of this section during application of coatings, and for 48 hours following completion of application.

.6 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. Do not install flooring to floor drains occurring within finished floor areas.

.2 Provide termination strips between dissimilar flooring materials and fill with sealant.

.3 Carefully prepare and mix materials used in flooring work in compliance with flooring manufacturer's written requirements.

.4 Flooring Application: Apply each component of flooring system in compliance with flooring manufacturer's directions to produce a smooth and uniform monolithic wearing surface, uninterrupted except at divider strips, or other types of joints, indicated or required.

.5 Apply sealer in accordance with manufacturer's written requirements. Wipe off excess water before it dries.

.6 Apply second coat of sealer in same manner as first, but not until Work is complete and terrazzo has been cleaned again as previously specified above. Apply two coats of surface finish.

.7 Base detail as indicated.

.8 Provide termination strips at cove base and where epoxy terrazzo meets different flooring types. Provide grout on adjacent flooring surfaces suitable for level transition to epoxy terrazzo divider strip. Provide transition strips where indicated.

.9 Match approved samples in sheen, colour and texture.

.10 Finish overall terrazzo and strip surface shall be smooth, flush, and imperfections shall be indiscernible when viewed from distance of 762 mm (30").

.11 Joints: Where substrate is interrupted by expansion or control joints, provide joint in flooring to comply with details indicated, or if not indicated, as recommended by flooring manufacturer.

3.6 Field Quality Control

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

3.7 Adjusting and Cleaning

.1 Existing Terrazzo Clean-up

.1 Strip existing finish to approval of *Consultant* using equipment and method as recommended by manufacturer.

.2 Cleaning and Sealing:

.1 Wash surfaces with a neutral cleaner, rinse with clean water and allow to dry. Apply 2 coats of sealer in accordance with flooring manufacturer's directions.

.2 Touch up and refinish minor defective work of this section. Refinish entire coated surface areas where finish is damaged or otherwise unacceptable.

.3 Remove promptly, as work progresses, spilled or spattered coating materials from surfaces of work performed under other sections. Clean uncured flooring materials from surfaces in accordance with flooring manufacturer's written requirements. Removal of cured materials requires scraping, chipping, or grinding. Do not mar surfaces while removing. Clean floors on completion of work.

.4 Leave storage and mixing areas in same condition as equivalent spaces in *Work*. Clean flooring just prior to final acceptance using materials and procedures recommended by flooring manufacturer.

.5 Final cleaning is specified in Section 01 74 00.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.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.

.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.

.4 MPI (Master Painters Institute) Manual:

.1 Provide and maintain 1 copy of MPI Manual, latest edition, at site office for reference.

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*.

.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 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.

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.

.6 Paints and coatings materials used within the weatherproofing system shall not exceed the VOC content limits of the following criteria.

.1 Interior paints and coatings: to following Green Seal GS-11 VOC limits:

.1 Flat coating type: 50 gm/L.

.2 Non-flat coating type: 150 gm/L.

.2 Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates: Green Seal Standard GC-03, Anti-Corrosive Paints, maximum 250 gm/L.

.3 Clear wood finishes, floor coatings, stains, and shellacs applied to interior elements: South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings.

2.3 Equipment

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

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 catalyzed 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 and gloss schedule: as indicated on drawings.

.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.

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 Concrete substrates: Remove release agents, curing compounds, efflorescence, and chalk.

.6 Masonry substrates: Remove efflorescence and chalk.

.7 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.

.8 ZF75 and ZF120 galvannealled-metal substrates: Remove grease and oil residue from galvannealled sheet metal by methods to produce clean surfaces that promote adhesion of subsequently applied paints.

.9 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.

.10 Aluminum substrates: Remove loose surface oxidation.

.11 Wood substrates for paint finish:

.1 Scrape and clean knots, and apply coat of knot sealer before applying primer.

.2 Sand surfaces that will be exposed to view, and dust off.

.3 Prime edges, ends, faces, undersides, and backsides of wood.

.4 After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

.12 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.

.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 Mechanical and Electrical Items

.1 Finish paint primed mechanical and electrical items with 2 coats of paint. Include for the following list unless otherwise indicated:

.1 Air handling units.

.2 Convectors.

.3 Conduit.

.4 Diffusers.

.5 Ductwork.

.6 Grilles.

.7 Hangers.

.8 Heaters.

.9 Fire hose cabinets.

.10 Fire extinguisher cabinets.

.11 Louvres.

.12 Radiators.

.13 Stacks.

.14 Vents.

.2 Prime and paint exposed insulated and bare pipes. Prime and paint exposed conduits and electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items. Use heat resistant epoxy paint on pipes and surfaces where operating surface temperature exceeds 65°C.

.3 Coordinate the painting of pipes, and coverings with mechanical contractor applying colour banding, flow arrows and pipe identification after the painting of pipes and coverings.

.4 Paint work to match adjacent walls and ceilings unless directed otherwise.

.5 Paint interior surfaces of air ducts and pipe trenches including heating pipes and elements that are visible through grilles and louvres with one coat of flat metal paint to limit of sight-line. Paint to be black or white as directed by *Consultant*.

.6 Gas pipes, whether concealed or exposed, shall be painted in accordance with gas code.

.7 Paint and finish wall surfaces behind convectors. Walls to be finished prior to installation of convector covers. Touch up walls after covers are installed as necessary to make good installation damage.

.8 Air diffusers shall be primed and finished with 2 coats of paint of same colour and sheen as ducts and/or ceiling.

3.5 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*:

.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.

3.6 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.

3.7 Interior Paint Systems

.1 System references listed are based on MPI Manual and are Premium Grade, Low VOC (Green Seal GS-11), High Performance Architectural, unless otherwise indicated:

.1 Concrete vertical surfaces: (including ceilings)

.1 INT 3.1C High performance architectural latex.

.2 Primed ferrous metal; touch-up and finish coats required under this section:

.1 Ferrous metal fabrications: Prepared and primed in accordance with Section 05 50 00.

.2 INT 5.1R High performance architectural latex.

.3 Galvanized metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.)

.1 INT 5.3M High performance architectural latex.

.4 Dressed lumber: (including door frames, casings, mouldings, etc.)

.1 INT 6.3A High performance architectural latex.

.5 Plaster and gypsum board: (gypsum wallboard, drywall and textured finishes)

.1 INT 9.2B High performance architectural latex finish.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Tackboards.

.2 Marker boards (whiteboards).

.3 Interactive whiteboards (smart boards).

.4 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.

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 Tackboards

.1 Acceptable manufacturers:

.1 ASI Visual Display Products.

.2 Claridge – CPE Design Solutions.

.3 Delta Products Ltd.

.4 Global School Products Inc.

.2 Natural cork tackboard: 12.7 mm (1/2") factory prelaminated consisting of 6 mm (1/4") thick pure grain natural cork laminated to 6 mm (1/4") particle board substrate under mechanical pressure in maximum panel sizes of 1524 mm x 3657 mm (5'-0" x 12'-0"). Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.

.3 Aluminum trim: in accordance with Trim Components paragraph below.

2.3 Marker Boards (Whiteboards)

.1 Acceptable manufacturers:

.1 ASI Visual Display Products.

.2 Claridge – CPE Design Solutions.

.3 Delta Products Ltd.

.4 Global School Products Inc.

.2 Porcelain enamel board with porcelain enamel writing surface. Boards shall be manufactured in accordance with Porcelain Enamel Institute's standards. Gloss factor: 6-8 as measured by 45° glossmeter.

.1 Face Sheet: 28 gauge Porcelain Enamel Steel.

.1 Colour: White colour writing surface, designed for long lasting heavy duty marker writing surface, free of permanent marker staining.

.2 Core: 11 mm (7/16") MDF.

.3 Backing: moisture barrier back.

.3 Joints shall be absolutely flush and level, plumb true with edges finished square and fitted as closely as possible. Use concealed joint fasteners.

.4 Particle board backing to CAN3-0188.1-M78, 6 mm (1/4") thick, with sanded faces.

.5 Concealed mechanical joining system: join abutting panels with a spline as recommended by the manufacturer.

.6 Aluminum trim in accordance with Trim Components paragraph below.

2.4 Interactive Whiteboards (Smart boards)

.1 Interactive dry erase application screen surface to consist of a proprietary surface permanently bonded to a magnetic substrate that allows use of dry erase markers, interactive stylus and touch interactivity. Projection surface to have a gain of 2.5 and a viewing half angle of 25 degrees. Frame shall be 25 mm thick with a 9.5 mm bezel in aluminum with a silver finish. Bezel thickness at the screen surface is 1.5 mm.

.2 Include top mounting bracket, lower mounting brackets, 24” long marker tray, set of three dry erase markers, foam eraser, cleaning cloth, and cleaning solution.

.3 Viewing area: 1350 mm x 2150 mm (h x w).

.4 Basis of design:

.1 Da-Lite ‘IDEA Screen’.

2.5 Trim Components

.1 Acceptable Manufacturers:

.1 ASI Visual Display Products.

.2 Claridge – CPE Design Solutions.

.2 Aluminum trim:

.1 Acceptable Products:

.1 Basis of design: ASI ‘9800 Series’ trim or similar equivalent.

.3 Accessories:

.1 Perimeter.

.2 Divider Bar.

.3 Maprail.

.4 Tray.

.4 Extruded aluminum components, AA6063 T5 or approved alternative, 25 mm x 25 mm x 3 mm (1” x 1” x 1/8”), mitred corners.

.5 Finish: etched and clear anodized 0.051 mm (0.002") satin finish free from extruding draw marks and surface scratches.

.6 Reveal: Provide 3.2 mm (1/8") reveal between board finish and aluminum frame.

.7 Final assembly to have seamless/welded flush and level butt joints. No visible joints accepted and no intermediate trim.

2.6 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

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Signage.

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 manufacturers' installation instructions.

.3 Samples:

.1 Submit 3 - 305 x 305 mm (12" x 12") samples for each sign type, each fastener type and finish specified.

.4 Templates:

.1 Submit templates to *Contractor* for use by installers and fabricators as required for proper location and installation of signage.

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 Fabricators and 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 Provide when requested, at the *Consultant*'s discretion, mock-ups of items as requested by *Consultant*.

.2 Reviewed mock-ups become the standard for the work of this section.

1.5 Delivery, Storage, and Handling

.1 Package or crate, and brace and wrap *Products* to prevent damage during shipment and handling. Label packages and crates according to signage numbers as listed in the signage schedule, and protect finish surfaces from environmental conditions where required.

.2 Deliver *Products* to location at building site designated by *Contractor*.

.3 Provide methods for lifting or hoisting units into place without causing damage.

PART 2 - PRODUCTS

2.1 Interior Signage

.1 Interior signage:

.1 Material: minimum 6 mm thick acrylic with minimum 0.8 mm thick applied vinyl letters and Braille beads.

.2 Text: as indicated on drawings.

.3 Font: Helvetica Medium and Grade 2 Braille.

.4 Symbols, letters, and numbers shall be raised tactile.

.5 Text colour: white letters on black background, final colours as selected by *Consultant*.

.6 Corners: 6 mm radius, unless otherwise indicated.

.7 Fastening:

.1 Install signs with mechanical tamperproof, stainless steel fasteners.

.8 Refer to drawings for room names and sign sizes.

.9 Where indicated, use universally accepted male, female, and barrier-free symbols.

PART 3 - EXECUTION

3.1 Installation

.1 Examine surfaces to which signage is to be anchored and report any unacceptable conditions. Commence work only after surfaces are acceptable.

.2 Install in accordance with signage manufacturer's specifications and templates as required for installation of work of this section.

.3 Install signage level and securely at locations indicated.

3.2 Adjusting and Cleaning

.1 Verify under work of this section that installed *Products* function properly, and adjust them accordingly to ensure satisfactory operation.

.2 Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at site only if acceptable.

.3 Remove excess materials from the *Place of the Work*.

.4 Upon completion of the work of this section, or at such time or times as the *Contractor* shall direct, remove protective coverings and clean down the finished work.

.5 Clean adjacent surfaces which have been soiled or otherwise marred, in an acceptable manner, to completely remove evidence of material causing same.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section includes:

.1 Roller window sun shades at interior locations.

.2 Roller window room darkening (black-out) shades at interior locations.

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:

.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.

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 MechoShade Systems, Inc.

.4 Solarfective Products by Legrand Global.

.5 Sun Glow Window Covering Products of Canada Ltd.

.6 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:

.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

.1 Shades shall be operated to permit infinite positioning. Left or 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.

.3 Drive Chain: No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have passed a 40 kg (90 lb) load test.

.1 Provide child-safe chain retainers.

.2 Control shades and room darkening shades independently.

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 molded 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.

.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.

.9 Room darkening (black-out) shade features: 13 mm (1/2") pile mounted in prefinished 38 mm x 28 mm (1-1/2" x 1-1/8") extruded aluminum side and bottom channels finished to match mullions. Include Dynamic hembar to allow for variance in window sill level.

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: Clear anodized AA-M12C22A31.

.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 Solarfective 'Solarblock 300 Series'.

.2 Substitutions: in accordance with Section 01 25 00.

.2 Colour: as selected by *Consultant* from manufacturer's full range.

.2 Room darkening (black-out) fabric; dimensionally stable fabrics:

.1 Acceptable *Products*:

.1 Phifer SheerWeave Style 7000.

.2 Substitutions: in accordance with Section 01 25 00.

.2 Colour: as selected by *Consultant* from manufacturer's full range.

.3 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.

.4 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.

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.

.7 Room darkening shades (black-out) to be installed to eliminate passage of light from exterior.

.8 Electrical wiring, hook-up, switches; motorized shades: in accordance with Divisions 26, 27, and 28.

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.

END OF SECTION

THE MITCHELL PARTNERSHIP INC.
CONSULTING ENGINEERS

MECHANICAL SPECIFICATION

FOR

KAWARTHA HEIGHTS PUBLIC SCHOOL
PETERBOROUGH, ONTARIO
CLASSROOMS 4, 5, 6, 7

ISSUED FOR TENDER

PREPARED BY:

THE MITCHELL PARTNERSHIP INC.
200 KING STREET WEST, SUITE 310
TORONTO, ONTARIO
M5H 3T4

(416) 499-8000

DATE: MARCH 13, 2024
TMP FILE NO. 23-1111-000

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 These Specifications are an integral part of the Contract Documents. Tendering and Contract Requirements and Division 01 00 00, General Requirements apply to all Specification Sections.

.2 Ensure that all mechanical and electrical services are arranged so that “layering” of services is minimized. Offset as required to maximize ceiling space.

.3 Maintain the specified ceiling height while allowing 200 mm for lighting below all mechanical services.

.4 Work in the Specifications is divided into descriptive Sections which are not intended to delegate functions or work to any specific Subcontractor or identify absolute contractual limits between Subcontractors or between the Contractor and his Subcontractor. The requirements of any one Section apply to all Sections. Refer to other Sections to ensure a complete operational product and fully coordinated standard of work.

.5 Refer to architectural drawings for finish required for mechanical systems. Where a discrepancy exists between finish listed in mechanical and architectural specifications, the more expensive specifications will be enforced.

.6 The responsibility for determining which Subcontractor or supplier shall provide labour, material, products, equipment, and services to complete the work rests solely with the Contractor.

.7 The direction to 'provide' equipment, materials, products, labour and services shall be interpreted to 'supply, install and test' the Division 20 00 00 work indicated on the Drawings and specified. All products and equipment shall be new.

.8 Provide mechanical components and normal system accessories not shown on the Drawings or stipulated in the Specifications but required to ensure complete operational systems acceptable to the Consultant and all authorities having jurisdiction.

.9 Obtain and pay for all permits required by Authorities Having Jurisdiction, testing agencies, regulatory agencies and for other permits required to complete the work of this Division.

1.2. INTENT/PHASING

.1 Mention in the Specifications or the indication on the Drawings of equipment, materials, operation and methods, requirements of the quality noted, the quantity required, and that the systems are complete in every respect.

.2 Consider the Specifications as 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.

.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 materials, equipment and parts of equipment and repair related damages.

.4 Phasing shall be scheduled with the Owner.

1.3. CONTRADICTION AND AMBIGUITY

.1 Where there is apparent contradiction or ambiguity in the documents, or where there are apparent discrepancies in or omissions from the documents, or if there is any doubt as to the intent of the documents, the bidder shall request and obtain written clarification(s) from the Consultant prior to submitting a tender.

.2 Consideration will not be granted for misunderstanding of the intent of the documents or the extent of the work to be performed.

1.4. METRIC PRACTICE

.1 Conform to Canadian Metric Practice Guide CSA CAN3-Z234.1-89.

.2 Provide adapters between metric and imperial installations.

.3 Metric descriptions in this Division are nominal equivalents of Imperial values.

1.5. COORDINATION

.1 Coordinate and schedule the work of this Division with other work to facilitate mutual progress.

.2 Identify and resolve interference problems prior to prefabrication and installation of equipment. Submit interference drawings for review prior to installing anything on site. Do not proceed until drawings have been reviewed.

.3 Examine the site and all Contract Documents prior to bid submission. No allowance will be made for any difficulties encountered due to any features of the building, methods of construction, site or surrounding public and private property which existed up to the bid close.

1.6. REFERENCE STANDARDS

.1 Provide new materials and equipment of design and quality defined in Section 20 25 00. Provide current models of equipment manufactured in North America, unless specified otherwise, with published ratings certified by recognized North American testing and standards agencies.

.2 Workmanship and installation methods shall conform to best practice. Employ tradesmen to perform work under the direct supervision of qualified personnel.

.3 Install equipment in accordance with manufacturer’s recommendations.

.4 Meet ASHRAE/IES 90.1, 2013 (or most recent edition) Standards for the supply and installation of all equipment.

.5 Meet the additional selection, sizing and performance criteria specified in this Specification.

.6 Be responsible for all aspects of your work including any damage resulting.

1.7. DRAWINGS AND MEASUREMENTS

.1 Read the mechanical work drawings in conjunction with all other structural, architectural, sprinkler, electrical, etc., drawings and, where applicable, the Code Consultant's report.

.2 The mechanical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of the building is to be taken on site. Do not scale the drawings, and do not use the drawings for prefabrication work.

.3 The drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, all offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and structural details but not shown on the drawings.

.4 The locations of equipment and materials shown may be altered, when reviewed by the Consultant, to meet requirements of the equipment and/or materials, other equipment systems being installed, and of the building, all at the responsibility of the contractor and at their cost.

.5 Sections of the mechanical specification are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections are to be read as a whole.

.6 The mechanical specification does not generally indicate the specific number of items or extent of material required. The specification is intended to provide product data and installation requirements. It is necessary to refer to drawing schedules, layouts, schematic diagrams, riser diagrams, and details to determine correct quantities.

.7 The mechanical drawings and specification are intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.

.8 The mechanical drawings and specifications have been prepared solely for the use by the party with whom the Consultant has entered into a contract and there are no representations of any kind made by the Consultant to any other party.

.9 When a discrepancy exists within the drawings or specification, the most costly arrangement will take precedence.

.10 Drawings do not indicate exact new or existing architectural, structural or electrical features. Coordinate with other contractors prior to commencement of work. Site measure all existing architectural, structural and electrical systems as required.

.11 Do not scale Drawings. Take field measurements before ordering and fabricating materials.

.12 Obtain 'roughing-in' requirements of equipment which is not part of Division 20 00 00 work before proceeding.

.13 Leave areas clear for future equipment and maintenance including coil/fan removal.

1.8. REGULATORY REQUIREMENTS

.1 Meet the requirements of Section 01 41 00.

.2 Meet the requirements and recommendations of all Municipal, Provincial and Federal Bylaws and Ordinances.

.3 In general, the physical and chemical properties and characteristics of Division 20 00 00 work shall meet the requirements of recognized agencies which shall include:

AMCA	-	Air Moving & Conditioning Association
ADC	-	Air Diffusion Council
ANSI	-	American National Standards Institute
AHRI	-	Air Conditioning & Refrigeration Institute
ASHRAE	-	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
AWWA	-	American Water Works Association
CGA	-	Canadian Gas Association
CGSB	-	Canadian General Standards Board
CSA	-	Canadian Standards Association
CTI	-	Cooling Tower Institute
EGC	-	Enbridge Gas Company
MTC	-	Ministry of Transportation and Communication
NBCC	-	National Building Code of Canada
NFPA	-	National Fire Protection Association
OBC	-	Provincial Ontario Building Code
OFM	-	Local Fire Codes or Standards Ontario Fire Marshall
OH	-	Ontario Hydro Special Inspection Department
OME	-	Ontario Ministry of Environment
OML	-	Ministry of Labour and Workmen's Compensation Requirements
OSBIE	-	Ontario School Board’s Insurance Exchange
OWRA	-	Ontario Plumbing Code
PBD	-	Local Building Codes City of Peterborough, Buildings Department
TSSA	-	Technical Standards & Safety Authority
UL	-	Underwriter's Laboratories Inc.
ULC	-	Underwriter's Laboratories of Canada

.4 Give all necessary notices, obtain all permits and pay for fees, taxes and other costs in connection with the work. File all necessary forms, Contract

Documents and prepare submissions and obtain approvals of regulatory bodies having jurisdiction.

.5 Comply with the requirements of the Model National Energy Code for Buildings or ASHRAE 90.1-2013 in the selection, application and installation of all mechanical equipment and systems.

1.9. CHANGES TO CONTRACT WORK

.1 Do not proceed with changes to Work without written authority from the Owner.

.2 Follow procedures outlined in Tendering and Contract Requirements for administration and execution of Contract revisions.

.3 Quotations for changes to work shall be determined by one of the following methods as selected by the Owner.

.1 By estimate and acceptance of a lump sum ("Lump Sum method");

.4 Changes in the work evaluated using the lump sum method shall be based on the following factors:

.1 For Materials and Equipment - The latest edition of Allpriser published list prices, less the following discounts:

Item	Discount
Steel Pipe	50%
Copper Pipe	45%
Cast Iron Soil Pipe	45%
Stainless Steel Pipe and fittings	45%
Welded Fittings	50%
Grooved Fittings	30%
Threaded Fittings	40%
Cast Iron Screwed Fittings	40%
Copper Fittings	45%
Cast Iron MJ Fittings	35%
Valves	25%
Insulation Materials	35%
All Other Materials	25%
Equipment Rental	Actual Rate, but not to exceed local rates.

.2 For Base Labour Units - The most recent edition of the Mechanical Contractors Association Labour Calculator and SMACNA published Labour Units, latest edition. If required/applicable, factors affecting productivity as outlined in the document "Change Order Protocol" shall include the following additional factors when evaluating change pricing:

.1 Site Conditions

.2 Clean Up

.3 Material Handling

.4 Scheduling

.5 Time Keeping

.6 Mobilization and Demobilization

.7 Labour Warranties (not included in Labour Rate)

.8 Estimating

.9 Fabrication Drafting

.10 Measuring

.11 Printing

.12 Record Drawings and As-Built Drawings

.13 Interference Drawings

.14 Garbage Sorting, Tagging, Disposal

.15 Installation Height (applies to work 10 feet or more above working surface)

.16 Multi-storey - lost productivity factor

.17 Environmental conditions - lost productivity factor

.18 Availability of personnel - lost productivity factor

.19 Stacking of trades - lost productivity factor

.20 Abnormal work schedule - lost productivity and increased supervision factor(s)

.21 Crew size inefficiency – use of larger than planned workforce

Under no circumstances shall the cumulative total of additional factors exceed 20% of the hours established using Base Labour units.

.5 Where changes are evaluated using either the Lump Sum method, or the Time and Material method use Labour Rates defined on the Bid Form in effect at the

time of bid submission and adjusted from time to time by changes to applicable legislation and/or Union Contract. The Labour Rate shall include:

.1 Base Rate

.2 Vacation/Stat Pay

.3 Union Deductions and Charges

.4 Legislated Burdens

.5 Expendable Small Tools

.6 Finance Payroll

.7 Rest Breaks

.8 Idle Time

.9 Safety

.10 Labour Warranties

.11 Parking

.6 Where changes are evaluated using either the lump sum method, or the time and material method, the cost to the Owner shall be the actual cost of credits and, where additional work is required, the cost to the Owner shall be the actual cost plus a percentage covering overhead and profit, after all credits included in the change have been deducted.

.7 Where “credit” changes are estimated, the overall factors used to establish the value of the change shall not be less than 80% of equivalent factors used for “add” changes.

.8 Where changes are evaluated using either the lump sum method, or time and material method, the markup for overhead and profit shall be limited to and be calculated as follows:

.1 Work carried out by the Trade Contractor or Trade Subcontractor: 10% overhead and profit combined.

.2 Trade Contractor’s overhead and profit on Trade Subcontractor’s work: 5% overhead and profit combined.

.3 Credits to Owner’s account: For changes involving deletions only, overhead and profit shall not be deducted.

.4 Trade Contractor and trade Subcontractor’s overhead and profit shall be calculated on net additional work only.

.5 The cumulative total percentage for overhead and profit charged by the Trade Contractor, Trade Subcontractor and others shall not exceed 20% of the cumulative total value of such change in the work, net of overhead and profit.

.9 Where changes are extensive, or where requested by the Consultant, material and labour take-off shall be organized on a drawing by drawing basis or area by area basis to more readily facilitate verification of quantities and labour hours.

1.10. WARRANTY

.1 Meet the requirements of Tendering and Contract Requirements.

.2 Warranty all equipment, material and workmanship for not less than one year from date of Substantial Performance of the Work, or for longer periods when stated elsewhere in the Specifications.

.3 If any equipment or material does not match the manufacturer's published data or rating schedules during performance tests, replace without delay. Bear all associated costs of replacement. Adjust all components to achieve the specified ratings.

.4 The Owner will give notice of observed defects promptly in writing.

.5 Promptly correct defects and deficiencies which originate during the warranty period. Pay for resulting damage.

1.11. INSTRUCTIONS TO BIDDERS

.1 Pay attention to “Basis of Design”, “Alternative” and “Alternate” manufacturers and supplier defined in Section 20 25 00.

.2 The Bidder is invited to submit additional alternate prices not specifically requested with the Bid.

.3 Alternate prices may be used to establish the lowest Contract Price.

.4 The lowest or any Bid will not necessarily be accepted.

1.12. QUALITY ASSURANCE

.1 All mechanical work is to be done by journeyman tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced journeyman tradesman. The use of apprentice tradesmen is to be limited and the journeyman/apprentice ratio is subject to the Consultant’s approval.

.2 All journeyman tradesmen are to have valid trade certificates available at the site for review by the Consultant at any time.

.3 An experienced and qualified superintendent is to be onsite at all times when mechanical work is being performed.

1.13. WORKPLACE SAFETY

.1 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for all

products where required and maintain one copy at the site in a visible and accessible location available to all personnel.

.2 Comply with all requirements of Occupational Health and Safety Regulations and all other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations.

.3 If at any time during the course of the work asbestos containing materials, black mould, lead paint, or any other such materials are encountered or suspected, immediately report the discovery to the Consultant and cease all work in the area in question. Do not resume work in affected areas until the situation has been properly corrected and without written approval from Owner.

PART 2 - SUBMITTALS

2.1. SHOP DRAWINGS

.1 Submit shop drawings via email in pdf format only. Provide hard copy reproduction of all shop drawings for manuals, authorities having jurisdiction, the Owner and for coordination among other Trades. Identify Shop Drawing by Specification index reference and project name.

.2 Review all Shop Drawings prior to submittal and clearly certify as 'Correct for Review by Consultant'. Show company name, date and sign all Shop Drawings.

.3 Consultant review of Shop Drawings does not relieve the Contractor of full responsibility for errors, necessity to check Shop Drawings, furnish materials and equipment and perform work required by the Contract Documents.

.4 Clearly identify all components, accessories, including options to be supplied with each item.

.5 Submitted product data shall include sufficient detail to allow a reasonable assessment of the equipment being provided. The data shall include, but not be limited to:

.1 dimensions, including service clearance requirements

.2 part load operational capabilities and limitations

.3 materials of construction including exterior and internal finishes

.4 factory test standards rating conformance to recognized and applicable industry standards

.5 extended warranty coverage

.6 product installation, startup and operation manuals

.7 statement of compliance with the Model National Energy Code of Canada, as applicable

.6 Incomplete submissions will be returned as unacceptable.

.7 Bind one set of reviewed Shop Drawings in each Operating and Maintenance Manual.

.8 Provide shop drawings for specified items as follows:

Section	Title	Equipment
20 05 00	Basic Mechanical Materials and Methods	Expansion Joints & Guides Hangers
20 07 00	Insulation	Insulation Materials Spec Sheets
23 05 93	Balancing	Air Balancing Reports Water Balancing Reports
23 21 13	Hydronic Piping Systems	Piping Joints
23 37 13	Air Terminals	Grilles and Diffusers

2.2. ALTERNATIVE MANUFACTURER AND SUPPLIER

.1 Equipment and materials are specifically described for the purpose of indicating standards of quality and workmanship. Base Bid on the items specified in Section 20 25 00 as “Basis of Design” or “Alternative Manufacturer”.

.2 Maximize the Canadian content of all equipment and materials used on this project.

.3 Alternate equipment or materials may be submitted with the Bid Form, indicate appropriate cost saving. Supply with each alternative, following bid submission, upon request by Consultant, the following information:

.1 details of manufacture

.2 dimensions including required clearance

.3 performance data

.4 the cost saving for piping, ductwork and electrical changes imposed by the alternative

.5 the effect upon and estimated cost to other trades

.6 Canadian content percentage

.4 Where alternates are accepted, there will be no further cost allowances for subsequent changes in Division 20 00 00 work or other Contracts to make the alternates complete and equal to the specified equipment and materials.

.5 If alternate equipment is accepted, prepare when requested, equipment layouts at no extra cost. Show clearly in plan, elevations and sections, all equipment details including dimensional changes. Show location changes to

ducts, pipes and wiring and the effect of these changes on the building. Drawings shall be 1:50 scale.

.6 The right is reserved to accept or reject any alternative.

2.3. SAMPLES

.1 Submit samples or provide site mockup of proposed materials upon request of the Consultant, including:

.1 insulation and adhesives

.2 hangers, pipe supports, inserts and fastening devices

.3 pipe and duct identification

.4 diffusers, registers and grilles

.2 Provide site mockup of proposed materials before proceeding.

2.4. COORDINATION DRAWINGS

.1 Division 20 00 00 shall take the lead role in preparation of electronic interference/coordination drawings. Use all other disciplines electronic drawings as basis for preparation of interference drawings. Position all Division 20 00 00 services to accommodate the work of other divisions.

.2 Prior to commencement of work, submit for Consultant review, pipe, duct and equipment interference and sleeving drawings for each floor level and for all Division 20 00 00 work. Drawings must be coordinated and certified correct for review.

.3 Coordination drawings shall be to a scale sufficient to show the necessary details. Submit for review, using the same procedures as specified for Shop Drawings.

.4 Prepare drawings in conjunction with other Divisions, wherever possible conflict due to the positioning of Division 20 00 00 equipment, piping or ductwork exists.

.5 Dimension proposed location of Division 20 00 00 work with respect to building elevations and established grid lines.

.6 Prepare fully dimensioned detail drawings of all shafts, duct spaces and pipe spaces. Show sleeving, recessed and formed holes required in concrete for Division 20 00 00 work. Include information pertaining to access, clearances, tappings, housekeeping pads, drains and electrical connections.

.7 Base information used to prepare drawings on reviewed Shop Drawings.

.8 Provide field drawings with position of various services when required by Consultant.

.9 Submit a list of access doors and panels showing proposed type, size and location. Coordinate drawings with Architectural detail drawings and reflected ceiling plans prior to submission.

.10 Revise or alter the arrangement of work that has been installed without proper coordination, study and review, even if it was completed in accordance with the Contract Documents, in order to conceal the work behind finishes, or to allow the installation of other work, at no additional cost. In addition, pay for the cost of alterations in other work required by the alterations to your work.

.11 All shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.12 Use the project's CAD files as the starting point for the creation of coordination drawings. Use the structural steel contractor's CAD files and not the design files. The contractor's drawings will show angles, braces, supports, etc. that are not in the design model. Use the electrical contractor's CAD file in combination with the electrical consultant's model.

.13 Continuously update the CAD model to accurately reflect all instructions issued by the architect and consultants in whatever format these instructions are issued. They most likely will not be issued as CAD files.

2.5. RECORD DRAWINGS

.1 Meet the requirements of Section 01 78 39.

.2 Suitably store and protect drawings on site and make available at all times for inspection.

.3 Show locations of access doors and panels and identify the equipment and components that they serve.

.4 Transfer all record drawings to AutoCAD prior to submission to Consultant.

.5 Submit record drawings for review in PDF format and hard copy.

2.6. OPERATING AND MAINTENANCE MANUALS

.1 Meet the requirements of Section 01 78 00. Arrange manuals into system sections and subsections consistent with the layout and function of the mechanical system.

.2 It is absolutely unacceptable to submit the operations and maintenance manual in "bits and pieces". Submit one comprehensive fully complete manual for review.

.3 Submit a searchable PDF file.

.4 Submit one fully organized PDF for review at least two weeks before instructions to Owner are commenced.

.5 Submit one final manual after incorporating all requested changes to the consultant.

.6 Ensure that the terminology used in various sections of the manual is consistent.

.7 Each manual shall contain the following information:

.1 description of each system with description of each major component of system

.2 complete sets of page size equipment Shop Drawings

.3 equipment manufacturer's installation, startup and operation manuals

.4 equipment manufacturer's recommended spare parts lists

.5 equipment identification list with serial numbers

.6 final balancing reports

.7 extended warranty documentation

.8 belt schedule/inventory/list

PART 3 - EXECUTION

3.1. INSPECTION, TESTING AND CERTIFICATES

.1 Periodic inspections of the work in progress will be made to check general conformity of the work to the Contract Documents. Observed deficiencies will be reported. Correct deficiencies immediately.

.2 Meet the requirements of all laws, bylaws, codes, regulations and authorities having jurisdiction.

.3 Where the Contract Documents, instructions or the governing authorities require Division 20 00 00 work to be tested, inspected, or approved, give sufficient notice of its readiness for inspection and schedule the date and time for such inspection.

.4 Uncover Division 20 00 00 work that is covered up without consent, upon Consultant request, for examination and restore at no extra cost to the Owner.

.5 Furnish certificates and evidence that Division 20 00 00 work meets the requirements of authorities having jurisdiction.

.6 Correct deficiencies immediately upon notification.

3.2. TEMPORARY SERVICES

.1 Provide temporary mechanical services in accordance with the requirements of Section 01 50 00.

.2 Make connections to temporary power source for use by Division 20 00 00.

.3 Provide and maintain temporary fire protection services as required by the authorities having jurisdiction.

.4 When the permanent water service is installed, it shall be used to supply water for the use of Other Contractors.

.5 Perform operations necessary for checking, testing and balancing after written approval is given to start up systems. Ensure that care is taken to protect equipment from damage and to prevent distribution of dust through duct systems.

.6 Do not use permanent plumbing, heating or air conditioning systems for temporary services during construction, except with written permission from Consultant.

3.3. CUTTING AND PATCHING

.1 Meet the requirements of Section 01 73 29.

.2 Give notification in time to Other Contractors of openings required for Division 20 00 00 work. Supply accurate details of location and size. When this requirement is not met, bear the cost of cutting and patching.

.3 In existing work, cutting, patching and restoration of finished work to original condition will be carried out by Other Contractors at the expense of Division 20 00 00.

.4 Obtain written Consultant approval before cutting openings through structure.

.5 Where new work connects with existing and where existing work is altered, cut, patch and restore to match existing work.

3.4. PROTECTION

.1 Protect all work from damage. Keep all equipment dry and clean at all times.

.2 Cover openings in equipment, pipes and ducts, with caps or heavy gauge plastic sheeting until final connections are made.

.3 Repair any damage caused by improper storage, handling or installation of equipment and materials.

.4 Protect equipment, pipes and temporary services from weather damage.

3.5. TEMPORARY AND TRIAL USE

.1 Obtain written permission from Consultant to use and test permanent equipment and systems prior to Substantial Performance acceptance by Consultant.

.2 Consultant may use equipment and systems for test purposes prior to acceptance. Provide labour, fuel, material and instruments required for testing. Rectify incomplete work immediately to satisfaction of Consultant.

.3 Protect equipment and system openings from dirt, dust and other foreign materials during temporary usage. Whenever air handling systems are used for temporary services, in addition to other requirements specified, provide minimum 12 mm thick glass fibre filter media in all supply openings, exhaust

opening and all return air openings, transfer openings and other identified openings.

.4 In all HVAC equipment serving construction areas, provide temporary 15 mm thick glass fiber filter media upstream of all equipment filter assemblies.

.5 Maintain all temporary filters described above throughout duration of project. Replace filters as necessary.

.6 Clean and renew equipment and systems used prior to acceptance.

.7 Warranty, including duration and commencement date, shall not to be affected by startup date of equipment.

3.6. COMPLETION

.1 Meet the requirements of Section 01 78 13.

.2 Remove all debris from inside systems and equipment.

.3 Rectify deficiencies and complete work before submitting request for Substantial Performance inspection.

.4 Follow manufacturer's written instructions regarding bearing lubrication.

.5 Check and align all drives to manufacturer's acceptable tolerances.

.6 Adjust belts for proper tension.

.7 Check and align all pumps to manufacturer's acceptable tolerances.

.8 Remove all temporary protection and covers.

.9 Remove oil and grease from equipment and bases.

.10 Clean all fixtures and equipment. Polish all plated surfaces.

.11 Vacuum clean the inside of all air handling systems, including fans, ducts, coils and terminal units to ensure that they are free from debris and dust.

.12 Change air and water filters.

.13 Remove, clean and reinstall pipeline strainer screens.

.14 Leave Division 20 00 00 work in as new working order.

3.7. INSTRUCTIONS TO OWNER

.1 Meet the requirements of Section 01 79 00.

.2 Submit check lists for each system or piece of equipment, indicating that all components have been checked and are complete prior to instruction period.

.3 Thoroughly instruct the Owner in the safe and efficient operation of the systems and equipment.

.4 Arrange and pay for the services of qualified manufacturer's representatives to instruct Owner on specialized portions of the installation, such as refrigeration machines, boilers, automatic controls and water treatment.

.5 Submit a complete record of instructions given to the Owner. For each instruction period, supply the following data:

.1 date

.2 duration

.3 system or equipment involved

.4 names of persons giving instructions

.5 names of persons being instructed

.6 other persons present

.6 Submit receipted verification of completed training to Consultant prior to final release of retentions.

.7 Carry out instructional period during a period of 5 days scheduled at Owner's convenience.

3.8. INTERRUPTION OF EXISTING SERVICES

.1 Arrange, schedule and perform work with minimum disturbance to existing facilities and services.

.2 Submit a complete schedule of service interruptions and changeovers with approximate dates required, durations and times of day, for approval at commencement of project and during the shop drawing phase.

.3 Include for all pipe freezing and hot tap procedures to connect to existing systems.

.4 Notify Owner at least 72 hours in advance of planned interruption to existing services.

.5 Interruption of services must occur after hours at the times and for the duration stipulated by the Owner.

.6 Keep service interruption duration to an absolute minimum. Carry out all preparatory work, measurements, prefabrication, etc., without interruption of existing services.

.7 If service interruptions are required by the Owner during the night or on weekends, etc., premium time shall be included in the Contract Price. No extra charges will be allowed at a later date for failure to include same.

3.9. REMOVAL AND REUSE OF EXISTING MATERIALS

.1 Carry out demolition work in accordance with the Occupational Health and Safety Code.

.2 Remove existing equipment, services and obstacles where required for refinishing or restoring existing surfaces. Replace same as work progresses.

.3 Include for removal and disposal of all equipment and systems hazardous substances including refrigerant, oil, fuel oil and other hazardous substances to meet all local laws, regulations and bylaws.

.4 Turn over to the Owner existing material and equipment removed but not identified for reuse on site. Acceptance of removed material and equipment is at discretion of Owner. Remove such items from site when deemed unsuitable.

.5 Period to be scheduled.

.6 Prepare new site for immediate conversion and connection of reused equipment. Carry out all preparatory work, measurements, prefabrication, etc., without interruption of existing services. All work to disconnect, remove, relocate, convert, connect, test and commission reused equipment shall be performed during a two-day weekend shutdown period. Include premium time in the Contract Price.

.7 Execute work with least possible interference or disturbance to Owner and to other work taking place over the same time period.

.8 Use only elevators assigned for Contractor use for moving men and material within buildings. Protect walls of elevators to satisfaction of Owner prior to use and accept liability for damage, safety of equipment and overloading of existing equipment.

3.10. PROTECTION OF OWNER'S PREMISES

.1 Adhere strictly to the Owner's requirements.

.2 Confer with the Owner concerning schedule, dust and noise control prior to commencing work in or adjacent to existing facilities where such work might affect either those facilities or their occupants.

.3 Execute work with least possible interference or disturbance to occupants, public and normal use of premises.

.4 Provide temporary means to maintain security when security has been reduced by work under this Division.

.5 Only elevators, dumbwaiters, conveyors or escalators assigned for Contractor's use may be used for moving men and material within building. Protect walls of passenger elevators, to approval of Owner prior to use. Accept liability for damage, safety of equipment and overloading of existing equipment.

.6 Provide temporary dust screens, barriers, warning signs in locations where renovations and alteration work is adjacent to areas which will be operative during work.

.7 Drawings indicate approximate locations of known existing underground and above ground facilities. Avoid damage to existing services. Bear cost of repairs and replacements.

.8 Immediately advise Consultant when unknown services are encountered and await instructions.

.9 Accept liability for costs incurred by the Owner in repairing and cleaning equipment, etc., resulting from failure to comply with the above requirements.

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 Provide all labour, materials, products, equipment and services to supply and install the basic mechanical materials indicated on the Drawings and specified in all mechanical specifications including, but not limited to, Division 20, 21, 22, 23, 25 of these Specifications.

1.2. IDENTIFICATION OF MECHANICAL SERVICES

.1 Identify all mechanical services after finish painting is complete.

.2 Use terminology consistent with the Drawings and Specifications.

.3 Identify lay-in type acoustic ceilings used for access to equipment and components by a method acceptable to Consultant.

.4 Mark valve and equipment identification on Record Drawings.

.5 Provide typewritten master lists for each Equipment Room. Frame under glass. Insert copies in Operating and Maintenance Instruction Manuals.

1.3. PIPE AND DUCTWORK IDENTIFICATION

.1 Provide SMS Wrap-Mark or Primark Pipe Markers on all pipe coverings, using Wrap-Mark pipe markers with flow arrow and alternating wording. For outside diameters up to 150 mm, allow marker to completely wrap pipe. For larger outside diameters, secure markers with stainless steel springs. Secure markers on vertical piping and elsewhere where markers could be inadvertently moved.

.2 Locate identification and flow arrows so they can be seen clearly from floor and service platforms:

.1 at least once in each room

.2 at each piece of equipment

.3 at each branch close to connection point to main piping and ductwork

.4 at not greater than intervals of 15 metres on straight runs of exposed piping and ductwork

.5 at entry and leaving point to pipe and duct chases, or other concealed spaces

.6 both sides where piping and ductwork passes through walls, partitions and floors

.7 on vertical pipes and ducts approximately 1800 mm above floor

.3 Colour code pipes to meet code and Owner’s requirements. At minimum, colour code pipes with 50 mm wide bands in accordance with the detail shown on the drawings.

.4 Identify electrical tracing of pipes on pipe insulation.

PART 2 - PRODUCTS

2.1. PIPING HANGERS AND SUPPORTS

.1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with the Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe Hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to the following requirements:

.1 unless otherwise specified, all ferrous hanger and support products are to be electro-galvanized

.2 hangers and supports for insulated piping are to be sized to fit around the insulation and the insulation jacket

.2 Horizontal suspended piping/hangers and supports shall be:

.1 adjustable steel clevis hanger – Anvil Fig. 260 – MSS Type 1

.2 adjustable swivel ring band type hanger – Anvil Fig. 69 – MSS Type 10

.3 Horizontal pipe on vertical surfaces shall be:

.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170

.2 heavy-duty steel pipe bracket – Anvil Fig. 262 or Myatt Fig. 161 – MSS Type 26

.3 single steel pipe hook – Myatt Fig. 156

.4 Epoxy coated steel pipe stays are not permitted

.4 Vertical piping on vertical surfaces shall be:

.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170

.2 heavy-duty steel pipe bracket or soil pipe bracket – Anvil Fig. 262 or Myatt Fig. 161 – MSS Type 26

.3 extension split pipe clamp – Anvil Fig.'s 138R or Myatt Fig. 129 – MSS Type 12

.4 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact

.5 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate the pipe from the clamp

.6 insulation protection shields to and including 40 mm dia. – equal to Anvil "Rib-Lok" Fig. 168 galvanized steel shields with ribs to keep the shield centred on the hanger

.7 Epoxy coated steel pipe stays are not permitted.

.5 Hanger rods shall be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit the loading in accordance with Table 3 in MSS SP-58, but in any case minimum 9.5 mm dia.

.6 Horizontal pipe on racks shall be Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:

.1 standard galvanized steel U-bolts/clamps supplied by the rack manufacturer

2.2. SLEEVES, WALL AND FLOOR PLATES

.1 For pipe sleeves, use machine cut and reamed standard weight steel piping.

.2 Cover pipe sleeves in walls and ceilings of finished areas, other than Equipment Rooms, with satin finish stainless steel, or satin finish chrome or nickel plated brass escutcheons, with non-ferrous set screws. Do not use stamped steel split plates. Split cast plates with screw locks, however, may be used.

2.3. PROVISION FOR PIPE EXPANSION, CONTRACTION AND BUILDING SHRINKAGE

.1 Provide expansion loops and offsets to permit the safe expansion and contraction of piping due to thermal effects, building shrinkage and movement. Where space limitations do not permit the use of expansion loops or offsets, provide Flexonics Expansion Joints properly selected for system operating pressures according to the following:

.1 For piping up to and including 65 mm, select ends to suit specified pipe fittings. Pressure ratings for Model H and HB expansion compensated as 1400 kPa and 1050 kPa.

.2 Steel Piping - Flexonics Model H expansion compensator with two ply stainless steel bellows.

.3 Copper Piping - Flexonics Model HB expansion compensator with two ply bellow, all bronze construction.

.4 Steel Piping - Flexonics controlled, flexing expansion joint with stainless steel pressure carrier, flanged ends.

.5 Copper Piping - Flexonics controlled, flexing expansion joint with monel pressure carrier, and brass flanged ends.

2.4. DRAINS

.1 Provide minimum 20 mm ball valve with hose end adapter, metal cap and chain at all low points of all systems. Locate to allow easy connection of hose.

2.5. FIRESTOPPING

.1 Provide ULC classified firestopping products by 3M, Hilti or Specified Technologies Inc. which have been tested in accordance with CAN4-S115.

PART 3 - EXECUTION

3.1. PIPE, DUCT AND EQUIPMENT INSTALLATION

.1 Locate distribution systems, equipment and materials for maximum usable space, optimum service clearances and to accommodate current requirements and identified future expansion.

.2 Coordinate Division 20 00 00 services installation above ceilings to allow installation and future relocation of lights and air terminals without interfering with or requiring relocation of mechanical, electrical or other services, or removal of ceiling grid.

.3 Include all pipe and duct offsets required to eliminate interference with the work of other Divisions.

.4 Install equipment and materials to present a neat appearance. Run piping, ducts and conduit parallel to or perpendicular to building planes. Conceal piping, ducts and conduit in finished areas. Install so as to require a minimum amount of furring.

.5 Install pipe, duct and conduit straight, parallel and close to walls and slab or deck underside, with specified pitch.

.6 Use standard fittings for all direction changes. Do not use drilled tees and other field fabricated fittings.

.7 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.

.8 Where pipe sizes differ from connection sizes of equipment, provide reducing fittings between inline components such as valves, strainers and fittings, and equipment. Reducing bushings is not permitted.

.9 Cap open ends of piping during installation.

.10 Lay copper tubing so that it is not in contact with dissimilar metal and will not kink or collapse.

.11 Use non-corrosive lubricant or teflon tape equal to and apply on male thread.

.12 Provide brass adaptors or dielectric couplings wherever dissimilar metals are joined.

.13 No pipe to be laid in water or when, in opinion of Consultant conditions are unsuitable.

.14 Ensure that pipe installation does not transmit vibration to the walls and floors through which they pass.

.15 Make provisions for neat insulation finish around equipment and materials. Do not mount equipment within insulation depth.

3.2. CONNECTIONS TO EQUIPMENT

.1 Provide unions or flanges at all connections to equipment. Ensure that piping adjacent to equipment is readily removable for servicing and/or removal of equipment without shutting down entire system.

.2 Install unions in piping up to and including 50 mm pipe size. Install flanges in piping 65 mm pipe size and larger.

.3 Prevent galvanic corrosion by isolating copper and steel. Use red brass adapters, or completely isolate flanges using full face gaskets with bolts installed through phenolic sleeves with insulating fibre washers. Where the Plumbing Code prohibits the use of red brass adapters, use insulating couplings. Where valves are required, solid brass isolating valves may be used in lieu of adapters or couplings.

.4 Provide metallic code rated continuity link between flanges or unions, where pipes carry flammable fluids or gases.

.5 Make all plumbing and sheet metal connections to equipment provided by the Owner.

3.3. HANGERS

.1 Suspend piping, ductwork and equipment with all necessary hangers and supports for a safe and neat installation. Ensure that pipes are free to expand and contract and are graded properly. Adjust each hanger to take its full share of the weight.

.2 Suspend hanger rods directly from the structure. Do not suspend pipes, ducts or equipment from other pipes, ducts, equipment, or ceilings.

.3 Provide auxiliary structural steel angles, channels and beams (vertical and horizontal) where ductwork, piping and equipment is suspended between joists or beams. All support assemblies shall be secured and supported by building structure.

.4 Use galvanized rods, steel support angles, channels and beams where exposed to direct contact with water or to possible high humidity conditions where condensation can occur.

.5 Space hangers to ensure that structural steel members are not over stressed. Do not space hangers further apart than indicated in the tables. When requested, submit detailed drawings showing locations and magnitude of ductwork, piping and equipment loads on the structure. Provide calculations when requested by Consultant.

.6 Do not use trapeze type hangers for support of piping, without prior review by Consultant. Where permitted, fabricate from angle or channel frames, and space hangers to suit the smallest pipe size.

.7 Do not use hooks, chains or straps to support equipment and materials.

.8 Ensure that copper materials are completely isolated from ferrous materials. Use plastic or epoxy coated hangers and clamps. Use non-lead inserts between copper piping and other ferrous materials.

.9 Provide round steel threaded rods meeting ASTM A-36. Provide cadmium plated rod and accessories where exposed to direct contact with water or to possible high humidity conditions where condensation can occur.

.10 The following table establishes minimum standards of rod sizes and hanger spacing for steel and copper piping.

Maximum Horizontal Spacing of Supports			
Pipe Size mm	Rod Size mm	Steel m	Copper m
12	10	1.5	1.5
20	10	1.8	1.8
25	10	1.8	1.8
32	10	2.4	2.1
40	10	2.7	2.4
50	10	2.7	2.7
65	12	3.0	3.0
75	12	3.0	3.0
90	12	3.0	3.3
100	16	3.0	3.7

.11 In addition to these basic requirements, provide hangers in the following location:

.1 to eliminate vibration

.2 at points of vertical and horizontal change of direction of pipe

.3 at valves and strainers

.4 to avoid stress on equipment connections

.12 Refer to applicable articles of the Specification regarding thermal insulation requirements. Unless shown specifically on Drawings, provide the following support methods.

.1 For insulated warm and hot water piping, for condensate piping and for steam piping up to 65 mm diameter, support with hangers directly on piping.

3.4. FIRESTOPPING

.1 Ensure that fire ratings of floors and walls are maintained.

.2 Fill spaces between openings, pipes and ducts passing through fire separations and install firestopping systems in accordance with the appropriate ULC system number for the products and type of penetration.

3.5. GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

.1 It is critical that all mechanical services be installed as tight to the underside of structure as possible. Locate and arrange all pipes and ducts as high as possible above the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork as required when directed to do so by Consultant.

.2 Install mechanical systems as high as possible. Coordinate scope of work with other trades prior to installation to ensure a coordinated installation. Where required, install mechanical systems in joist/structure space.

.3 Coordinate mechanical and electrical services and install such that “layering” of services is minimized. Offset services as required to minimize crossing.

.4 Maintain the specified ceiling height while allowing 200 mm clear for lighting below all mechanical services.

.5 Unless otherwise specified, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Note that walls which are painted are considered finished.

.6 Install all pipes and ducts parallel to building lines and to each other.

.7 Neatly group and arrange all exposed work.

.8 Locate all work to permit easy access for service or maintenance as required and/or applicable. Locate all valves, dampers and any other equipment which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate the accessories at the floor level.

.9 Make all connections between pipes of different materials using proper approved adapters. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.

.10 Ensure that equipment and material manufacturer’s installation instructions are followed unless otherwise specified herein or on the drawings and unless such instructions contradict governing codes and regulations.

.11 Carefully clean all ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.

.12 Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around the pipe or duct.

.13 Inspect surfaces and structure prepared by other trades before performing your work. Verify that surfaces or the structure to receive your work have no

defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of your work will constitute acceptance of such surfaces as being satisfactory.

.14 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean the piping prior to being concealed.

.15 Where mechanical work is located in high humidity areas where ferrous metal products will be subject to corrosion and protection for such products is not specified, provide finishes on the products to protect against corrosion or provide products which will not corrode in the environment, i.e. aluminum ductwork, copper or stainless steel pipe, etc.

.16 Whether shown or specified on the drawings or not, provide screwed unions or flanges in all piping connections to equipment, and in regular intervals in long (in excess of 12 m) piping runs to permit removal of sections of piping.

3.6. PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream all piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two pipe threads are to remain exposed.

.4 Unless otherwise specified, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.

.5 Install mechanical joint fittings and couplings in accordance with the manufacturer’s instructions.

.6 Solvent weld PVC piping in two parts, primer stage and cementing stage, in accordance with the manufacturer’s recommendations, ASTM D2855, and CSA requirements.

3.7. PIPE LEAKAGE TESTING

.1 Before new piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test all piping for leakage.

.2 Tests are to be witnessed by the Consultant and/or Owner’s representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.

.3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.

.4 Test heat transfer (HVAC) system piping with cold water at a pressure of 1035 kPa for a minimum of two hours.

.5 The following requirements apply to all testing:

.1 ensure that all piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing

.2 temporarily remove or valve off all piping system specialties or equipment which may be damaged by test pressures prior to pressure testing the systems, and flush piping to remove foreign matter

.3 when testing is carried out below the highest level of the particular system, increase the test pressure by the hydrostatic head of 7 kPa for every 600 mm below the high point

.4 include for temporary piping connections required to properly complete the tests

.5 piping under test pressure is to have zero pressure drop for the length of the test period

.6 make tight leaks found during tests while the piping is under pressure, and if this is impossible, remove and refit the piping and reapply the test until satisfactory results are obtained

.7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions

.8 tests are be done in reasonably sized sections so as to minimize the number of tests required

.6 In addition to the leakage tests specified above, demonstrate proper flow throughout the systems including mains, connections and equipment, as well as proper venting and drainage, and Include for any necessary system adjustments to achieve the proper conditions.

3.8. USE OF MECHANICAL SYSTEMS FOR TEMPORARY HEATING

.1 Permanent building mechanical systems are not to be used for temporary heating purposes during construction.

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 Comply with Division 01 00 00, General Requirements.

.2 Provide all labour, materials, products, equipment and services to supply and install thermal insulation, vapour barriers and finishes for mechanical work as indicated on the Drawings and in these Specifications.

.3 Insulation thermal performance values and thicknesses shall meet the most stringent requirements of both The National Energy Code of Canada for Buildings 1997 and ASHRAE 90.1-2013.

1.2. SUBMITTALS

.1 Submit samples and specification sheets of insulation materials. Include manufacturer's installation instructions.

1.3. ENVIRONMENTAL REQUIREMENTS

.1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulating cements.

.2 Ensure items to be insulated are dry and clean to not promote the growth of moulds.

1.4. QUALITY ASSURANCE

.1 Insulation materials shall be manufactured to meet ISO 9000 quality standards.

PART 2 - PRODUCTS

2.1. MATERIALS – GENERAL

.1 All insulation pertaining to Division 23 00 00 shall be carried out by one firm specializing in insulation work. Do not mix similar products of multiple manufacturers.

.2 Provide non-combustible insulation, jackets and finishes having a Flame Spread/Smoke Developed rating of 25/50 or less, meeting CAN/ULC S-102-M88 requirements or NFPA 90a, 101 and 255.

.3 In high humidity environments (greater than 60% RH average ambient condition) all insulation materials shall be of the closed cell type which shall not permit the growth of molds if the insulation or insulation cover is cut, punctured or damaged.

.4 Attain a complete and continuous vapour barrier over insulation applied to cold and dual temperature piping, sheet metal and equipment. Use Owens Corning Fiberglas "Evolution" paper free All Service Jacket and SSL II adhesive. Apply to piping, fittings, valves and inline components, sheet metal, fittings and equipment. Seal longitudinal and circumferential laps with manufacturers recommended adhesive.

.5 Re-cover all exposed insulation and insulation finishes with minimum 0.20kg/square metre canvas, and two applications of Childers CP50 or Bakor 120-09 white fire resistant coating. In mechanical rooms where insulation is exposed cover with PVC jacket and fitting covers installed as per manufacturer's instructions and conforming to the specified Flame Spread/Smoke Developed Rating.

2.2. PIPE INSULATION

.1 Provide insulation materials with a maximum thermal conductivity of 0.036 W/m.°C at 38°C mean temperature.

.2 On hot piping applications, hold insulation in place with flare type staples (outward clinch).

.3 Apply pipe insulation over 40 mm in thickness in two layers with joints staggered.

.4 Insulate fittings with fabricated mitered or preformed sections of specified insulation.

.5 Insulate over flanges and mechanical couplings with specified insulation and thickness, sized to suit flange diameters. Fill spaces between insulation and adjoining pipe insulation with similar material.

.6 Insulate valves and inline components with flexible insulation density 12kg/cubic metre compressed not more than 50% of original thickness. Build up to specified thickness with approved asbestos free finishing cement.

.7 Do not insulate terminal unit automatic control valves installed in hot piping. Do not insulate terminal unit automatic control valves which are installed in cold and dual temperature piping and which are located over condensate drain pans.

.8 Provide removable 1.31 mm galvanized sheet metal enclosures lined with Armaflex FS sheet insulation 25 mm thickness on pipeline strainers to facilitate screen access.

.9 Provide one of the following pipe insulation types, and as scheduled in the Pipe Insulation Table:

.1 Type P1: Owens Corning 850 Pipe Insulation, Johns Manville Micro-Lok AP-T PLUS Fiberglas Pipe Insulation, Manson Fiberglas Pipe Insulation or Knauf Pipe Insulation with factory applied paper free ASJ vapour barrier jacket where scheduled.

.10 Pipe Insulation Table:

No	Duty	Insulation Type	Thickness	Vapour Barrier
1	Domestic cold water and non-potable water			
	{100mm} [4"] and less	P-1	{12mm} [1/2"]	Yes
	{125mm} [5"] and larger	P-1	{25mm} [1"]	Yes

No	Duty	Insulation Type	Thickness	Vapour Barrier
2	Domestic hot and domestic tempered water, and domestic hot water and tempered water recirculation			
	{32mm} [1-1/4"] and less	P-1	{25mm} [1"]	No
	{40mm} [1-1/2"] and larger	P-1	{40mm} [1-1/2"]	No
4	Primary heated water supply and return, and secondary heated water supply and return (Below {94°C} [201°F])			
	{32mm} [1-1/4"] and less	P-1	{40mm} [1-1/2"]	No
	{40mm} [1-1/2"] and larger	P-1	{50mm} [2"]	No

.11 In lieu of specified pipe insulation, where permitted by governing authorities, and in concealed locations, Imcoa Polyolefin or Armstrong AP Armaflex FS pipe insulation in nominal 12 mm thickness may be substituted for the following applications, on piping not exceeding 100 mm diameter, and shall be applied in strict accordance with manufacturer's recommendations:

.1 heated water, chilled water and dual temperature water runouts concealed behind perimeter enclosure

PART 3 - EXECUTION

3.1. PROTECTION

.1 Protect the work of other trades with tarpaulins.

.2 Protect the work of this trade from being defaced by other trades. Make good any damage and leave in perfect condition, ready for final painting.

3.2. INSTALLATION

.1 Apply insulation over clean dry surfaces, firmly butting all sections together.

.2 Apply insulation, vapour barriers and insulation finishes in strict accordance with manufacturer's recommendations.

.3 Do not cover equipment nameplates with insulation.

.4 Coordinate related work with other Divisions.

END OF SECTION

PART 1 - INSTRUCTION TO BIDDERS

.1 The Stipulated Bid Sum shall be for 'basis of design' or 'alternative' manufacturer only. The bidder acknowledges that if an alternative is bid, there may be differences in equipment size, orientation, weight, etc., Include all necessary changes in design when an alternate product is bid. Where a choice of '**Other**' equipment is given, indicate selection included in Stipulated Bid Sum by submitting this Section. '**Other**' products may be considered where an appropriate saving is offered. Failure to complete and submit this section will indicate that the Contractor has agreed to provide the 'basis of design' equipment specified in each specification section, listed in each equipment schedule, and/or shown on the Drawings.

.2 Express '**Other**' prices as an addition to or deduction from the Stipulated Bid Sum.

.3 The Owner reserves the right to accept or reject any 'other' price offered.

.4 The Stipulated Bid Sum will be adjusted by the addition or deduction of 'Other' prices accepted by Owner to form the Contract Price.

.5 The Owner may select the Contractor on the basis of the adjusted bid price.

.6 Where modifications to the work of Other Trades is required as a result or part of the "other' offered, include the cost of said modifications in the 'other' price offered.

.7 Submit the following list of base bid and alternative suppliers in accordance with Bid requirements.

Spec. Reference Section	Equipment	Basis of Design Manufacturer or Supplier	Alternative Manufacturer or Supplier	Other Manufacturer or Supplier	Add or Deduct From Base Bid Price for Other
20 05 00	Hangers and Supports	Anvil	( ) Myatt ( ) Taylor	_____	$_____
20 07 00	Thermal Insulation	Fibreglass Canada	( ) Johns Manville ( ) Manson ( ) Knauf ( ) Owens Corning	_____	$_____
23 21 13	Gate, Globe, Check and Ball Valves	Kitz	( ) Crane ( ) Jenkins ( ) WKM	Toyo Nibco Red White Newman Hattersley	$_____ $_____ $_____ $_____
23 21 13	Butterfly Valves	DeZurik	( ) Challenger ( ) Crane ( ) Keystone ( ) Jenkins	Centreline Victaulic Bray	$_____ $_____ $_____

Spec. Reference Section	Equipment	Basis of Design Manufacturer or Supplier	Alternative Manufacturer or Supplier	Other Manufacturer or Supplier	Add or Deduct From Base Bid Price for Other
23 37 13	Air Terminals	E H Price	( ) Nailor ( ) Carnes ( ) Metalaire	_____	$_____

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 These Specifications are an integral part of the Contract Documents. Tendering and Contract Requirements and Division 01 00 00, General Requirements apply to all Division 20 00 00 Specification Sections.

.2 Provide labour, materials, products, equipment, and services required to complete the demolition work specified herein.

.3 Refer to Drawings for extent of demolition work. The drawings indicate the approximate locations of services as far as these are known.

.4 Dispose, off site, of all debris in accordance with the jurisdictional authorities.

.5 Removal and storage of salvageable items will be as directed by this specification section and the Owner or their representative.

.6 During the course of this work, suspected hazardous or contaminated materials will probably be encountered. The Owner has engaged the services of TBD to carry out a contaminated materials survey. The results of this survey are available by request.

.7 Mechanical demolition work associated with this building is indicated on the demolition drawings and generally and consists of the following:

.1 Plumbing and drainage

.2 HVAC systems and equipment

1.2. REFERENCE STANDARDS

.1 Meet the requirements and recommendations of all Municipal, Provincial and Federal Bylaws and Ordinances.

.2 Execute this work in accordance with the latest edition of the following codes and standards.

.1 CAN/CSA-S350-M1980 - Code of Practice for Safety in Demolition of Structures.

.2 Ontario Building Code.

.3 Occupational Health and Safety Act.

.4 Regulations for Construction Projects.

.5 Ontario Fire Code.

.6 Regulations under Fire Marshals Act.

1.3. QUALITY ASSURANCE

.1 All work shall be performed by a firm having adequate equipment and skilled labour and being able to provide written evidence of satisfactorily completed work, similar to that specified during the past immediate five (5) years.

.2 Removal from site and disposal of debris shall be carried out in accordance with the requirements of the local jurisdictional authorities.

.3 Arrange and pay for all permits, notices and inspections necessary for the proper execution and completion of the demolition work.

1.4. SUBMITTALS

.1 Submit shop drawings as requested by the consultant, indicating demolition sequence, cutting and patching, bracing and protection of existing services designated to remain.

PART 2 - PRODUCTS

2.1. DISPOSAL OF MATERIALS

.1 All materials which have not been designated for salvage from the demolition shall become the property of the Contractor. Remove all material and debris from the site as quickly as possible and dispose of legally. Burning of debris or selling of materials on the site will not be permitted.

.2 Present to the Owner existing equipment removed but not identified for salvage on site. Acceptance of removed equipment is at the discretion of the Owner. Remove such items from site when deemed unsuitable.

.3 Conform to requirements of municipality's Works Department regarding disposal of waste materials.

.4 Materials prohibited from municipality waste management facilities shall be removed from site and disposed to recycling companies specializing in recyclable materials.

PART 3 - EXECUTION

3.1. GENERAL INSTRUCTIONS

.1 At the end of each work shift, leave work in a safe condition.

.2 Patch fire rated partitions and floors to maintain rating upon removal of mechanical services originally spanning fire rated assembly.

.3 Demolish work into sections of practical size for removal without alteration or damage to existing building.

3.2. STORAGE OF MATERIALS

.1 Store materials only in areas designated by the Owner and as permitted by the local jurisdictional authorities.

.2 Materials and debris shall not be stacked in the building to the extent that overloading of any part of the structure will occur.

3.3. PROTECTION OF OWNERS PREMISES

.1 Adhere strictly to the Owner's requirements.

.2 Confer with the Owner concerning schedule, dust and noise control prior to commencing work in or adjacent to existing facilities where such work might affect either those facilities or their occupants.

.3 Execute work with the least possible interference or disturbance to occupants, public and normal use of premises.

.4 Provide temporary means to maintain security when security has been reduced by Division 20 00 00.

.5 Only elevators, dumbwaiters, conveyors or escalators assigned for Contractor's use may be used for moving men and material within building. Protect walls of passenger elevators, to approval of Owner prior to use. Accept liability for damage, safety of equipment and overloading of existing equipment.

.6 Provide temporary dust screens, barriers, and warning signs in locations where renovations and alteration work is adjacent to areas which will be operative during work.

.7 Protect all mechanical systems, indicated to remain, from damage.

.8 Provide and maintain ready access to firefighting equipment at all times.

.9 Provide and maintain proper and suitable fire extinguishers throughout the duration of the work.

.10 The drawings indicate the approximate locations of services as far as these are known. Should any mechanical or electrical service line be broken, or disrupted by operations specified under this contract, repair service lines, and make good all damage due to the disruption or break, at no expense to the Owner. Notify the Owner immediately whenever any service line is broken or damaged.

.11 The drawings indicate the approximate locations of services as far as these are known. Immediately advise Consultant in writing when unknown services are encountered.

.12 Accept liability for costs incurred by the Owner in repairing and cleaning equipment, etc., resulting from failure to comply with the above requirements.

3.4. RESTRICTIONS ON USE OF PREMISES

.1 Use only those existing entrances and stairs designated by the Owner for access to and egress from the existing buildings and various floors where work of this contract is to be carried out. No traffic through other areas of the building will be permitted without the prior consent of the Owner.

.2 Keep stairs and corridors clear and open as required by Fire Marshall for exit purposes in case of fire, and as required for use by the Owner's personnel.

.3 Owner will designate which toilet facilities may be used.

3.5. PREPARATION

.1 Notify the consultant a minimum of 48 hours prior to commencing this work.

.2 Prior to commencing this work arrange to have the appropriate trades concerned present for the disconnection of all utility services.

.3 Ensure that all existing services designated to remain are adequately protected.

3.6. INTERRUPTION OF EXISTING SERVICES

.1 Arrange, schedule and perform work with minimum disturbance to existing facilities and services.

.2 Submit a complete schedule of service interruptions and changeovers with approximate dates required, durations and times of day, for approval before proceeding.

.3 Notify Owner in writing at least 72 hours in advance of planned interruption to existing services.

.4 Interruption of service must occur at the times and for the duration stipulated by the Owner.

.5 Keep service interruption duration to an absolute minimum. Carry out all preparatory work, measurements, etc., without interruption of existing services.

.6 If service interruptions are required by the Owner during the night or on weekends, etc., premium time shall be included at the Contract Price. No extra charges will be allowed at a later date for failure to include same.

END OF SECTION

PART 1 - GENERAL

1.1. QUALIFICATIONS

.1 The TAB Agency shall be a current member in good standing with either the Associated Air Balance Council or National Environmental Balancing Bureau.

1.2. SUBMITTAL REQUIREMENTS

.1 Submit the following information with the Bid Form:

.1 List of proposed equipment to be used for this project.

.2 Proof of membership in the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).

.3 The names and qualifications of all personnel who will be assigned to this project. Use of other personnel will be grounds for contract termination.

.4 A listing of references including project names, Consultant, Contractor and Owner references with telephone numbers.

1.3. WORK INCLUDED

.1 Comply with Division 01 00 00, General Requirements and all documents referred to therein.

.2 Provide all labour, materials, products, equipment and services to test, adjust and balance all air and hydronic systems to verify conformance to specified quantities and to the design intent of the mechanical system.

.3 Refer to Specification 01 91 00 for commissioning activities to be performed by others. Cooperate with the Commissioning Authority.

.4 The following systems and/or equipment are included in the Scope of Work:

.1 Hydronic Systems

.1 System Mains and Branches

.2 Coils (Water Temperature and Flow)

.5 Refer to Specification Section 23 31 00 for test openings in duct system. Provide additional openings to fulfill the work of this section.

1.4. REFERENCE STANDARDS

.1 All work shall be in accordance with the latest edition of the AABC or NEBB National Standards. If these contract documents set forth more stringent requirements than the Reference Standards, these contract documents shall prevail.

1.5. REFERENCE DOCUMENTS

.1 Obtain and pay for a complete set of reviewed shop drawings.

.2 Obtain and pay for a complete set of Mechanical Drawings and Specifications.

PART 2 - PRODUCTS

2.1. TEST EQUIPMENT

.1 When requested by the Consultant, provide current calibration certificates for test equipment.

PART 3 - EXECUTION

3.1. GENERAL

.1 The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC or NEBB Standards or 5%, whichever is more stringent.

.2 Any deficiencies in the installation or performance of a system or component shall be reported in writing to the Contractor and Consultant.

.3 Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be physically marked to show final settings.

3.2. JOB SITE INSPECTION

.1 Inspect the installation of the systems to be tested at least twice during the construction period. Ensure specified devices and components required for testing and balancing functions have been installed according to the manufacturer’s recommendations.

.2 Ensure all required balancing dampers are installed, functional, and accessible for use in testing and balancing procedures.

.3 Provide a written report of inspection to the Contractor and Consultant identifying specific concerns and deficiencies affecting the testing and balancing procedures.

3.3. AIR DISTRIBUTION AND TERMINALS

.1 Adjust duct distribution to obtain specified air quantities. At least one zone balancing damper shall be completely open. Multi diffuser/grille branch ducts shall have at least one volume damper completely open.

.2 Test and adjust each air terminal to obtain specified flow. Adjust deflectors and pattern controllers to eliminate drafts.

3.4. HYDRONIC PIPING AND DISTRIBUTION

.1 Adjust water flow in distribution system to obtain specified flows.

.2 Test and record flow and differential pressure systems to establish references for satisfactory operation.

.3 Test and adjust system feeders to ensure adequate system static pressure is available under all operating conditions.

.4 Test and adjust hydronic terminals to obtain specified flow.

3.5. PRELIMINARY TESTING

.1 In the event preliminary testing reveals a deficiency in the system which cannot be corrected through the balancing process, advise the Contractor and Consultant in writing describing the conditions and suggested corrective action.

3.6. REPORTS

.1 Provide PDF copies of the TAB report for Consultant review.

.2 Summarize all testing into logical sections, tabulated and summarized.

.3 Identify system terminals and distribution on legible plan or schematic drawings depicting actual system arrangement. Label pitot tube traverse locations, terminal identification and equipment identification in a manner consistent with the contract documents.

3.7. REPORT VERIFICATION

.1 Cooperate with the Consultant in field verification of the final reported valves.

.2 Specific and random verifications will be performed using the same procedures used in preparation of the reports.

.3 Sufficient verifications will be performed to satisfy the Consultant that the reports accurately represent the actual system conditions.

3.8. GUARANTEE

.1 Provide AABC National Project Performance Guaranty or NEBB Performance Bond for the work.

.2 Include a copy of the guarantee in each copy of the Testing and Balancing Report.

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 Comply with Division 01 00 00, General Requirements and all documents referred to therein.

.2 Provide all labour, materials, products, equipment and services to supply, install and test the heated water, glycol, chilled water and condenser water piping systems indicated on the Drawings and specified in this Section of the Specifications.

.3 Install all piping in accordance with CSA B214.07, Installation Code for Hydronic Heating systems.

PART 2 - PRODUCTS

2.1. PIPING, JOINTS AND FITTINGS

.1 Meet the following pipe requirements:

.1 Pipe: 12 mm to 50 mm

.1 ASTM A53, Standard wall (minimum Schedule 40) steel electric resistance weld for internal pressure up to 4100 kPa and ASTM A106 where pressure exceeds 4100 kPa. Fittings and couplings shall be threaded malleable iron meeting ASA B16.3 for pressure classes 1035 kPa and 2068kPa. Use cast iron meeting ASA B16.4 for pressures classes of 1206 kPa or 2758 kPa.

.2 Provide ASA B16.18, Type L copper takeoffs from risers, runouts and horizontal distribution systems.

.2 Meet Section 20 05 00 requirements for pipe installation and equipment connection including union and flange provision.

2.2. VALVES

.1 Gate and globe valves shall be Kitz to the following Kitz figure numbers:

To 1400 kPa working pressure:

	Figure Numbers	
	Gate	Globe
50 mm and smaller Soldered Screwed	 44 24	 10 09

.2 For pipe sizes 50 mm and smaller, ball valves may be substituted for the above gate and globe valves. Provide ball valves with brass or bronze body, chrome plated solid ball, PTFE seats and seals and full port:

.1 soldered - Kitz Figure 59

.2 screwed - Kitz Figure 58

.3 Check valves shall be non-slam type, selected for system operating pressures and temperatures.

2.3. AIR VENTS

.1 Select air vents to suit system operating pressures.

.2 Provide automatic air vents, complete with isolating gate valves at all high points where mains are trapped, where shown in the Drawings and where shown on Typical Detail Sheets. Pipe outlet from each vent to a service sink, drip pan or floor drain.

.3 Provide manual air vents, screwdriver or key type at each unit heater, cabinet unit heater, convector, wallfin section and fan coil unit.

PART 3 - EXECUTION

3.1. INSTALLATION

.1 Meet Section 20 05 00 requirements.

.2 Use valves and strainers of the same size as pipe in which it is installed, unless otherwise indicated.

.3 Provide globe, ball or plug valves for throttling or controlling flow in accordance with article 2.2.

.4 Provide gate, ball or butterfly valves for shutoff in accordance with article 2.2.

.5 Install reducing fittings so as not to trap air.

.6 Provide long radius elbows.

.7 Provide flanges or unions at connections to all equipment.

.8 Provide screwed or flanged joints only in accessible locations. Provide access doors as required.

.9 Do not use field fabricated fittings.

.10 Equip low points with 20 mm drain valve piped to floor drain. Provide, at high points on lines and on equipment connections, collection chambers and high capacity float operated automatic air vents.

.11 The first hanger on branch take off piping from a riser shall be spring hung to reduce stress on riser and branch.

.12 Connect branch pipe runouts to top of main distribution pipe.

3.2. TESTING

.1 Meet testing requirements of all authorities having jurisdiction. Obtain certification and certify tests not required by authorities. Perform not less than the following tests.

.2 Prove hydronic piping tight under a hydrostatic test of 150% of design working pressure but not less than 700 kPa. Test without pressure drop for a period of not less than 4 hours.

.3 Perform tests before piping is covered or concealed.

.4 Remove all components which will not withstand test pressure and replace after tests.

.5 Eliminate leaks or remove and refit defective parts. Do not caulk threaded or welded joints.

.6 After work is completed, adjust and put all parts of the system into proper working order. Adjust all valves to achieve specified heating capacities. Leave the complete job ready for regular operation, all to the satisfaction of the Consultant.

.7 After the testing period, drain the system, and before water treatment is introduced into the system, clean out all dirt pockets and strainers.

.8 Provide lubricating oils, packing, and other accessories, for proper operation of the system.

.9 The final test and acceptance shall not be made until the work is finally completed.

3.3. PRESSURE CLASS DETERMINATION

.1 Refer to the hydronic schematics, plan notes, schedules, and equipment specifications to determine the required pressure class. Where there is a conflict, provide products per worst case/highest rating.

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 Comply with Division 01 00 00, General Requirements and all documents referred to therein.

.2 Provide all labour, materials, products, equipment and services to clean all existing rigid ductwork.

1.2. REFERENCE DOCUMENTS

.1 Obtain and pay for, a complete set of Mechanical Drawings and Specifications.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.1. SCOPE OF WORK

.1 Scope: This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.

.2 The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

3.2. HVAC SYSTEM INSPECTIONS AND SITE PREPARATIONS

.1 HVAC System Evaluation: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project.

.2 Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

3.3. GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

.1 Contaminant: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

.2 Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3 micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.

.3 Controlling Odours: All reasonable measures shall be taken to control offensive odours and/or mist vapours during the cleaning process.

.4 Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.

.5 Air Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.

.6 Service Openings: The contractors shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection:

.1 Contractor shall utilize the existing service openings already installed in the HVAC system where possible.

.2 Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.

.3 Closures must not significantly hinder, restrict, or alter the airflow within the system.

.4 Openings must not compromise the structural integrity of the system.

.5 Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.

.6 Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.

.7 Rigid fibre glass ductboard duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques which comply with UL Standard 181 and UL Standard 181a are suitable for fibre glass duct system closures.

.8 All service openings capable of being reopened for future inspection or remediation shall be clearly marked and shall have their location reported to the owner in project report documents.

.7 Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.

.8 Duct Systems: Contractor shall:

.1 Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.

.2 Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Testings (see NADCA Standards).

3.4. HEALTH AND SAFETY

.1 Safety Standards: Cleaning contractors shall comply with all applicable federal, state, and local requirements for protecting the safety of the contractors' employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.

.2 Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.

.3 Disposal of Debris: All debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

3.5. MECHANICAL CLEANING METHODOLOGY

.1 Source Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods which will render the HVAC System Visibly Clean and capable of passing cleaning verification methods (see applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC System or negatively alter the integrity of the system:

.1 All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

.2 All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet vacuums.

.3 All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

.4 All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

.2 Methods of Cleaning Fibrous Glass Insulated Components:

.1 Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

.2 Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).

.3 Damaged Fibrous Glass Materials:

.1 If there is any evidence of damage, deterioration, delamination, friable material, mould or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.

.2 When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.

.4 Biocidal Agents and Coatings:

.1 Biocidal agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.

.2 Application of any biocidal agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.

.3 Only biocidal agents registered by the US Environmental Protection Agency (EPA) specifically for use within HVAC system shall be used.

.4 Biocidal agents shall be applied in strict accordance with manufacturer's instructions.

.5 Biocidal coating products for both porous and non-porous surfaces shall be EPA registered water-soluble solutions with supporting efficacy data and MSDA records.

.6 Biocidal coatings shall be applied according to manufacturer's instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application. Application of any biocidal coating shall be in strict accordance with manufacturer's minimum millage surface application rate standards for effectiveness.

3.6. CLEANLINESS VERIFICATION

.1 General: Verification of HVAC system cleanliness will be determined after mechanical cleaning and before the application of any treatment or

introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.

.2 Visual Inspection: The HVAC system shall be inspected visually to ensure that no visible contaminants are present:

.1 If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the owner reserves the right to further verify system cleanliness through gravimetric or wipe testing analysis testing.

.2 If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subject to reinspection for cleanliness.

3.7. POST-PROJECT REPORT

.1 At the conclusion of the project, the Contractor shall provide a report to the owner indicating the following:

.1 Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.

.2 Areas of the system found to be damaged and/or in need of repair.

3.8. APPLICABLE STANDARDS AND PUBLICATIONS

.1 The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto:

.1 National Air Duct Cleaners Association (NADCA): NADCA 1992-01, “Mechanical Cleaning of Non-Porrous Air Conveyance System Components” 1992.

.2 National Air Duct Cleaners Association (NADCA): “Understanding Microbial Contamination in HVAC Systems” 1996.

.3 National Air Duct Cleaners Association (NADCA): “Introduction to HVAC System Cleaning Services” 1995.

.4 National Air Duct Cleaners Association (NADCA): NADCA Standard 05 “Requirements for the Installation of Service Openings in HVAC Systems” 1997.

.5 Underwriters Laboratories (UL): UL Standard 181.

.6 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-2010, “Ventilation for Acceptable Indoor Air Quality”.

.7 Environmental Protection Agency (EPA): “Building Air Quality” December 1991.

.8 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards - Metal and Flexible" 1985.

.9 North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems" 1993.

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 Comply with Division 01 00 00, General Requirements and all documents referred to therein.

.2 Provide all labour, materials, products, equipment and services to supply and install all fans indicated on the Drawings and specified herein.

1.2. REFERENCE STANDARDS

.1 Fans to be standard products, selected from published literature of manufacturer.

.2 Ratings to AMCA for sound and air delivery performance. Provide AMCA seal on each fan.

.3 Fans shall be factory balanced, statically and dynamically to AMCA Standards.

1.3. SUBMITTAL DATA

.1 Provide sound and air delivery performance ratings for fans where inlet vanes are provided. Include sound and power data at 100%, 66% and 33% capacity.

1.4. PERFORMANCE REQUIREMENTS

.1 Refer to Fan Schedule and Drawings for fan sizes, arrangements and capacities.

PART 2 - PRODUCTS

2.1. CIRCULATING FANS

.1 Provide {1525 mm} [60"] dia. ceiling fans with sealed chrome steel ball bearings, totally enclosed motor, statically and dynamically balanced fan wheels, baked enamel finish and speed controller.

PART 3 - EXECUTION

3.1. INSTALLATION

.1 Locate units to enable servicing to all sides in compliance with manufacturer's recommendations.

3.2. STARTUP AND TESTING

.1 Manufacturer shall inspect installed equipment for proper alignment and lubrication at time of startup and shall verify on startup report if acceptable.

END OF SECTION

PART 1 - GENERAL

1.1. WORK INCLUDED

.1 Comply with Division 01 00 00, General Requirements and all documents referred to therein.

.2 Provide all labour, materials, products, equipment and services to provide air terminals as indicated on the Drawings and specified in this Section of the Specifications.

1.2. REFERENCE STANDARDS

.1 Provide equipment performance rated in accordance with ADC (Air Diffusion Council) Equipment Test Code 1062GRD 84, IS0 Standard 5135 and IS0 Standard 5219.

1.3. SHOP DRAWINGS

.1 As part of air terminal shop drawing submittal, submit a light troffer shop drawing showing method of connection and compatibility with the light fixture.

1.4. SAMPLES

.1 Submit air terminal samples when requested by Consultant.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

.1 Unless otherwise specified, provide all grilles, registers and diffusers from one manufacturer. Products manufactured or provided by Titus shall not be allowed.

2.2. GRILLES, REGISTERS AND DIFFUSERS

.1 Refer to the air terminal device schedules for descriptions of terminal types, sizes, materials of construction and finishes.

.2 Provide mitred corners and end borders for linear diffusers' terminations, except those that terminate flush with walls and partitions, in which case provide flush-fitting end caps.

PART 3 - EXECUTION

3.1. INSTALLATION

.1 Provide air terminals in strict accordance with manufacturer's recommendations and final reflected ceiling plans.

END OF SECTION

ELECTRICAL SPECIFICATION

FOR

KAWARTHA HEIGHTS PUBLIC SCHOOL
CLASSROOMS 4-5-6-7 RENOVATION
KAWARTHA PINE RIDGE DISTRICT SCHOOL BOARD
11 KAWARTHA HEIGHTS BOULEVARD
PETERBOROUGH, ONTARIO

CONSULTING ENGINEERS:

HAMMERSCHLAG & JOFFE INC.
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Toronto, Ontario
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1 GENERAL

1.01 REFERENCES

.1 The General Conditions of the Contract, the Supplementary Conditions, and all Sections of Division 01 apply to and are a part of this Section of the Specification.

1.02 APPLICATION

.1 This Section specifies requirements that are common to electrical work Sections of the Specification, and it is a supplement to each Section and is to be read accordingly.

1.03 NOTE RE: BOLD LETTERING

.1 "Bold" type lettering is used throughout this Specification in an attempt to enhance the readability of the text. The use of "bold" lettering does not indicate a greater level of importance.

1.04 SUBMITTALS

.1 As specified in this Section, submit the following to the Consultant:

.1 **Project close-out documentation:** O & M Manuals, record as-built drawings, and all associated data.

.2 **Progress payment breakdown:** a detailed breakdown of the electrical work cost.

.3 **Contractor's P. Eng. Documentation:** the name, qualifications, and evidence of current liability insurance for all professional engineers to be retained by the Contractor to perform work associated with the Contract.

.4 **Extended Warranties:** copies of all extended warranties specified, and in the name of the Owner.

.5 **O & M Training Schedules & Manual:** a proposed schedule of demonstration and training dates and times, and a preliminary copy of the training manual developed for operational and maintenance training.

1.05 DEFINITIONS

.1 The following are definitions of words found in electrical work Sections of the Specification and on associated drawings:

.1 "Concealed" – means work hidden from normal sight in furred spaces, shafts, tunnels, ceiling spaces, walls, and partitions.

.2 "Exposed" – means work normally visible, including work in electrical and equipment rooms and similar spaces.

.3 "Provide" (and tenses of provide) – means supply and install complete.

.4 "Install" (and tenses of install) – means install and connect complete.

.5 "Supply" – means supply only.

.6 "Finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished.

.7 "Governing authority" and/or "regulatory authority" and/or "Municipal authority" – means all government departments, agencies, standards, rules, and regulations that apply to and govern the electrical work and to which the work must adhere.

.8 "Consultant" – means the Architect or Consulting Engineer who has prepared the Contract Documents on behalf of the Owner.

.9 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the specification they are understood, unless otherwise defined, to mean that the product referred to as "indicated", "shown", "listed", or "noted" on the drawings.

.10 Wherever the words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected" or similar words or phrases are used in the specification or on the drawings they are understood, unless otherwise defined, to mean that work or product referred to is "approved by", "inspected by", etc., the Consultant.

.2 In the electrical specification, singular may be read as plural, and vice-versa.

1.06 QUALITY ASSURANCE

.1 All electrical work is to be done by journeyman tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced journeyman tradesman. The use of apprentice tradesmen is to be limited and the journeyman/apprentice ratio is subject to the Consultant's approval.

.2 An experienced and qualified superintendent is to be on-site at all times when electrical work is being performed.

1.07 WORKMANSHIP

.1 Install equipment, conduit, and cables in a workmanlike manner to present a neat appearance and to function properly to the satisfaction of the consultant. Install runs parallel and perpendicular to building planes. Install conduit concealed in chases, behind furring or above ceiling, except in unfinished areas exposed conduits and junction boxes shall not be accepted. Install exposed systems neatly and group to present a neat appearance.

.2 Install all equipment and apparatus requiring maintenance, adjustment, or eventual replacement with due allowance, therefore.

.3 Include in the work, all requirements of manufacturers shown on the shop drawings and installation manuals.

.4 Replace work unsatisfactory to the Consultant without extra cost.

.5 Make provisions to accommodate future plant and equipment indicated on drawings.

1.08 CODES, REGULATIONS, AND STANDARDS

.1 All Codes, Regulations, and Standards referred to in this Section and in Sections to which this Section applies are the latest edition of the Codes, Regulations, and Standards in effect at the time of bidding on this Project and applicable to the place of the work.

.2 All electrical items are to be certified and bear the stamp or seal of an approved recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

.3 Requirements of the Contract Documents are to take precedence when they are more stringent than codes, ordinances, standards, and statutes.

1.09 IMPERIAL AND METRIC MEASUREMENTS

.1 Conform to requirements of CAN/CSA-Z234.1, Canadian Metric Practice Guide.

.2 Both Metric and Imperial units of measurement are indicated in the electrical Specification. Metric measurements are "soft" and have been rounded off. Coordinate material sizes with other trades.

1.10 EXAMINATION OF SITE AND DOCUMENTS

.1 When estimating the cost of the work and prior to submitting a bid for the work carefully examine all of the bid documents and visit the site to determine and review all existing site conditions that will or may affect the work and include for all such conditions in the bid price.

.2 Report to the Consultant, prior to bid submittal, any existing site condition that will or may affect performance of the work as per the drawings and specifications. Failure to do so will not be grounds for additional costs.

1.11 DRAWINGS AND SPECIFICATION

.1 Read the electrical work drawings in conjunction with all other structural, architectural, sprinkler, mechanical, etc., drawings.

.2 The electrical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of the building is to be taken at the site. Do not scale the drawings, and do not use the drawings for prefabrication work.

.3 The drawings are intended to convey the scope of work and do not show architectural, structural details or the work of other trades. Provide, at the Electrical Contractor’s cost, all offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and structural details or the work of other trades but not shown on the drawings.

.4 The locations of equipment and materials shown may be altered, when reviewed by the Consultant, to meet requirements of the equipment and/or materials, other equipment or systems being installed, and of the building, all at the Electrical Contractor’s cost.

.5 Sections of the electrical specification are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections are to be read as a whole.

.6 The electrical specification does not generally indicate the specific number of items or extent of material required. The specification is intended to provide product data and installation requirements. It is necessary to refer to drawing schedules, layouts, schematic diagrams, riser diagrams, and details to determine correct quantities.

.7 The electrical drawings and specification are intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.

.8 Make, at no additional cost any changes or additions to materials and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).

.9 Alter, at no additional cost, the location of materials and/or equipment as directed provided that the changes are made before installation and do not necessitate additional material in excess of 5.0m (15'-0").

.10 Install all ceiling mounted components (lighting fixtures, detectors, speakers) in accordance with reflected ceiling plans approved by the Consultant. Refer to Architectural drawings for layout. When the scale and date of the drawings are the same, or when the discrepancy exists within the specification, the costliest arrangement will take precedence.

.11 In the case of discrepancies or conflicts between the drawings and specification, the documents in the case of discrepancies or conflicts between the drawings and specification, the documents with more stringent requirements will prevail.

.12 In the case of discrepancies between the drawings and specifications, the documents will govern in the order specified in the General Conditions, however, when the scale and date of the drawings are the same, or where the discrepancy exists within the specification, the costliest arrangement will take precedence.

1.12 PLANNING AND LAYOUT OF THE WORK, AND ASSOCIATED DRAWINGS

.1 Properly plan, coordinate, and establish the locations and routing of services with all subcontractors affected prior to installation such that the services will clear each other as well as any obstructions, including structural components of the building. Unless otherwise specified, the order of right-of-way for services is to be as follows:

.1 Piping requiring uniform pitch

.2 Piping 100 mm (4") dia. and larger

.3 Large ducts (main runs)

.4 Electrical cable tray and bus duct

.5 Conduit 100 mm (4") dia. and larger

.6 Piping less than 100 mm (4") diameter

.7 Smaller branch ductwork

.8 Conduit less than 100 mm (4") diameter

.2 Unless otherwise shown or specified, conceal all work in finished areas, and conceal work in partially finished or unfinished areas to the extent made possible by the area construction. Install conduit, raceway, and similar services as high as possible to conserve headroom and/or ceiling space. Notify the Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.

.3 Revise or alter the arrangement of work that has been installed without proper coordination, study, and review, even if it was completed in accordance with the Contract Documents, in order to conceal the work behind finishes, or to allow the installation of other work, at no additional cost. In addition, pay for the cost of alterations in other work required by the alterations to the Electrical Contractor's work.

.4 All junction boxes, equipment, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost. Location of required access panels need to be preapproved by the consultant.

1.13 CONSTRUCTION DRAWINGS

.1 Prepare interference drawings in conjunction with all trades concerned, showing sleeves, cables and conduit, routes, light fixtures, and openings for passage through structure and all insert sizes and locations.

.2 Prepare composite interference drawings, fully dimensioned, of cable, conduit, cable trays, light fixtures, and equipment in all other critical locations to avoid conflict of trades. Base equipment drawings upon shop drawings and include, but do not necessarily limit to, all details pertaining to access cleanouts, tapings, sleeves, electrical connections, location and elevation of ducts, conduits, etc. obtained from consultation with and agreement of the trades involved.

.3 Prepare all drawings to scale and dimension. Forward these drawings, approved by all Trades and the Contractor, to the Consultant for his records. Provide transparencies or provide print copies in the number as specified elsewhere in the contract documents, but not less than four (4).

.4 Provide detailed layouts of all equipment and electrical rooms to ensure selected equipment fits the space.

.5 Bind one complete set of construction drawings showing "as built" conditions in each operating and maintenance instruction manual. Provide JPEG files of drawings, on a USB drive, in each manual.

1.14 COORDINATION OF THE WORK

.1 Review all the Contract Documents and coordinate the work with the work of all subcontractors. Coordination requirements are to include, but not be limited to, the following:

.1 Written notifications of all concrete work such as housekeeping pads, bases, etc., required for electrical work, and including required dimensions, operating weight of equipment, location, etc.

.2 Depth and routing of excavation required for electrical work, and requirements for bedding and backfill.

.2 Co-operate with other trades and the Tenant’s trades whose work is attached to or is affected by the work of this sub-contractor, to ensure a satisfactory installation and to avoid delays.

.3 No extra compensation shall be considered for interference of equipment that could have been avoided by the co-ordination of the work by each trade.

.4 Furnish all items to be built in, in time, complete with all pertinent information, commensurate with the progress of the work.

.5 Coordinate all equipment nomenclature, including however not limited to fire alarm devices, mechanical equipment, escalators, elevators, exit stairs, corridors, and other areas of the facility. Note nomenclature shown on the construction drawings is for construction identification purposes only and does not reflect final user desired nomenclature or code requirements, nor any of the existing facility nomenclature.

.6 Coordinate and arrange for meetings with AHJ, fire alarm contractor, sprinkler trade and general contractor to ensure life safety and fire alarm systems are coordinated and with nomenclature preapproved by the AHJ.

.7 Coordinate and arrange for meeting with Landlord user group and provide proposed nomenclature that takes inconsideration existing facility nomenclature. Include for number of meetings as required.

.8 Coordinate and arrange for meetings with mechanical trade and general contractor to ensure all equipment nomenclature is agreed upon.

1.15 GENERAL RE: INSTALLATION OF EQUIPMENT

.1 Unless otherwise specified all equipment is to be installed in accordance with the equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

.2 Ensure that proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Remove and replace any equipment which does not meet this requirement.

1.16 INSTALLATION IN EXIT CORRIDORS AND EXIT STAIRS

.1 Any conduit or other electrical installation, not relating specifically to a 2 hour or greater time rated enclosure or an exit or corridor or stair shaft, which shall be enclosed in a 2-hour fire rated enclosure. The cost of this enclosure shall be borne by Divisions 26, 27 and 28.

.2 Contractor shall overlay electrical drawings to provide proposed conduit layout to demonstrate passing through exit pathways is unavoidable.

.3 Where purpose of corridors, exist or areas are not clearly identified on Architectural set of drawings, contractor shall obtain clarification and shall confirm installation of systems prior commencement of work.

1.17 PERMITS, FEES, AND CERTIFICATES

.1 Apply for, obtain, and pay for all permits required to complete the electrical work.

.2 Submit to the Consultant, all approval/inspection certificates issued by governing authorities to confirm that the work as installed is in accordance with the rules and regulations of the governing authorities. Pay any costs associated with issue of the certificates.

.3 Include a copy of all approval/inspection certificates in each operating and maintenance manual.

.4 Arrange for inspection of all work by the Authorities Having Jurisdiction over the work. On completion of the work, present to the Owner the Final Unconditional Certificate of Approval of the Inspecting Authorities.

.5 Comply with the requirements of the latest edition of the Applicable C.S.A. Standards, the requirements of the Authorities Federal, Provincial and Municipal Codes. The Applicable Standards of the Underwriter's Association and all other Authorities Having Jurisdiction. These Codes and Regulations constitute an integral part of these specifications. In case of conflict, the Codes take Precedence over the Contract Documents. In no instance reduce the standard established by the drawings and specification by applying any of the Codes referred to herein.

.6 Before starting any work, submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Consultant immediately of such changes, for proper processing of these requirements. Prepare and furnish any additional drawings, details or information as may be required.

1.18 WORKPLACE SAFETY

.1 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for all products where required and maintain one copy at the site in a visible and accessible location available to all personnel.

.2 Comply with all requirements of Occupational Health and Safety Regulations and all other regulations pertaining to health and safety, including worker’s compensation/ insurance board and fall protection regulations.

.3 **Asbestos, Mould, Lead Paint, Etc.:** If at any time during the course of the work asbestos containing materials, black mould, lead paint, or any other such materials are encountered or suspected, immediately report the discovery to the Consultant and cease all work in the area in question. Do not resume work in affected areas until the situation has been properly corrected and without written approval from the Owner.

1.19 SHOP DRAWINGS AND PRODUCT DATA SHEETS

.1 Prior to supplying any products to the site, submit for review, shop drawings and/or product data sheets indicating in detail the design, construction, and performance of products as requested in Sections of this Specification. The number of copies of shop drawings and/or product data sheets will be as later directed.

.2 Shop drawings are those prepared specifically for the Project. Product data sheets are copies of manufacturer's standard catalogue, etc., literature.

.3 Unless otherwise specified or required, submit shop drawings/product data sheets via email in AutoCAD, REVIT, or PDF format only.

.4 Wherever possible, shop drawings and/or product data sheets are to be 215 mm x 280 mm (8½" x 11"), 215 mm x 356 mm (8½" x 14"), or 356 mm x 432 mm (11" x 17") single side white bond paper with sufficient clear space for review stamps, comments, and identification as specified below.

.5 Shop drawings and product data sheets must confirm that the product proposed meets all requirements of the Contract Documents.

.6 Each shop drawing or product data sheet is to be properly identified with the project name and the product drawing or specification reference, i.e., "Lighting Fixture F1", and all shop drawing or product data sheet dimensions are to be either SI or Imperial to match dimensions on the drawings.

.7 Prior to submitting the shop drawing, carefully review each shop drawing and product data sheet prior to submittal to ensure that the proposed product is correct and meets with all requirements of the Project. Endorse each copy of each shop drawing or product data sheet "Correct for Review by Consultant", or "Certified to Be in Accordance with All Requirements" and include company name, the submittal date, and the signature of an officer of the company to indicate the Electrical Contractor's review and approval as above.

.8 The Consultant will review shop drawings and product data sheets and will indicate the review status by stamping the shop drawings and product data sheets as follows:

.1 **"Reviewed" or "Reviewed as Noted"** to indicate that his review is final, and no re-submittal is required

.2 **"Returned for Correction"** to indicate that the submission is rejected and is to be revised in accordance with comments marked on the shop drawings and product data sheets by the Consultant and re-submitted.

.9 The Consultant will retain one or two copies of each shop drawing or product data sheet submission.

.10 The following is to be read in conjunction with the wording on the Consultant's review stamp applied to each and every electrical workshop drawing, or product data sheet submitted:

.1 "This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the product data/shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of the responsibility for errors or omissions in the product data/shop drawings or of his responsibility for meeting all requirements of the Contract Documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades."

1.20 SAMPLES

.1 Provide working samples of all luminaires and lamps as well as devices and cover plates for approval by the Owner and Consultant, prior to release of orders.

1.21 CHANGES OR REVISIONS TO THE WORK

.1 Whenever the Consultant proposes in writing to make a change or revision to the design, arrangement, quantity, or type of any work from that required by the Contract Documents, prepare, and submit to the Consultant for approval, a quotation being the Electrical Contractor's proposed cost for executing the change or revision.

.2 The Electrical Contractor's quotation is to be a detailed and itemized estimate of all products, material, labour, and equipment costs associated with the change or revision, plus overhead and profit percentages and all applicable taxes and duties.

.3 Unless otherwise stated in the Contract Documents, the following requirements apply to all quotations submitted:

.1 When the change or revision involves deleted work as well as additional work, the cost of the deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from the cost of the additional work before overhead and profit percentages are applied to the additional work.

.2 Material costs are not to exceed those published in local estimating price guides such as Allpriser, less applicable trade discounts.

.3 Costs for journeyman and apprentice labour must not exceed prevailing rates at the time of execution of the Contract and must reflect the actual personnel performing the work.

.4 Cost for the site superintendent must not exceed 10% of the total hours of labour estimated for the change or revision, and the change or revision must be such that the site superintendent's involvement is necessary.

.5 Costs for rental tools and/or equipment are not to exceed local rental costs.

.6 If overhead and profit percentages are not specified in the General Conditions of the Contract, Supplementary Conditions, or elsewhere in preceding Sections of the Specification, but allowable under the Contract, then allowable percentages for mark-up and overhead and profit are to be 10% and 5% respectively.

.7 The overhead percentage will be deemed to cover all quotation costs other than actual site labour, product and materials, and rentals.

.8 All quotations, including those for deleted work, must include a figure for any required change to the Contract time.

.9 **Mark-up for:** cleaning, safety, project manager, union fees, etc. labour rated mark-ups are not applicable.

.10 Subcontractor quotation shall be subject to the above.

.4 Labour and material pricing shall be per submitted unit rates where available, additionally labour for small items such as but not limited to straps, connectors, supports, clips, couplings, fasteners, marettes, bushings etc. will not be paid for. For the balance, NECA Table 1 or 2 is to be used where no unit rates exist.

.5 Overtime and premium time labour may be applied to quotations when preapproved by Stakeholder and validated to impact project schedule.

.6 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable the Consultant to expeditiously process the quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.7 If, in the Electrical Contractor's opinion, changes or revisions to the work should be made, inform the Consultant in writing and, if the Consultant agrees, a Notice of Change will be issued.

.8 Do not execute any change or revision until written authorization for the change or revision has been obtained.

1.22 SCAFFOLDING, RIGGING, AND HOISTING

.1 Unless otherwise specified or directed, supply, erect and operate all scaffolding, rigging, hoisting equipment and associated hardware required for the Electrical Contractor's work. Immediately remove from the site all scaffolding, rigging, and hoisting equipment when no longer required.

1.23 TEMPORARY SERVICES

.1 Refer to General Conditions.

.2 This contract includes all temporary wiring and connections for the elevators and escalators, as required such that respective contractor has all necessary power and connections available for certification of the equipment, prior to turnover and to meet the schedule. In certain circumstances tenant services will not be in place during elevator and escalator installation. Provide suitable temporary power for Division 25 to commission all their equipment. Mark phase rotation on all mechanical rotating equipment and include for temporary power for start-up prior to permanent tenant power being made available.

.3 The project is being turned over in phases for occupancy. Ensure fire alarm and emergency lighting are fully functional for occupancy for each phased handover. Provide necessary temporary services. Prior to each phase handover, contactor shall provide ULC 537 partial verification fire alarm report.

.4 For renovation projects, maintain adequate temporary emergency and regular lighting in all areas. In this regard, provide temporary luminaires under scaffoldings or where ceilings have been removed or in other areas, or where light fixtures have been removed. Provide 30 FC average. Ceilings below 15’-0” above finished floor level (a.f.f.l.) provide LED industrial fluorescent luminaires with wrap around lenses. Emergency lighting shall be to Code requirements. Provide necessary temporary exit signs. Maintain during construction and remove when instructed to do so.

.5 New luminaires may not be used for temporary construction lighting.

1.24 PROJECT CLOSEOUT SUBMITTALS

.1 Prior to application for Substantial Performance, submit all required items and documentation specified, including the following:

.1 Operating and Maintenance Manuals.

.2 As-built record drawings and associated data.

.3 Extended warranties for equipment as specified.

.4 All operating test certificates, i.e., Fire Alarm System Test Certificate.

.5 Testing and commissioning records.

.6 Identified keys for electrical equipment and/or panels for which keys are required, and all other items required to be submitted.

.7 Other data or products specified.

.2 **Operating and Maintenance Manuals:** Submit three hard copies of operating and maintenance manuals consolidated in hardcover three "D" ring binders, each binder sized to include approximately 25% spare space for future data, and identified permanently with the Project name, "ELECTRICAL OPERATING AND MAINTENANCE MANUAL" wording, and the date. Manuals are to include the following:

.1 An Introduction sheet listing the Consultant's, Contractor's, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses.

.2 A Table of Contents sheet, and corresponding index tab sheets.

.3 A copy of each "Reviewed" or "Reviewed as Noted" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, and the email address for local source of parts and service.

.4 Test reports, and certificates issued by governing authorities.

.3 **Operating Data:** Operating data is to include:

.1 A description of each system and its controls.

.2 Operation instruction for each system and each component.

.3 Description of actions to be taken in event of emergencies and/or equipment failure.

.4 **Maintenance Data:** Maintenance data is to include:

.1 Servicing maintenance, operation, and trouble-shooting instructions for each item of equipment and each system.

.2 Schedules of tasks, frequency, tools required, and estimated task time.

.3 Complete parts list with numbers.

.5 **Performance Data:** Performance data is to include:

.1 Equipment and system start-up data sheets.

.2 Equipment performance verification test results including all work sheets, and final commissioning report.

.6 **Review Submittal:** Assemble one copy of the O & M Manual and submit to the Consultant for review prior to Owner training and instructions and assembling the remaining copies. Incorporate all comments into the final submission.

.7 **Digital O & M Manuals:** Submit four digital versions of the hard copy manual using the latest version of Adobe Acrobat Portable Document Format and enhanced with bookmarks, internet links, and internal document links. The digital copies are to be copied to CDR with custom labels which indicate the project name, date, the Consultant's name, and "Operating & Maintenance Manual for Electrical Systems".

.8 **Record "As-Built" Drawings and Data:** As work progresses at the site, clearly mark in red in a neat and legible manner on a set of white prints of the Contract Drawings, all significant changes, and deviations from the routing of services and locations of equipment shown on the Contract Drawings and resulting from the issue of Addenda, Site Instructions, Change Orders, and job conditions. Use notes marked in red as required. Maintain the white print red line as-built set at the site for the exclusive use of recording as-built conditions, keep the set up to date at all times, and ensure that the set is always available for periodic review. The as-built set is also to include the following:

.1 The dimensioned location of all inaccessible concealed work.

.2 The locations of control devices with identification for each.

.3 The location of all junction boxes, terminal cabinets, etc.

.4 For underground conduit, ducts, etc., record dimensions, invert elevations, all offsets, fittings, and accessories if applicable, and locate dimensions from benchmarks that will be preserved after construction is complete.

.5 The location of all concealed services terminated for future extension.

.9 **Digital Record "As-Built" Drawings:** When work on site is complete, transfer all the as-built red line information from the site as-built drawings into REVIT and CAD format. Submit final as-built drawings in both PDF, CAD and REVIT format. As-built drawings shall not include any information regarding the Consultant. Apply 'As-Built' stamp to all drawings and include the Contractor's name and company information on the title block.

.1 Projects set up in AutoCAD shall be limited to CAD and PDF digital records.

.10 **Review and Submittal:** Prior to inspection for Substantial Performance of the work, submit for review, the red line site as-built white prints, a CAD disc of the as-built drawings, and a bound set of white prints (of equal quality to the Contract Drawings) made from the disc. The Consultant will review the drawings and, if necessary, return the disc and the marked-up white prints for corrections or further revisions, in which case complete the corrective and/or revision work and resubmit the disc and white prints until they are determined to be acceptable, all prior to issue of a Certificate of Substantial Performance.

1.25 PROGRESS PAYMENT BREAKDOWN

.1 Submit, prior to submittal of the first progress payment draw, a breakdown of the cost of the electrical work to assist the Consultant in reviewing and approving monthly progress payment claims.

.2 The payment breakdown is subject to the Consultant's approval and progress payments will not be processed until an approved breakdown is in place. The breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning, and project closeout submittals.

1.26 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

.1 All professional engineers retained by the Electrical Contractor to perform consulting services with regard to the Electrical Contractor's work, i.e., structural and seismic engineers, are to be members in good standing with the local Association of Professional Engineers and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of the governing authorities in the locale of the work.

.2 The Electrical Contractor's engineer's professional liability insurance is to protect the Electrical Contractor's Consultants and Sub-Consultants, and their respective servants, agents, and employees against any loss or damage resulting from the professional services rendered by the Electrical Contractor's Consultants, Sub-Consultants, and their respective servants, agents, and employees in regards to the work of this Contract.

.3 Liability insurance requirements are as follows:

.1 Coverage is to be a minimum of $2,000,000.00 inclusive of any one occurrence unless otherwise noted in contract documents provide by Stakeholder.

.2 The insurance policy is not to be cancelled or changed in any way without the insurer giving the Owner a minimum of thirty days written notice.

.3 Liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the location of the work.

.4 Evidence of the required liability insurance in such form as may be required is to be issued to the Owner, the Owner's Consultant, and Municipal Authorities as required prior to commencement of the Electrical Contractor's Consultant's services. Submit copies of letters of undertaking and final sign off schedules as may be required by the Authorities Having Jurisdiction (AHJ).

1.27 EXTENDED WARRANTIES

.1 Unless otherwise specified, all extended warranties specified in electrical work Sections of the Specification are to be full parts and labour warranties, at the site, and in accordance with requirements of the Contract warranty, but direct from the equipment manufacturer/supplier to the Owner. Submit signed and dated copies of extended warranties which clearly state requirements specified above.

1.28 TRIAL USAGE

.1 Prior to trial usage, checkout procedures and start up procedures to be carried out as per sections 01 70 00 of the specification.

.2 The Owner has the privilege of the trial usage of electrical systems or parts thereof for the purpose of testing and learning the operational procedures.

.3 Carry out the trial usage over a length of time as deemed reasonable by the Consultant, at no extra cost.

.4 Carry out the operations only with the express knowledge and under supervision of the Prime Subcontractor who shall not waive any responsibility because of trial usage.

.5 Trial usage shall not be construed as acceptance by the Owner, nor the start of the warranty period.

1.29 EQUIPMENT AND MATERIAL MANUFACTURER REQUIREMENTS

.1 Equipment and materials scheduled or specified on the drawings or in the Specification have been selected to establish a performance and quality standard.

.2 In most cases, acceptable equipment and material manufacturers are listed for any product specified by manufacturer's name and model number. Unless otherwise stated, the bid price may be based on products supplied by any of the manufacturers named as acceptable for the particular product. If acceptable manufacturers are not listed for a particular product, base the bid price on the products supplied by the specified manufacturers.

.3 If products supplied by a manufacturer named as acceptable are used in lieu of the products specified by manufacturer's name and model number, ensure that the product is equivalent in performance and operating characteristics (including energy efficiency if applicable) to the specified product. Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a manufacturer other than the specified manufacturer. In addition, in equipment spaces where products named as acceptable are used in lieu of the specified products and the dimensions of such products differ from the specified products prepare and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly.

1.30 LIST OF ACCEPTABLE MANUFACTURERS AND SUPPLIERS

.1 Within one day after award of a Contract, submit to the Consultant for review, a list to indicate the name of the manufacturers/suppliers the Electrical Contractor proposes to use for each item of equipment, material, or service listed, except for items such as conduit, branch circuit conductors, and similar products. Manufacturers and/or suppliers on the list must be named in the Specification or on the drawings.

.2 If the List of Acceptable Manufacturers and Suppliers is not submitted within one day after award of a Contract, the products specified and scheduled by manufacturer's name and model number and on which the Project is based are to be supplied. No substitutions whatsoever will be accepted unless previously approved in writing by the Consultant.

.3 If a Supplementary Bid Form is issued with the Bid Documents and requests the list of acceptable manufacturers and suppliers, the completed Supplementary Bid Form is to be submitted within one day after the date for bid closing.

1.31 SUBSTITUTED OR ALTERNATIVE PRODUCTS

.1 Products supplied by a manufacturer/supplier other than a manufacturer specified as acceptable may be considered for acceptance by the Consultant if requested in writing a minimum of seven days prior to the bid closing date. Requests may be made by letter, or by email. Telephone requests will not be considered.

.2 Each request for acceptance of a proposed substitution or alternative product must be accompanied by detailed catalogue and engineering data, fabrication information, and performance characteristics to permit the Consultant to make an informed decision.

.3 Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a substituted or alternative manufacturer. In addition, in equipment spaces where substituted or alternative products are used in lieu of the specified or acceptable products and the dimensions of such products differ from the specified or acceptable products, prepare, and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly.

.4 The Consultant's decision regarding any proposed substitution or alternative product is final.

1.32 PHASING OF THE WORK

.1 Phasing of the work is required to maintain the existing building in operation, all as specified by Consultants and Architect. Include all costs for phasing the work including all required "off hours" premium time labour costs.

1.33 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

.1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for the equipment/system manufacturer's authorized representative to visit the site to examine the installation, and when any required corrective measures have been made, to certify in writing to the Consultant that the equipment/system installation is complete and in accordance with the equipment/system manufacturer's instructions.

1.34 EQUIPMENT AND SYSTEM START-UP

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in electrical work Sections in accordance with the following requirements:

.1 Submit a copy of each equipment/system manufacturer's start-up report sheet to the Consultant for review and incorporate any comments.

.2 Under direct on-site supervision and involvement of the equipment/system manufacturer's representative, start-up the equipment/systems, make any required adjustments, document the procedures, leave the equipment/systems in proper operating condition, and submit a complete set of start-up documentation sheets signed by the manufacturer/supplier and the Contractor.

1.35 EQUIPMENT AND SYSTEM COMMISSIONING

.1 After successful start-up and prior to Substantial Performance, commission the electrical work in accordance with requirements of CSA Z320, Building Commissioning. Use commissioning sheets included with the CSA Standard, and any supplemental commissioning sheets required. Submit final commissioning data sheets, TAB reports, project closeout documents, and other required submittals.

.2 Commission electrical equipment and systems in accordance with the Section entitled Electrical Work Commissioning.

.3 Cooperate with the Owner's Commissioning Agent who is responsible for commissioning electrical equipment and systems. Refer to and perform duties required the Section entitled Owner's Commissioning Agent.

1.36 EQUIPMENT AND SYSTEM O & M DEMONSTRATION & TRAINING

.1 Refer to equipment and system operational and maintenance training requirements specified in this and other Divisions of the project.

.2 Train the Owner's designated personnel in all aspects of operation and maintenance of equipment and systems as specified in electrical work Sections of the Specification. All demonstrations and training are to be performed by qualified technicians employed by the equipment/system manufacturer/supplier.

.3 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Operating and Maintenance Manuals are to be used during the training sessions, and training modules are to include:

.1 **Operational Requirements and Criteria:** requirements and criteria are to include but not be limited to equipment function, stopping, and starting, safeties, operating standards, operating characteristics, and limitations.

.2 **Troubleshooting:** troubleshooting is to include but not be limited to diagnostic instructions, test, and inspection procedures.

.3 **Documentation:** documentation is to include but not be limited to equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like.

.4 **Maintenance:** maintenance requirements are to include but not be limited to inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools.

.5 **Repairs:** repair requirements are to include but not be limited to diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.

.4 Assemble the training modules into a training manual and submit a copy to the Consultant for review prior to scheduling training. Ensure that each participant in each training session has all required training material.

.5 Schedule demonstrations and training at mutually agreed to times with a minimum of 7 working days' notice.

.6 Demonstration and Training Confirmation: Obtain a list of personnel to receive demonstration and training from the Consultant, and have each participant sign the list to confirm that he/she understood the demonstration and training session.

2 PRODUCTS

2.01 SLEEVES

.1 Galvanized Sheet Steel: Minimum #16-gauge galvanized steel with an integral flange at one end to secure the sleeve to formwork construction.

.2 Polyethylene: Factory fabricated, flanged, high-density polyethylene sleeves with reinforced nail bosses.

.3 Waterproof Sleeves: Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at the sleeve midpoint, or PSI-Thunderline "Century-Line" Model CS HDPE sleeves.

.4 Galvanized Steel: Schedule 40 mild galvanized steel.

2.02 MULTI-CABLE TRANSITS

.1 UL/ULC listed and labelled multi-cable transits sized to suit the fire barrier opening and the number of cables/conduits involved and to facilitate a minimum 2-hour watertight fire and smoke seal. Each assembly is to be complete with a stainless-steel frame, cadmium plated compression bolts, proper end packing, compression plates, steel stay plates, and fire rated neoprene insert blocks.

2.03 FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Firestopping and smoke seal system materials for electrical penetrations through fire rated construction are specified in the electrical work Section entitled Sleeves and Sleeve Seals for Electrical Raceways and Cabling and the work is to be done as part of the electrical work.

.2 Firestopping and smoke seal system materials approved list include 3M, Hilti and approved equal.

2.04 WATERPROOFING SEAL MATERIALS

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so that when the bolts are tightened the links expand to seal the opening watertight. The seal assemblies are to be selected to suit the pipe size and the sleeve size or wall opening size. Acceptable products are:

.1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S-316

.2 The Metraflex Co. "MetraSeal" type ES

2.05 ESCUTCHEON PLATES

.1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to the building surface, each plate sized to completely cover the conduit/cable sleeve or building surface opening, and to fit tightly around the conduit or cable.

2.06 ACCESS DOORS

.1 Prime coat painted steel (unless otherwise specified) flush access doors, each complete with a minimum #16-gauge frame, minimum #18-gauge door panel, heavy-duty rust-resistant concealed hinges, a positive locking screwdriver lock, and mounting and finishing features to suit the particular construction in which it is to be installed.

.2 Access door sizes are to suit the concealed work for which they are supplied, and wherever possible they are to be of a standard size for all applications, but in any case, they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry. Provide layout to Consultant and Architect for approval prior commencement of work.

.3 Access doors in fire rated construction are to be ULC listed and labelled and of a rating to maintain the fire separation integrity.

.1 Obtain approval by AHJ prior planning installation that requires access doors in fire rated assembly areas.

.4 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout, and constructed of stainless steel with a #4 finish, or as approved by the Architect.

.5 Any use of access doors in public areas requires Consultant and Architect preapproval, provide proposed access doors layout coordinated with other disciplines. Access doors shall be proposed grouped with other trades requirements and are subject to coordinated approval by all consultants.

.6 Any use of access doors in process areas requires Consultant and Architect preapproval, provide proposed access doors layout coordinated with other disciplines. Access doors shall be proposed grouped with other trades requirements and are subject to coordinated approval by all consultants.

2.07 IDENTIFICATION MATERIALS

.1 **Equipment Nameplates:** Minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as single-phase starters and switches, minimum 25 mm x 65 mm (1" x 2½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:

.1 Unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved capital letter wording to completely identify the equipment and its use with no abbreviations.

.2 wording is generally to be as per the drawings, i.e., Lighting Panel A, and is to include equipment service and building area/zone served and where powered from but must be reviewed prior to engraving.

.3 Supply stainless steel screws for securing nameplates in place.

.4 Nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.

.2 **Self-Adhesive Labels:** Equal to Brother "P-Touch" or Thomas & Betts Canada Ltd. "EZCODE" Model EZL500 electronic labelling system self-adhesive labels with size and colour as directed, and permanently printed circuit identification nomenclature which is to be approved by the Consultant prior to producing the labels.

.3 **Warning Signs:** Equal to Thomas & Betts Canada Ltd. "BP" Series 250 mm x 355 mm (10" x 14") semi-rigid vinyl signs with corner screw holes, the required printed wording (generally red on a white background with black trim), pressure sensitive adhesive on the back, and stainless steel screws.

.4 **Conduit and Armoured Cable Identification:** Equal to Brady Canada minimum 50 mm (2") wide self-adhesive coloured vinyl tape.

.5 **Conductor Terminations:** Equal to Electrovert Ltd. Slip-on "Z" type

.6 **Conductor Colour Coding:** As specified with the conductors.

2.08 ELECTRICAL ENCLOSURES

.1 Unless otherwise specified or required by AHJ, electrical enclosures are to be wall mounting NEMA/EEMAC/CSA enclosures as follows:

.1 indoor in sprinkler protected areas, Type 2

.2 indoor in high humidity/washdown areas, Type 4

.3 indoor in corrosive environments, Type 4X, 316 stainless steel

.4 indoor explosion-proof, Class 1, Groups C & D, Type 7

.5 outdoor, minimum Type 3R and as per project drawings, the greater requirements will prevail

.6 indoor in non-hazardous areas except as noted above, Type 1

2.09 ENCLOSURE BACKBOARDS

.1 Construction grade Fir plywood, G1S, 20 mm (¾") thick with width and length to suit enclosure dimensions, coated on all surfaces with a ULC listed water based latex intumescent flame-retardant paint, ASTM E-84 Class A rated.

3 EXECUTION

3.01 GENERAL ELECTRICAL WORK INSTALLATION REQUIREMENTS

.1 Unless otherwise specified, locate, and arrange horizontal conduits, raceways, and conductors above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.

.2 Unless otherwise specified, install all conduits and conductors concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Note that walls which are painted are considered finished.

.3 Unless otherwise specified conduits and main distribution conductors may be exposed in equipment rooms.

.4 Install all exposed conduits, raceways, and conductors parallel to building lines and to each other.

.5 Do not install conduit, raceway, or conductors within 150 mm (6") of "hot" piping or equipment.

.6 All conduit, raceway, conductors, etc., must be supported from the structure, not from ceiling hangers, piping, ductwork, cable tray, and similar mechanical or electrical products.

.7 Neatly group and arrange all exposed work. Do not install conduit to prevent access into equipment.

.8 **Access**: Locate all work to permit easy access for service or maintenance as required and/or applicable. Locate all products which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where such products occur in vertical services in shafts, pipe spaces or partitions, locate the accessories at the floor level.

.9 **Manufacturer's Instructions:** Ensure that equipment and material manufacturer's installation instructions are followed unless otherwise specified herein or on the drawings, and unless such instructions contradict governing codes and regulations.

.10 **Cleaning:** Carefully clean all conduits, raceway, and fittings prior to installation. Temporarily cap or plug ends of conduit, which are open and exposed during construction.

.11 **Surfaces to Receive the Electrical Contractor's Work:** Inspect surfaces and structure prepared by other trades before performing electrical work. Verify that surfaces or the structure to receive electrical work has no defects or discrepancies, which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of this Electrical Contractor's work will constitute acceptance of such surfaces as being satisfactory.

.12 **Repair of Finished Surfaces:** For factory-applied finishes, repaint or refinish all surfaces damaged during shipment and installation. The quality of the repair work is to match the original finish. This requirement also applies to galvanized finishes.

.13 **Work in High Humidity Areas:** Where electrical work is located in high humidity areas where ferrous metal products will be subject to corrosion and protection for such products is not specified, provide finishes on the products to protect against corrosion or provide products which will not corrode in the environment.

3.02 WORKMANSHIP

.1 Install equipment, conduit, and cables in a workmanlike manner to present a neat appearance and to function properly to the satisfaction of the consultant. Install runs parallel and perpendicular to building planes. Install conduit concealed in chases, behind furring or above ceiling, except in unfinished areas exposed conduits and junction boxes shall not be accepted. Install exposed systems neatly and group to present a neat appearance.

.2 Install all equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore.

.3 Include in the work, all requirements of manufacturers shown on the shop drawings and installation manuals.

.4 Replace work unsatisfactory to the Consultant without extra cost.

.5 Make provisions to accommodate future plant and equipment indicated on drawings.

.6 In parking garages raceways runs shall be located at the parking stalls and away from main drive aisle.

3.03 INSTALLATION OF SLEEVES

.1 Where conduits, round ducts, and armoured cable pass through concrete and/or masonry surfaces, provide sleeves as follows:

.1 In poured concrete slabs: unless otherwise specified - minimum 16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves.

.2 In concrete or masonry walls: Schedule 40 galvanized steel pipe.

.2 Waterproof Sleeves: Provide waterproof sleeves in the following locations:

.1 In mechanical room floor slabs, except where on grade.

.2 In slabs over mechanical, fan, electrical and telephone equipment rooms, or closets.

.3 In all floors equipped with waterproof membranes.

.4 In the roof slab.

.5 In waterproof walls.

.3 Size sleeves, unless otherwise specified, to leave 12 mm (½") clearance around the conduit, duct, cable, etc.

.4 Pack and seal the void between the sleeves and the conduit, duct, cable, etc., in non-fire rated construction for the length of the sleeves as follows:

.1 Interior construction: pack sleeves in interior construction with mineral wool and seal both ends of the sleeves with non-hardening silicone base caulking compound.

.2 Exterior walls above grade: pack sleeves in exterior walls above grade with mineral wool and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified.

.3 Exterior walls below grade: seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

.5 Where sleeves are required in masonry work, accurately locate, and mark the sleeve location, and hand the sleeves to the mason for installation.

.6 Terminate sleeves that will be exposed so that the sleeve is flush at both ends with the building surface concerned so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above the finished floor.

.7 "Gang" type sleeving will not be permitted.

.8 Where sleeves are provided in non-fire rated construction for future services, or where conduit, ducts, cable, etc., has been removed from existing sleeves, cap, and seal both ends of the sleeved opening.

3.04 RECTANGULAR OPENINGS:

.1 Rectangular openings for cable tray, raceways, multiple conduits and/or cables and similar rectangular openings will be provided in new poured concrete work, masonry, drywall, and other building surfaces by the trade responsible for the particular construction in which the opening is required.

.2 **Waterproof Openings:** Provide watertight link type mechanical seals in exterior wall openings where shown or specified. Assemble and install each mechanical seal in accordance with the manufacturer's instructions. After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until the seal is completely watertight.

.3 **Openings in Non-Fire Rated Construction:** For all rectangular openings in non-fire rated construction, pack and seal the space between the conduits, ducts, cables, etc., with mineral wool for the full thickness of the building surface penetrated, and seal both ends.

.4 **Openings in Fire Rated Construction:** Provide multi-cable transits in all fire rated openings and install in accordance with the manufacturer's instructions.

3.05 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, reproducible drawings indicating the size and location of all required sleeves, recesses and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs,

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

3.06 INSTALLATION OF ESCUTCHEON PLATES

.1 Provide escutcheon plates suitable secured over all exposed conduits, ducts, armoured cable, etc., passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.

.2 Install the plates so that they are tight against the building surface concerned and ensure that the plates completely cover sleeves and/or openings, except where waterproof sleeves extend above floors, in which case the plate is to fit tightly around the sleeve.

3.07 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide fastening and securing hardware required for electrical work to maintain installations attached to the structure or to finished floors, pads, walls, and ceilings in a secure and rigid manner capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.

.2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where floor, wall, or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure. Provide reinforcing or connecting supports where required to distribute loading to structural components.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is given, comply with requirements of CAN3-Z166.1 and .2.

.5 Do not attach fasteners to steel deck without written consent from the Consultant.

3.08 SUPPLY OF ACCESS DOORS

.1 Supply access doors to give access to all electrical work which may need maintenance or repair, but which is concealed in inaccessible construction, except as otherwise specified herein or on the drawings.

.2 Locate access doors as inconspicuously as possible in walls and partitions and arrange electrical work such that it is clearly within view and accessible for inspection and servicing, and to suit access door locations shown on the reviewed and approved white prints of reflected ceiling plan and elevation drawings submitted as per Part 1 of this Section.

.3 Group services to ensure the minimum number of access doors is required. Access doors will be installed by the trades responsible for the particular type of construction in which the doors are required.

.4 Submit a sample of each proposed access door for review prior to ordering.

3.09 ELECTRICAL WORK IDENTIFICATION

.1 Identify all new/relocated electrical work in accordance with existing identification standards at the site.

.2 Identify all electrical work, including conduit systems and wiring, as follows:

.1 the size and wording of identification nameplates must be approved by the Consultant.

.2 Identification wording for equipment is to follow drawing nomenclature unless otherwise specified.

.3 Secure nameplates to equipment with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces.

.4 Locate nameplates in the most conspicuous and readable location.

.5 For multi-cell or multiple component equipment provide a main nameplate and a smaller nameplate for each cell or component.

.6 Where electrical work is to be identified in conjunction with mechanical work, coordinate with the mechanical trades to ensure identical tagging.

.7 All identification wording is to be in English.

.8 All identification and colour coding are to be indicated on record drawings.

.3 **Terminal Cabinets, Pull Boxes, Junction Boxes, Etc.:** Clearly identify terminal cabinets, main pull, and junction boxes by neatly spray painting the outside surface of the cover with a paint colour as specified below for conduit and conductor identification. Provide a nameplate on terminal boxes, main pull and junction boxes in communication systems specified in Division 27.

.4 **Transformers:** Transformer nameplated must identify the transformer capacity as well as primary and secondary voltages.

.5 **Branch Circuit Panelboards:** Panelboard nameplates must identify the electrical source connected to the panelboard, each circuit breaker, and, neatly typed on the door directory card, the load connected to each breaker.

.6 **Motor Starters and Disconnect Switches:** Provide nameplates for each motor starter and disconnect located in a motor control centre or on a motor starter panel, and on each individually mounted starter and disconnect provided as part of the electrical work. Nameplates must also indicate the voltage and phase.

.7 **Luminaires on Emergency Circuits:** Identify all luminaires on emergency circuit be means of a 15 mm (½") diameter self-adhesive red label secured to the T-bar ceiling component adjacent to the luminaire, or if not in a T-bar ceiling, to the frame of the luminaire.

.8 **Lighting Switches & Receptacles:** Identify each lighting switch and each receptacle by means of a permanent self-adhesive label indicating the source panelboard and circuit number and secured to the device faceplate.

.9 **Communication Equipment/Systems:** Identify all "head end" equipment with nameplates and all "downstream" devices with self-adhesive labels indicating circuit numbers.

.10 **Warning Signs:** Provide appropriately worded warning signs secured in place with stainless steel hardware in locations as follows:

.1 On all doors into transformer vaults.

.2 On all doors into high voltage switchgear rooms.

.3 On all collector bus enclosures.

.4 On pad mounted transformer enclosures.

.5 Wherever else required by Code.

.11 **Conduit & Armoured Cable:** Colour code conduit and armoured cable by means of 25 mm (1") wide primary colour plastic adhesive backed tape or neatly applied suitable paint with, where scheduled, a 20 mm (¾") wide auxiliary colour at all points where the conduit or cable penetrates a wall, ceiling, floor, at 6 m (20') intervals or at least once in each room or accessible ceiling space, at each access door location, and elsewhere at 15 m (45') intervals. Unless otherwise indicated/specified, colours are to be as follows:

Service	**Primary Colour**	**Secondary Colour**
up to 250 volts	yellow	
250 to & including 600 volts	yellow	green
above 600 volts to 5 kV	yellow	blue
above 5 kV to 28 kV	yellow	red
communications	green	
fire alarm	red	
emergency voice	red	blue
security systems	red	yellow
isolated power	orange	

.12 **Wire & Cable Terminations:** Identify both end of wire and cable terminations with the same unique number. Where numbers are not indicated or specified, assign a number, and record them.

.13 **Buried Cable/Duct Runs:** Identify buried cable/duct runs under paved and landscaped areas with appropriate concrete markers, flush with grade at each change in direction, at least twice on runs less than 60 m (200') and on 60 m (200') centres on longer runs.

.14 **Overhead Wiring Service Poles:** Unless otherwise indicated on the drawings identify poles with wording such as “HV#1”. For wooden poles, use 50 mm (2”) high non-corrosive embossed aluminium pole markers. For concrete poles use non-corrosive metal plated secured to the pole with metal strapping.

.15 **Distribution System Schematic Diagrams:** Prepare AutoCAD, coloured, 1200 mm x 900 mm (48” x 36”) schematic diagrams of electrical distribution systems to identify all equipment and circuits. Install framed and glazed diagrams in electrical rooms housing the system equipment. Confirm location prior to installation. Include reduced size copies of the diagrams in each copy of the O & M Manuals.

3.10 INSTALLATION OF TERMINAL BACKBOARDS

.1 Provide properly sized plywood backboards for wiring terminals in terminal cabinets and enclosures where shown/specified/required.

3.11 GENERAL ELECTRICAL WORK TESTING

.1 Perform testing in accordance with the Electrical Work Testing Section, and, in addition, any tests required by governing Codes, Standards.

3.12 BRANCH CIRCUIT BALANCING

.1 Connect all branch circuits to panelboards so as to balance the actual loads (wattage) to within 5%. If required, transpose branch circuits to achieve this requirement.

.2 After the building is occupied and if requested by the Consultant, demonstrate that branch circuit balancing has been achieved.

3.13 FINISH PAINTING OF ELECTRICAL WORK

.1 Finish paint exposed electrical work as specified and/or scheduled in accordance with requirements of the painting Section in Division 09.

.2 Touch-up paint all damaged factory applied finishes on electrical work products.

.3 Finish painting of exposed electrical work is specified in Division 09 and is part of the work of Division 09.

3.14 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

.1 Motor starters for mechanical equipment will be supplied as part of the mechanical work.

3.15 ELECTRICAL WIRING WORK FOR MECHANICAL WORK

.1 Unless otherwise specified or indicated, the following electrical wiring work for mechanical equipment is to be done as part of the electrical work:

.1 "Line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from the starters or disconnects to the equipment.

.2 Mounting of individual starters, "line" side power wiring to individual wall mounted starters, and "load" side wiring from the starters to the equipment.

.3 "Line" side power wiring to pre-wired power and control panels and variable frequency drives, and "load" side power wiring from the panels and VFD's to the equipment.

.4 Provision of receptacles for plug-in equipment.

.5 Provision of disconnect switches for all motors that are in excess of 10 m (30') from the starter location, or that cannot be seen from the starter location, and all associated power wiring.

.6 All motor starter interlocking in excess of 24 volts.

.7 Wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts.

.8 Provision of dedicated 120 volt, 15A-1P circuits terminated in junction boxes in mechanical equipment rooms for automatic control and building automation system wiring connections to be made as part of the automatic controls work.

.9 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers.

.10 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units.

.11 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.

.2 Mechanical wiring work not listed above, specified herein, or on the drawings will be done as part of the mechanical work in accordance with wiring requirements specified for the electrical work.

3.16 INTERRUPTION TO AND SHUTDOWN OF ELECTRICAL SERVICES AND SYSTEMS

.1 Co-ordinate all shutdown and interruption to existing electrical systems with the Owner. Generally, shutdowns may be performed out of building operating hours typically late nights to early mornings, assume no more than 6 hours per night.

.2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform the Owner and Consultant in writing seventy-two hours in advance of a minor proposed shut-down or interruption and obtain written approval to proceed. Major proposed shutdowns have to be planned weeks in advance. Do not shutdown or interrupt any system or service without such written approval.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible, and, prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.

3.17 EQUIPMENT BASES AND SUPPORTS

.1 **Concrete Housekeeping Pads:** Unless otherwise specified or required, set all floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of the equipment on each side and end, or a minimum of 200 mm (8") from the centreline of equipment anchor bolts to the edge of the base, whichever is larger. Conform to the following requirements:

.1 Supply dimensioned drawings and equipment base templates and provide anchor bolts for proper setting and securing of equipment on pads.

.2 Place anchor bolts during the concrete pour and be responsible for all required levelling, alignment, and grouting of the equipment.

.3 As a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.

.2 **Transformer to be installed on the precast, vault type pad as follows:**

.1 Concrete 4500 PSI (32 MPa), minimum 6” and selected to accommodate the transformer weight, and exceed with tolerance no less than 20%.

.2 Pad dimensions to exceed all transformer dimensions, by less than 300mm.

.3 Cable entry openings – PVC seal for 103mm and 127mm ducts as indicated on the drawings.

.4 Reinforcing steel to CSA CAN A23.1.

.5 Sized to accommodate the seismic zone of the installation and carry certification for its intended use.

.6 Coordinate and obtain guidance from the utility company as it relates to minimum size precast pad and type.

.7 Include for all costs, civil, coordination and precast pad to deliver a turnkey, levelled, and finished installation inclusive of site civil prep work to install the transformer pad with the required drainage provisions.

.8 Minimum drainage provisions are inclusive of 12” crushed stone compacted bedding to 100% ratio, installed under the transformer precast vault.

.3 **Structural Steel Stands/Supports:** For equipment not designed for base mounting, where required, provide welded, cleaned, and prime coat painted structural steel stands or supports conforming to the following requirements:

.1 All stands and supports, except those for small equipment, are to be designed by a structural engineer registered in the jurisdiction of the work and stamped and signed design drawings with calculations are to be submitted as shop drawings for review.

.2 All steel stands are to be flange bolted to concrete housekeeping pads.

.3 All stands and supports are to be seismically restrained in accordance with applicable requirements.

.4 **Seismic compliance:** notwithstanding the above in municipalities where seismic certification is required structural pads and equipment supports shall be verified and certified for seismic compliance. Electrical contractor to carry all costs for a third-party seismic engineer per item 3.26.

3.18 CONCRETE WORK FOR EQUIPMENT BASES/PADS

.1 Provide all poured concrete work, including reinforcing and formwork, required for electrical equipment bases/pads. Perform concrete work in accordance with requirements specified in Division 03.

.2 Concrete is to be minimum 32,000 kPa with 5% to 8% air entrainment ready-mix concrete exceeding CAN/CSA-A23.1 and the Building Code.

.3 Ensure that bases and pads are keyed into the structure to meet seismic restraint requirements.

3.19 CUTTING, DRILLING AND PATCHING

.1 Perform all cutting, drilling, and patching of the existing building for the installation of this Electrical Contractors work. Perform all cutting and drilling with proper tools and equipment. Confirm the exact location of cutting and drilling with the Consultant prior to commencing the cutting and/or drilling work.

.2 Patch surfaces, where required, to exactly match existing finishes using tradesmen skilled in the particular trade or application worked on.

.3 Where new conduits, conductors, etc., pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around the product involved.

.4 Prior to drilling or cutting an opening in poured concrete construction, determine the location, if any, of existing services concealed in the construction to be drilled or cut. X-ray or Ferro Scan Test the walls or slabs if required. Do not drill or cut post tensioned or precast slabs without permission.

.5 This Electrical Contractor will be responsible for the repair of any damage to existing services, exposed or concealed, caused as a result of their own cutting or drilling work.

.6 Where drilling is required in waterproof slabs, size the opening to permit snug and tight installation of a sleeve which is sized to leave 12 mm (½") clearance around the product involved. Provide a sleeve in the opening. Sleeves are to be Schedule 40 galvanized steel pipe with a flange at one end and a length to extend 100 mm (4") above the slab. Secure the flange to the underside of the slab and caulk the void between the sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a watertight installation.

3.20 PACKING AND SEALING CORE DRILLED OPENINGS

.1 Pack and seal the void between the core drilled opening and the service insulation for the length of the opening as follows:

.1 **Non-fire rated interior construction:** pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal.

.2 **Fire rated interior construction:** seal openings in fire rated interior construction with approved sealant at both ends of the opening with approved fire rated sealant. Ensure application of sealant is in accordance with manufacturer installation guidelines, adjust as require at no cost and ensure conduits and sleeves spacing is adequate and proper and as per sealant installation requirements. Conduit layouts penetrating through fire rated assembly shall not be completed prior selecting and obtaining approval for specific sealant use.

3.21 FLASHING FOR ELECTRICAL WORK PENETRATING THE ROOF

.1 Do all required flashing work, including counterflashing, for electrical work penetrating and/or set in the roof. Engage the services of an Owner approved waterproofing sub-contractor.

.2 Perform flashing work in accordance with requirements of drawing details, and requirements specified in Division 07.

3.22 CLEANING ELECTRICAL WORK

.1 Refer to cleaning requirements specified in Division 01.

.2 Clean **all** electrical work prior to application for Substantial Performance of the work.

3.23 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

.1 Maintain all equipment in accordance with the manufacturer's printed instructions prior to start-up, testing and commissioning.

3.24 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with requirements specified in Division 01.

.2 Separate and recycle waste materials in accordance with requirements of Canadian Construction Association Standard Document CCA 81, A Best Practices Guide to Solid Waste Reduction.

.3 Prepare a waste management and reduction plan and submit a copy for review prior to work commencing at the site.

.4 Place materials defined as hazardous or toxic waste in designated containers.

.5 Ensure emptied containers are sealed and stored safely for disposal.

3.25 SEISMIC RESTRAINT ANCHOR POINTS FOR EQUIPMENT

.1 All electrical equipment requiring seismic restraint (see the electrical work Section entitled Seismic Control and Restraint) is to be complete with manufacturer designed and rated seismic restraint anchor points and attachments, certified by the equipment manufacturers, so that the equipment may be bolted down or restrained in the field.

.2 The equipment to be restrained must be designed such that the strength and anchorage of the internal components of the equipment exceeds the force level used to restrain and anchor the equipment itself to the supporting structure.

.3 Contractor shall retain and pay for a registered seismic engineer to design and inspect the seismic restraints of the electrical system components covered under division 16 for this contract.

.4 The seismic engineer retained by contractor shall provide for the following:

.1 Signed and sealed letters of assurance of professional design and commitment for field review and summary of design and field review as required by authorities having jurisdiction.

.2 Certified detailed drawings of seismic restraints.

.3 Detailed specification for seismic restraints.

.4 Written reports of site reviews.

.5 Signed and sealed letter of assurance of professional review and compliance.

.5 Substantial performance will not be considered without the submission of the above documents. All the above documents shall be submitted to the consultant for further distribution and files.

.6 Electrical Contractor shall cooperate with the seismic engineer and promptly supply such information, including weights of equipment and base frame or mounting plate layouts, as requested by the seismic engineer necessary to support the design and details for seismic restraint.

.7 Electrical Contractor shall not be entitled to any additional compensation arising from the technical direction provided by the seismic engineer for seismic restraint and anchorage of electrical systems.

.8 Electrical Contractor and seismic restraint engineer shall note specific structural design and construction requirements for this building and shall design and install the seismic restraint system to suit.

3.26 REQUIREMENTS FOR BARRIER-FREE ACCESS

.1 Include for all applicable requirements for barrier-free access to electrical devices in accordance with governing Codes and Regulations, whether shown on the drawings, specified, or not.

END OF SECTION

1 GENERAL

1.01 APPLICATION

.1 This Section specifies requirements, criteria, methods, and execution for electrical demolition work that are common to one or more electrical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

1.02 SUBMITTALS

.1 Submit documentation to confirm that all PCB material and/or equipment containing PCB material has been properly removed and disposed of as applicable.

.2 Submit documentation to confirm all oil field equipment have been properly removed and disposed of as applicable. Note oil filled equipment should be drained on site, oil removed from equipment and handled in accordance or MOE and handled in separate containers prior removal from site to ensure no environmental impact beyond the project site.

1.03 REFERENCE STANDARD

.1 Perform demolition work in accordance with requirements of CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.

2 PRODUCTS

Not Applicable

3 EXECUTION

3.01 CONTINUATION OF ELECTRICAL SERVICES

.1 Critical systems such as fire alarm, building automation controls, communication systems that may be affected by the demolition scope shall be kept operational and if required to be relocated temporary provisions shall be implemented to replace and provide equal performance for the duration of the period while systems are re-established.

.2 Provide any required temporary supports for system that will require to remain during times of work in the area of demolition.

.3 Provide permanent supports of all passing through service is existing supports are affected by the demolition scope of work. Note, existing services required to remain may not all be visible and identified on the electrical set of drawings especially of scope of work include removal and or rework of concealed systems and structures.

3.02 DISCONNECTION AND REMOVAL OF EXISTING ELECTRICAL WORK

.1 Where indicated on the drawings, disconnect, and remove existing electrical work, including hangers, supports, etc. Disconnect at the point of supply, remove obsolete connecting services, and make the system safe. Cut back obsolete conduit behind finishes and cap unless otherwise specified.

.2 The scope and extent of the demolition or revision work is only generally indicated on the drawings. Estimate the scope, extent, and cost of the work at the site during the bidding period scheduled site visit(s).

.3 Where deemed necessary by the Owner and Consultant, existing shafts, walls, and inaccessible ceilings will be opened by the Owner to permit site visit inspection of services to be removed/revised as part of the work but usually concealed behind such construction.

.4 Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at the site during bidding period site visits will not be allowed.

.5 If any re-design is required due to discrepancies between the electrical drawings and site conditions, notify the Consultant who will issue a Site Instruction. If, in the opinion of the Consultant, discrepancies between the electrical drawings and actual site conditions are of a minor nature, the required modifications are to be done at no additional cost.

.6 Where existing electrical services extend through or are in an area to serve items which are to remain, maintain the services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during the renovation work, so as to be concealed behind new or existing finishes.

.7 Unless otherwise specified, remove from the site, and dispose of all existing materials which have been removed and are not to be relocated or reused.

.8 Unless otherwise specified, remove from the site, and dispose of all existing materials which have been removed and are not to be relocated or reused, except for the following which are to be handed over to the Owner at the site:

.1 Any excess LED lighting.

3.03 HAZARDOUS MATERIALS AND WASTE

.1 If hazardous materials and/or waste not listed in the Specification is found, stop the associated work, notify the Owner and Consultant immediately, and await directions.

3.04 INTERRUPTION TO AND SHUTDOWN OF ELECTRICAL SERVICES AND SYSTEMS

.1 Co-ordinate all shutdown and interruption to existing electrical systems with the Owner. Generally, shutdowns may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning.

.2 Areas where restaurants are located may be shut down only after 3:00 a.m.

.3 Upon award of contract, submit a list of anticipated shutdown times and their maximum duration.

.4 Prior to each shutdown or interruption, inform the Owner in writing seventy-two hours in advance of the proposed shutdown or interruption and obtain written approval to proceed. Do not shut down or interrupt any system or service without such written approval.

.5 Perform work associated with shutdowns and interruptions as continuous operations to minimize the shutdown time and to reinstate the systems as soon as possible, and, prior to any shutdown, ensure that all materials and labour required to complete the work for which the shutdown is required are available at the site.

3.05 ROOFING WORK

.1 Where roof revisions and/or replacements are part of the project, include for disconnecting, lifting, or temporarily removing electrical equipment and electrical connections to other roof mounted equipment as required to permit completion of the roofing work, and for re-installing/re-connecting the equipment when the roofing work is complete.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Product Data: Submit product data sheets for all products specified in Part 2 of this Section except for copper wire/cable conductors.

1.02 QUALITY ASSURANCE

.1 Grounding and bonding work is to be in accordance with requirements of the following:

.1 CSA C22.2 No. 41, Grounding and Bonding Equipment (Tri-National Standard with UL 467)

.2 CSA C22.2 No. 0.4, Grounding and Bonding of Electrical Equipment

.3 requirements of the Electrical Safety Authority and any other governing authority

.4 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities

1.03 COORDINATION

.1 Coordinate the installation of grounding hardware and conductors associated with concrete with the trades providing the concrete work.

1.04 FIELD QUALITY CONTROL REPORT

.1 Submit written and signed report(s) indicating successful results of the ground continuity tests specified in Part 3.

2 PRODUCTS

2.01 GROUND PLATES

.1 Copper plates, 1 m² (11 ft.² surface area, 6 mm (¼") thick.

2.02 GROUND BUS

.1 Solid electrical grade copper, minimum 50 mm x 6 mm (2" x ¼), minimum 600 mm (24") long but with lengths as required (continuous lengths for health care and data centre projects), predrilled for two-hole lug connections, suitable for wall or backboard mounting and complete with corner angles, tamper-proof stainless steel hex head bolts, nuts, and spring lock washers, standoff insulators, and all connection hardware.

2.03 FLEXIBLE GROUND BRAID

.1 Flat 98% conductivity tinned copper grounding braid with dimensions to suit the application.

2.04 GROUND CONDUCTORS

.1 Unless otherwise specified and/or shown. Stranded un-tinned soft annealed copper wire, bare or green PVC insulated conforming to requirement of the Section entitled Wire and Box Connectors (0-1000volts).

2.05 GROUNDING AND BONDING CONNECTIONS

.1 Below Grade: Equal to Erico International Corp. "CADWELD" exothermic welded connections.

.2 Above Grade: Compression type connectors with zinc-plated fasteners and external tooth lock washers, or, if approved by the Consultant, exothermic Erico International Corp. "CADWELD" welded connections.

2.06 COMMUNICATIONS, ACCESS CONTROL, AND ELECTRONIC SAFETY SYSTEM GROUND BUS

.1 As per the electrical work Section entitled Grounding and Bonding for Communications.

2.07 IT AND LAN ROOM/CLOSET GROUND BUS

.1 Solid electrical Grade copper bus bars, 300 mm x 50 mm x 9 mm (12" x 2" x ⅜") with 8 drilled holes, suitable for wall mounting and equipped with standoff insulators.

3 EXECUTION

3.01 GENERAL RE: SECONDARY GROUNDING AND BONDING

.1 Perform all required secondary electrical work grounding and bonding work in accordance with the Contract Documents and requirements of governing Codes and Standards, including the Electrical Safety Authority.

.2 Bond metallic conduits, boxes, cable tray, ducts, and non-current carrying metal parts of equipment together to form a continuous ground system. In electrical equipment rooms, solidly bond circuits, panelboards, conduits, equipment enclosures, and other equipment to perimeter ground bus using bronze connectors and hardware.

.3 Protect exposed conductors from injury. Install underground conductors a minimum of 450 mm (18”) below grade.

.4 Use tinned copper conductors for aluminium structures.

.5 Do not use bare copper conductors adjacent to un-jacketed lead sheath cables.

3.02 INSTALLATION OF GROUND BUS

.1 Provide ground bus in each electrical and IT/LAN room and where shown/specified on the electrical drawings. Wall mount 300 mm (12”) above finished floor level on standoff insulators and follow the outline of doorframes and room corners using 90º bus angles to form continuous bus. Connect the ground bus to the ground rod grid by means of two minimum #3/0 copper conductors terminated with approved fittings.

.2 Provide flexible braided copper ground straps from the ground bus to each steel doorframe and door in each High Voltage electrical room, each securely bolted in place. Connect all metal structure, frames, equipment inside the electrical High Voltage room.

.3 Tighten all bus bar joint connection bolts and lug using a torque wrench to the bus manufacturer’s prescribed tension, then coat the bus with two 100% covering coats of shellac to prevent copper oxidization.

3.03 NEUTRAL GROUNDING

.1 Connect transformer neutral and distribution neutral together using 1000 volt insulated conductor to one side of a ground test link, the other side of the test link being connected directly to the main station ground. Ensure that distribution neutral and neutrals of potential transformers and service banks are bonded directly to the transformer neutral and not to the station ground.

.2 Connect the neutral of the station transformer to the main neutral bus with a tap pf the same size as the secondary neutral.

.3 Ground the transformer tank with a continuous conductor from the tank ground lug through the connector on the ground bus to the primary neutral. Connect the neutral bushing at the transformer to the primary neutral in the same manner.

3.04 CABLE SHEATH GROUNDING

.1 Bond single conductor metallic sheathed cables together at on end only. Break the sheath continuity in an approved manner and provide #6 AWG flexible copper ground conductor soldered (not clamped) to the cable sheath.

3.05 IT AND LOCAL AREA NETWORK (LAN) ROOM/CLOSET GROUNDING

.1 Provide minimum 3/0 AWG insulated copper ground conductors and wall mounted copper ground bus in each LAN Room. Connect the ground bus to computer equipment racks and to the building ground system.

3.06 ELECTRICAL SERVICE EQUIPMENT GROUNDING AND BONDING

.1 Provide green insulated ground wire in electrical service conduits feeding electrical service switchboard, panels, disconnect switches, splitters, and similar distribution equipment.

Note: Electrical service equipment shall not rely on conduit for bonding and grounding.

.2 Ground wire shall be minimum #6 AWG and sized in accordance to the Electrical Safety Code.

3.07 ELECTRICAL BONDING AND/OR GROUNDING FOR AUTOMATION, CONVEYANCE, OR SIMILAR PANELS

.1 Provide a separate, insulated bonding conductor inside electrical service conduits (sized per National/Provincial Electrical Code), that feed conveyor panels, automation distribution panels, battery charger panels, Material Handling Equipment panels, etc. The conduit shall not be used as a bonding means

.2 Ground wire shall be minimum #6 AWG and sized in accordance to the Electrical Safety Code.

3.08 ELECTRICAL GROUNDING FOR MECHANICAL EQUIPMENT

.1 Provide green insulated ground wire in electrical service conduits feeding mechanical equipment, and to each started, Motor Control Centre and VFD.

.2 Ground wire size shall be selected to be no less than the minimum code required ground wire.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Product Data: Submit product data sheets for all products where submittal is specified in Part 2 or Part 3 of this Section.

.2 Colour Coated EMT Colour Chart: Submit the colour coated EMT manufacturer's standard colour chart for colour selection(s) by the Consultant.

.3 Drawing(s) of Conduit Locations/sizes In Structural Poured Concrete: As specified in Part 3 of this Section, submit drawings to indicate the proposed location, size, and length of run for conduit proposed to be installed in structural poured concrete work.

.4 Samples: If requested, submit samples of products specified in this Section.

2 PRODUCTS

2.01 OUTLET BOXES

.1 Unless otherwise specified, each box is to be CSA certified, suitable in all respects for the application, single or multi-gang as required, and complete with suitable securing lugs, connectors suitable for the connected conduit, knockouts, and, where necessary, suitable plaster rings, concrete rings, covers and any other required accessory. Unless otherwise specified, outlet boxes are to be as follows:

.1 Stamped, electro-galvanized steel outlet boxes.

.2 Zinc coated cast malleable iron or cast aluminium "FS and "FD" boxes with threaded inlet/outlet hubs.

.3 Rigid PVC outlet boxes.

.4 Equal to Hubbell Canada Inc. UL/ULC or ETL listed, single or multi-gang as required, fully adjustable both vertical and angular, formed galvanized cast iron, round, rectangular, or square as required flush concrete floor boxes complete with adjustable collars and brass screw-on hinged flip-open cover with provisions for installation of duplex power receptacles, telephone data jacks, and, for boxes containing both power and communication system outlets, proper barriers.

.5 Hubbell or Legrand-Wiremold flush, fire rated "poke-through" box assemblies to suit the devices required, with grey, black, or brass flanges and covers as selected by the Consultant.

.6 Cooper Crouse-Hinds or approved equal boxes for fire alarm systems, red epoxy paint, ULC listed and approved for fire alarm system wiring.

.7 Outlet box exterior fire seal shall be 3M™ Fire Barrier Moldable Putty Pads MPP.

.8 Fire suppression gasket in fire rated wall is required each time outlet box is installed inside fire rated assembly. The fire suppression gasket shall be made by Intumescent Technologies, LLC and PyroPhobic Systems, Ltd. - FireBløk™ Gasket, RECTORSEAL "Bio Fireshield or alternative equal.

2.02 SPLITTER TROUGH

.1 Heavy Duty, minimum formed #16 gauge steel Type 1 splitter trough in accordance with CSA C22.2 No. 76, Splitters, finished inside and outside with ANSI 61 grey heat cured powder epoxy paint, and complete with welded seams ground smooth, various size knockouts on each side, back mounting holes, removable doors with stainless steel hinges and hinge pins, terminal blocks for conductor connections, a single point ground lug.

.2 Enclosures: Unless otherwise specified, enclosures are to be in accordance with the following NEMA/EEMAC ratings:

.1 All enclosures located in sprinklered areas – Type 2.

.2 All enclosures except as noted above – Type 1.

2.03 PULL BOXES AND JUNCTION BOXES

.1 Each box is to be CSA certified, sized to suit the number and size of conduit and conductors, and complete with connecting and securing facilities. Unless otherwise specified, pull boxes and junction boxes are to be as follows:

.1 Heavy duty galvanized or prime coat plated steel, suitable in all respects for the application and complete with screw-on or hinged covers as required and connectors suitable for the connected conduit.

.2 "Condulet", heavy duty, threaded galvanized cast iron or cast aluminium pull boxes and junction boxes of an exact type to suit the application, each complete with a screw-on gasketed cover.

.3 Rigid plastic (PVC), junction boxes and access fittings with solvent weld type joints and screw-on PVC covers.

.4 Equal to Square D (Schneider Canada) Catalogue No. 970 cast bronze water-proof junction box for underwater lighting.

2.04 EMT

.1 Galvanized steel to CSA C22.2 No. 83, Electrical Metallic Tubing, complete with factory made bends where site bending is not possible, and joints and terminations made with steel couplings and set screw type connectors, concrete tight where required.

2.05 RIGID GALVANIZED STEEL CONDUIT

.1 Rigid galvanized steel to CSA C22.2 No. 45, Rigid Metal Conduit, with an enamel interior coating, galvanized threads where factory threaded, red lead coated threads where site threaded, factory made bends where site bending is not possible, factory made threaded fittings and connectors, and terminations made with rigid couplings, concrete tight where required.

2.06 FLEXIBLE GALVANIZED STEEL LIQUID-TIGHT CONDUIT

.1 Flexible galvanized steel liquid-tight conduit to CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, complete with Ideal Industries Inc. “Steel Tough” liquid-tight connectors at terminations.

2.07 FLEXIBLE GALVANIZED STEEL CONDUIT

.1 Galvanized steel flexible conduit to CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, complete with proper and suitable squeeze type connectors at terminations.

2.08 RIGID ALUMINUM CONDUIT

.1 Factory or site threaded rigid aluminium to CSA C22.2 No. 45, Rigid Metal Conduit, with bending, threading, fitting, coupling, etc., requirements as specified for rigid galvanized steel conduit.

2.09 RIGID BRONZE CONDUIT

.1 Factory threaded rigid bronze conduit with water-tight screwed joints, fittings, and terminations.

2.10 RIGID PVC CONDUIT

.1 Rigid PVC conduit to CSA C22.2 No. 211.1, Rigid Types EB1 and DB2/ES2 PVC Conduit, FT-4 rated, complete with site made heat gun bends for conduit to and including 50 mm (2") diameter, factory made fittings for conduit larger than 50 mm (2") diameter, solvent weld joints, factory made expansion joints where required, and terminations made with proper and suitable connectors and adaptors.

2.11 FLEXIBLE PVC CONDUIT

.1 Equal to Ipex Electrical Inc. "Cor-line" flexible, water-tight, corrugated PVC conduit with Ipex "Kwikon" fittings and ESU conduit supports spaced at every 600 mm to 900 mm (2' to 3"), and proper and suitable terminations and adapters.

2.12 FLEXIBLE POLYETHYLENE CONDUIT

.1 Polyethylene pipe to CSA-B137.1, Polyethylene (PE) Pipe, Tubing and Fittings for Cold Water Pressure Service, minimum Series 75, supplied in continuous coils of the proper length.

2.13 EPOXY COATED RIGID GALVANIZED STEEL CONDUIT

.1 Rigid galvanized steel to CSA C22.2 No. 45, Rigid Metal Conduit, with an additional epoxy coating both inside and outside, factory made bends where site bending is not possible, factory-made threaded fittings and connectors, and terminations made with rigid couplings.

2.14 COLOUR COATED EMT

.1 Equal to Allied Tube and Conduit "True Colour" EMT as specified for standard EMT but factory coated with colours selected by the Consultant from the conduit manufacturer's standard colours.

2.15 STAINLESS STEEL CONDUIT

.1 Equal to Allied Tube and Conduit rigid stainless-steel conduit to CSA C22.2 No. 45, Rigid Metal Conduit, Type 316 for corrosive environments, Type 304 elsewhere, complete with a smooth polished finish, standard NPT threads on each end, stainless steel fittings to match the conduit type where site bending is not possible, and water-tight rigid stainless-steel couplings at terminations.

2.16 FISH CORD

.1 Polyethylene or nylon fish cord/tape with cable pull accessories to suit the application.

3 EXECUTION

3.01 INSTALLATION OF OUTLET AND CONDUIT BOXES

.1 Provide an outlet box or back box for each luminaire, wiring device, telephone outlet, fire alarm system component, communications systems components, and all other such outlets.

.2 Stamped Galvanized Steel: Outlet boxes flush mounted in interior construction, surface mounted in concealed interior locations, and surface mounted in exposed interior locations where the connecting conduit is EMT are to be stamped galvanized steel outlet boxes unless otherwise noted.

.3 "FS" and "FD" Series Boxes: Outlet boxes for surface mounted for exterior lighting, receptacles, and other device outlets, boxes flush mounted in exterior building surfaces, and boxes mounted in interior device locations where the connecting conduit is rigid, and for boxes in perimeter walls where insulation and vapour barrier are present, are to be "FS" or "FD" Series cast boxes unless otherwise noted, cast iron inside the building, cast aluminium outside the building.

.4 Rigid PVC Boxes in New Concrete Slabs: Provide rigid PVC outlet boxes in locations as follows:

.1 In underground polyethylene conduit systems.

.2 For devices connected to isolated power system panelboards.

.3 For rigid PVC conduit systems where permitted.

.5 Steel Fire Alarm Boxes, red epoxy painted for fire alarm systems.

.1 Where exposed to exterior element or installed in areas subject to humidity, wet areas or areas with negative temperatures, connections to the fire alarm boxes shall be made at the bottom of the fire alarm box.

.6 Outlet or junction boxes installed in fire rated assembly shall be completed with highest due diligence, openings in the wallboard facing are to be cut so that the clearance between the box and wallboard shall not exceed 3 mm (1/8 inch).

.1 Exterior of the outlet or junction box shall be sealed with 3M™ Fire Barrier Moldable Putty Pads.

.2 Interior of the outlet box shall be protected by a fire suppression gasket rated no less than the wall rating.

.7 Outlet boxes for special wiring devices, for special equipment and special applications if required, are specified hereinafter in other Sections or on the drawings.

.8 The size and arrangement of outlet boxes are to suit the device, which they serve.

.9 Generally, mounting heights and locations for outlets are indicated on the drawings, however, confirm the exact location and arrangement of all outlets prior to roughing-in. Architectural drawings and the Consultant's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting height and locations. In addition, abide by the following requirements:

.1 Locate flush mounting boxes in masonry walls to require cutting of the masonry unit corner only, and coordinate masonry cutting to achieve a neat opening.

.2 Position outlet boxes to locate luminaires as shown on reflected ceiling plans.

.3 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

.10 Do not install outlet or back boxes "back-to-back" in walls and partitions. Stagger such outlets and seal against noise transmission with acoustic insulation. "Thru-wall" type boxes will not be permitted for any application.

.11 Where boxes ae multi-ganged or grouped together, mount boxes level and spaced consistently.

.12 Temporarily pack all open boxes located in concrete and masonry to prevent debris from entering the box.

.13 Include all costs for installed boxes that have not been covered by wall/ceiling finishes, to be relocated up to 1 m (3') to suit final device location coordination.

.14 Provide blank coverplates over all boxes left empty for future installation of devices. Clearly identify each box as to its intended use to the Consultant's approval. Generally, blank overplates are to be stainless steel.

3.02 INSTALLATION OF SPLITTER TROUGH

.1 Provide all required splitter trough in accordance with drawing plans, schedules, details, and requirements of the Specification.

.2 Rigidly secure the splitter trough in place, level and plumb.

.3 Ensure that the splitter trough itself, and all branch circuits, are properly identified.

.4 Ensure equipment is suitable for intended use and environment where installed.

3.03 INSTALLATION OF PULL BOXES AND JUNCTION BOXES

.1 Provide pull boxes in conduit systems wherever shown on the drawings, and/or wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30 m (100') in length, or with more than three 90° bends, are to be equipped with a pull box installed at a convenient and suitable intermediate accessible location.

.2 Provide junction boxes wherever required and/or indicated on the drawings.

.3 Unless otherwise specified, boxes are to be as follows:

.1 In rigid conduit and EMT inside the building – stamped galvanized or prime coated steel.

.2 In exterior rigid conduit – "Condulet" cast aluminium gasketted boxes unless otherwise noted.

.3 In plastic conduit – rigid PVC boxes.

.4 In bronze underwater conduit – cast bronze boxes.

.4 All pull boxes and junction boxes must be accessible after the work is complete.

.5 Accurately locate and identify all concealed pull boxes and junction boxes on "as-built" record drawings.

.6 Cover boxes in fire walls with aluminium tape and seal with caulking.

.7 Ensure equipment is suitable for intended use and environment where installed.

3.04 GENERAL RE: INSTALLATION OF CONDUIT

.1 Refer to the article entitled General Conduit and Conductor Installation Requirements in the electrical work Section entitled Basic Electrical Materials and Methods.

.2 Ensure that all open empty conduit ends are properly protected against dirt and debris during the construction process.

.3 Provide and install pull rope for conduits larger than 41 mm and pull nylon wire for any smaller conduit.

3.05 CONDUIT INSTALLATION REQUIREMENTS

.1 Unless otherwise specified, provide conduit for all conductors except armoured cable, mineral insulated fire rated cable, and except where cable tray, cable duct, or a similar raceway is used.

.2 Conduit Types: Conduit is to be as follows:

.1 For main distribution wiring in electrical rooms and similar areas – rigid galvanized steel.

.2 For exposed conduit from floor level to 1.2 m (4") above the floor in mechanical and other service rooms – rigid galvanized steel.

.3 For concealed conduit in exterior walls – rigid galvanized steel.

.4 For explosion-proof wiring – rigid galvanized steel.

.5 For conduit exposed outside the building, except where rigid PVC conduit is noted on the electrical drawings, contractor shall use rigid galvanized steel.

.6 For conduit associated with pool area outlets but not submerged in water – rigid galvanized steel.

.7 As an alternative to rigid galvanized steel, except in poured concrete construction – rigid aluminium conduit.

.8 For conduit in corrosive areas – epoxy coated rigid galvanized steel.

.9 For short (minimum 450 mm (18"), maximum 600 mm (24"), with a 180° loop wherever possible) runs of conduit to electric motors, distribution transformers, and vibration isolated equipment – flexible galvanized steel liquid-tight conduit.

.10 At points where exposed conduit crosses building expansion joints – flexible galvanized steel conduit.

.11 For branch circuit conductors underground inside the building, and underground outside the building beneath structures and concrete or asphalt paving – rigid PVC.

.12 For branch circuit conductors outside the building at roof level – rigid PVC.

.13 For branch circuit conductors in concrete slabs on grade, and in concrete and masonry walls except exterior walls - rigid PVC.

.14 For concealed branch circuit conductors associated with isolated power systems – rigid PVC.

.15 For branch circuit conductors in concrete slabs above grade – flexible PVC.

.16 For underwater conduit – rigid bronze.

.17 For exposed conduit in corrosive areas, food processing and preparation areas, chemical plants, wash down areas, and hygienically clean rooms or areas – rigid stainless steel with stainless steel support hardware to match conduit type.

.18 For fire alarm system, and communications/security systems conductors – colour coated EMT with colours as selected.

.19 For all conduit except as specified above – EMT.

.3 Conduit Fittings: Unless otherwise specified, conduit fittings are to be of the same material as the conduit and suitable in all respects for the application. Provide proper adaptors for joining conduit of different materials.

.4 Conduit Connectors: Unless otherwise specified, conduit connectors are to be of the same material as the conduit and suitable in all respects for the application.

.1 For areas which are sprinklered or wet rated connectors shall be rain or seal tight.

.2 Exterior equipment connections shall be with sealed type connectors rated for ambient temperature and moisture.

.3 Connectors to sensitive equipment such as fire alarm equipment, IT or similar rack mounted systems connectors shall be rain or seal tight.

.5 Conduit Bends: Site made bends for conduit must be made using proper bending equipment, bends must maintain the full conduit diameter with no kinking, and conduit finishes, and lining must not flake or crack when the conduit is bent.

.6 Site Cutting Conduit: Cut square and ream all site cut conduit ends.

.7 Conduit Threads: Site cut rigid steel conduit using proper thread cutting equipment, in an approved area. Protect the area and building surfaces from being soiled/damaged by the threading process. Clean and lubricate threads and coat threads with red lead or other zinc rich coating.

.8 Conduit Sizes: Generally, conduit is sized on the drawings. Conduit not sized on the drawings is to be sized in accordance with the governing Codes/Regulations. The sizes of branch circuit conductors shown/specified are minimum sizes and must be increased to suit length of run and voltage drop, and where this occurs, increase the conduit size to suit. Do not use conduit less than 15 mm (½") diameter.

.9 Empty Conduit: Ensure that all conduits left empty for future wiring are clean, capped, and properly identified. Provide end bushings and fish cord in all such conduit.

.10 Empty Conduit at Panelboards: Where a suspended ceiling occurs, provide 4, empty, 20 mm (¾") diameter conduits from each flush wall mounted panelboard terminated in the suspended ceiling above, capped and identified.

3.06 CONDUIT INSTALLED IN POURED CONCRETE

.1 Where conduit is to be embedded in structural poured concrete, obtain the Consultant's approval. Submit a drawing indicating the location and size of the conduit, the length of run, and any other required details. Obtain the Consultant's written approval prior to conduit installation. The Consultant's decision regarding conduit in structural poured concrete is final and is not the basis of a claim for additional costs.

.2 When and where conduit is permitted in structural poured concrete, abide by the following requirements:

.1 Install the conduit in accordance with requirements of CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.2 The conduit must be secured in a manner such that the c9ncrete will not be displaced when the concrete is poured, and during the concrete pour, monitor the conduit installation to prevent displacement or damage, and immediately report any misplacement or damage observed.

.3 Where conduit extends adjacent to a column, stay away from the column a minimum of 2 times the thickness of the slab and drop away from the column.

.4 Where conduits terminate adjacent to a column or wall, bring the conduit in toward the column/wall as close to 90º to the face of the column/wall as possible.

.5 Where more than 2 conduits are adjacent to each other they are to be spaced the greater of 3 conduit diameters or 100 mm (4") apart.

.6 The total depth of conduits crossing over each other is to be less than 1 third the thickness of the slab.

.7 Place conduit in the middle third of the slab thickness, and do not in any case lay conduit directly on reinforcing steel.

.8 Do not locate conduit adjacent to parallel reinforcing bars.

.9 The maximum size of any conduit is 1/5th of slab thickness.

.10 Do not install conduit longitudinally in a beam without specific approval of the Consultant and extend conduit through a beam at right angles to the beam span.

.11 Where conduits extend through beams stay a minimum of twice the depth of the beam away from the supports.

.12 Do not install conduit in the slab beside a drop or beam within twice the depth of the slab from the edge of the drop or beam.

.13 Do not install conduits through shear walls or columns without written approval from the consultant.

.14 Do not install conduit in parking garage structures, garage ramps, water retaining structures, or any other concrete subject to the application of de-icing products.

.15 In areas where installation of conduit embedded in concrete is not permitted, extend conduit through beams in sleeves, if the installation of the sleeves is permitted.

.16 Slope all underground conduits to drainage points and ensure that the conduits can be drained.

3.07 UNDERGROUND AND CONDUIT UNDER SLAB ON GRADE

.1 Where conduit is to be installed under a slab on grade, the system is to be a pull-in system, must consider and address any effects of magnetic fields, and the following is to apply:

.1 Concrete encased duct bank with non-ferrous conduits is to be used.

.2 Conduit is to be sloped to a proper drainage pit and away from the building.

.3 20% spare conduit (minimum 1) is to be provided.

.4 Conduits to be water sealed at each connection point into equipment and structure.

3.08 CONDUIT INSTALLATION FOR FLOOR OUTLETS

.1 Refer elsewhere to requirements for scanning and cutting the floor. Every floor shall be x-rayed or scanned by Div.26 prior to cutting or coring.

.2 Coordinate with the Tile Contractor to ensure conduits and outlets are correctly aligned with new floor surface. Outlets to be in the centre of tiles and shall not bridge tile joints. Ensure that sufficient non-shrink grout or non-shrink caulking is provided to prevent movement of outlets and cover the total installation and shall be trip free.

.3 Install sufficient conduit access points to satisfy the requirement of the specification and locations of electrical rooms.

.4 Conduits shall not be installed on surface in any public area.

.5 Hand over 20% spare floor outlet complete covers (IT and power) to Owner at end of project.

3.09 SEALED CONDUIT PENETRATIONS

.1 For isolation rooms, any conduit penetration any surface of the room is to be sealed with a suitable elastomeric and intumescent material to ensure complete isolation of the room/area. The sealing material must be non-hazardous and suitable in all respects for the specific application, including a fire rating if required. Submit product data for the proposed sealing material as well as WHMIS sheets and product installation instructions.

.2 For areas where ambient temperature is controlled substantially different then the balance of the facility, or any areas where temperature is maintained below 5^0C, any conduit penetration any surface of the area is to be sealed with a suitable elastomeric and intumescent material to ensure complete isolation of the room/area. The sealing material must be non-hazardous and suitable in all respects for the specific application, including a fire rating if required. Submit product data for the proposed sealing material as well as WHMIS sheets and product installation instructions.

.1 In areas such as coolers, freezers, install junction boxes back-to-back on both side of the wall to allow for sealant inspection and proper installation.

.2 When connection to equipment sensitive to moisture connection shall be made to the bottom end of the equipment to prevent condensation damages.

3.10 CONDUIT SUPPORT

.1 Underground Conduit: Unless otherwise shown or specified, support underground conduit on a well tamped bed of earth or sand, free from rocks or protrusions of any kind.

.2 Surface Mounted and Suspended Single/Double Conduit Runs: Support and secure single and double runs of conduit at support spacing in accordance with Code requirements by means of galvanized steel pipe straps, conduit clips, ring bolt type hangers with galvanized steel hanger rods, or by other approved manufactured devices.

.3 Conduit Expansion Facilities: Abide by the following:

.1 Wherever concealed or surface mounted conduit extends across a building expansion joint, provide expansion facilities to permit free movement without imposing additional stress or loading on the support system, and to prevent excessive movement at joints and connections.

.2 Provide manufactured expansion joint fittings in rigid PVC conduit at spacing recommended by the expansion joint fitting manufacturer.

.3 Make “snaked” bends in underground flexible polyethylene conduit.

3.11 CONDUIT SYSTEM BONDING

.1 Provide bond wire in each installed conduit.

.2 Bond wire to be sized in accordance to the Electrical Safety Code.

.3 Where noted on the drawings or required by code or provide separate ground and bond wire in each conduit.

3.12 CONDUITS IN EXIT RATED CORRIDORS AND STAIRS

.1 Where conduit feeds go through exit corridors, engages services of the on-site approved dry wall and framing contractor to provide fire rate shaft assembly to conceal the conduit to Code requirements. Include all costs in this regard.

.2 Provide fire rated access door for conduits installed in exit assemblies where required by code and as required by AHJ.

.3 Electrical installation in the exit rated areas shall be of non-combustable rating.

.4 Contractor shall overlay electrical drawings to provide proposed conduit layout to demonstrate passing through exit pathways is unavoidable.

.5 Where purpose of corridors, exist or areas are not clearly identified on Architectural set of drawings, contractor shall obtain clarification and shall confirm installation of systems prior commencement of work.

END OF SECTION

1 GENERAL

1.01 APPLICATION

.1 This Section specifies seismic control and restraint requirements that are common to electrical work Sections of the Specification, and it is a supplement to each Section and is to be read accordingly.

1.02 SEISMIC CONSULTANT

.1 Retain and pay for the services of an experienced Seismic Consultant who is a registered professional engineer licensed in the area of the work and a member in good standing of a Professional Engineers Association in the area of the work.

.2 The Seismic Consultant is to:

.1 Determine the proper seismic hazard level, design, recommend, and review all proposed electrical work seismic restraint shop, placement and securing drawings, and sign and stamp all drawings prior to submittal for review as specified below.

.2 Supervise installation of all electrical work seismic restraint and, when work is complete, certify in writing that the seismic restraint work has been installed in accordance with signed, stamped, and reviewed drawings.

.3 Prepare and submit to the Municipality and authorities having jurisdiction, on a form approved by the Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when the work is complete, original signed and sealed Letters of Assurance for the design, installation, and field review of all seismic restraint work.

1.03 SUBMITTALS

.1 Shop Drawings/Product Data Sheets: Obtain all required equipment information and submit manufacturer's shop drawings/product data sheets for all restraining devices and steel bases. Include placement data, and details of attachment to both the equipment and the structure meeting requirements of the forces involved. All product data sheets and drawings are to be signed and stamped by the Seismic Consultant referred to above.

.2 Seismic Consultant's/Seismic Control Product Manufacturer's Certification Letters: Submit copies of the Seismic Consultant's Letters of Assurance as specified above. Submit copies of the Seismic Consultant and seismic control manufacturer's certification letters as specified in Part 3 of this Section.

.3 Samples: If requested, submit samples of seismic restraint materials for review.

1.04 QUALITY ASSURANCE

.1 Seismic restraints are to be designed by a Seismic Consultant as specified above and are to be installed by qualified tradesmen under the supervision of and to the approval of the Seismic Consultant.

.2 Unless otherwise specified seismic control and restraints are to be designed in accordance with

.1 National Building Code of Canada

.2 CAN/CSA-S832, Seismic Risk Reduction of Operational and Functional

.3 local Code requirements

.3 All restraint products must be tested in an independent testing laboratory, or certified by the Vibration Isolation and Seismic Control Manufacturer's Association and Seismic Consultant, to confirm that the restraint products meet all requirements of this Section, i.e., dynamic ultimate limit load state as required by the Code, "Fail Safe" design, etc. If particular tests are carried out to represent a restraint type, the test is to be valid for the full load range of the restraint. Submit such tests or certification when requested.

.4 Seismic control and restraint product manufacturers are to provide all required assistance during the installation, and, when the installation is complete, submit written reports from the manufactures listing any deficiencies to the installation.

2 PRODUCTS

2.01 GENERAL

.1 Isolation, anchors, bolts, bases, restraints, etc., are to be designed to withstand without failure or yielding, the dynamic G load as specified in the Code for the seismic zone in which the building is located. Design loads are ultimate limit state loads (1.5 times working load) acting through the centre of gravity of the anchored or restrained equipment. "Fail Safe" designs are acceptable.

.2 For both isolated and non-isolated floor mounted equipment, design and provide anchors and bolts to withstand, without failure or yielding, a dynamic ultimate limit state load as defined in the Code, of the greater of 0.3 g or as required by the Code, applied horizontally through the centre of gravity.

.3 Where impact forces may be significant, use ductile materials.

.4 Seismic restraining devices, which are factory supplied with equipment, are to meet all requirements of this Section.

2.02 ACCEPTABLE MANUFACTURERS

.1 Acceptable seismic restraint product manufacturers are:

.1 Mason Industries Inc.

.2 Kinetics Noise Control

.3 Vibro-Acoustics Ltd.

.4 The VCM Group

2.03 SLACK CABLE RESTRAINTS

.1 Galvanized steel aircraft cable slack cable restraints meeting all current requirements of the Building Code, sized to suit the application and complete with all required cable ties, anchor hardware (selected for a load equal to twice the weight of the equipment), and similar connection accessories.

2.04 ANCHOR BOLTS

.1 Equal to Mason Industries type SAB seismic anchor bolts.

3 EXECUTION

3.01 INSTALLATION OF SEISMIC RESTRAINT MATERIALS

.1 Provide seismic restraint for all electrical equipment, conduit, raceways, lighting fixtures, etc., as per the requirements of the current edition of the Building Code and this Section of the Specification.

.2 Provide structural steel bases for all equipment unless the equipment manufacturer certifies direct attachment capabilities.

.3 Space restraints under equipment so that the minimum distance between adjacent corner restraints is at least equal to the height of the centre of gravity of the equipment. Include the height of the centre of gravity on shop drawings, otherwise, design for increased forces on the supports and submit design calculations with shop drawings.

.4 Floor mounted isolated equipment is to be installed on concrete housekeeping pads (design and thickness as selected by the Seismic Consultant) with at least 200 mm (8") clearance between drilled inserts and the edges of the pads. Ensure that all housekeeping pads are keyed to the structure to resist seismic displacement.

.5 Requirements pertaining to seismic control work are as follows:

.1 Execute seismic control and restraint work in accordance with drawing details and reviewed product data and shop drawings.

.2 Seismic control systems are to work in all directions.

.3 Fasteners and attachment points are to resist the same maximum load as the seismic restraint.

.4 Drilled or power-driven anchors and fasteners are not permitted.

.5 No equipment, equipment supports, or mounts are to fail before failure of the structure.

.6 Seismic control measures are not to interfere with the integrity of firestopping.

.7 All equipment is to be bolted to the structure, and all bolts are to be fitted with isolation washers.

.8 The number, size, type, and installation of anchor bolts are to be as recommended by the anchor bolt manufacturer and the Seismic Design Consultant.

.9 Where more than a 3 mm (1/8") differential exists between an anchor or attachment bolt diameter, an anchor and attachment point hole, or an isolator gap attachment bolt and equipment anchor attachment hole, pack the air gap with Mason type 0.5 FastSteel reinforced epoxy putty.

.10 All hung equipment and hangers are to be fitted with a means of preventing upward movement, and non-isolated equipment and hanger rods are to be fitted with oversized steel washers and nuts above and below the hanger or equipment attachment point, locked tight to prevent uplift of the equipment or hanger.

.11 Where suspended equipment hanger rod length exceeds 50 rod diameters between the structure and the equipment attachment point, reinforce the rods with angle iron to prevent bending due to uplift forces.

.12 Seismic control measures are not to jeopardize noise and vibration isolation systems, and 6 mm (¼") to 9 mm (3/8") clearance during normal operation of equipment and systems is to be provided between seismic restraint and equipment.

.13 Where hold-down bolts for seismic restraint equipment penetrate roofing membranes coordinate with roofing trade for installation of pitch pockets/"gum cups" and sealing compound to maintain the water-tight integrity of the roof.

.14 Where friction type clamps are used for support of equipment and connecting services, secure clamps to steel work by means of welding or other positive means to prevent slippage or loosening of the clamps due to seismic force.

3.02 SITE INSPECTION AND LETTERS OF CERTIFICATION

.1 When all seismic control products have been installed, arrange for the seismic control product manufacturer and Seismic Consultant to examine the installation of all seismic control products and to certify in writing (separate letters) that the products have been properly installed in accordance with governing Codes and Regulations, and recommendations and instructions. The Seismic Consultant is to apply his signed and dated professional stamp to the letter.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Product Data: Submit product data sheets for products specified in this Section.

.2 Panelboard Door Keys: Submit identified keys (minimum 6) for panelboard doors.

.3 Shop drawings will not be accepted without the short circuit and coordination study where specified.

1.02 QUALITY ASSURANCE

.1 Panelboards are to be rated to interrupt and withstand short circuit faults greater than the available fault current. Indicate conformance with this requirement on product data sheets submitted for review.

.2 Circuit breakers shall be in accordance to specification section; Moulded Case Circuit Breakers and built to CSA standards.

2 PRODUCTS

2.01 BRANCH CIRCUIT PANELBOARDS

.1 General Re: Panelboards: Breaker type branch circuit panelboards are to be dead front, factory assembled panelboards designed for sequence phase connection of branch circuit breakers, as per the drawing schedule and plans, and in accordance with requirements CAN/CSA-C22.2 No. 29, Panelboards and Enclosed Panelboards Industrial Products. Comply with OESC Rule 14-014 series rated combinations of over-current protective devices and ensure that equipment in which the lower rated devices are installed are marked with a series combination interrupting rating minimum 50% higher than the available fault current.
Each panelboard is to be complete with:

.1 Electrical grade, 95% conductivity copper sequence phase bus mains for the full length of each enclosure.

.2 A fully capacity neutral unless otherwise specified.

.3 Main and branch circuit conductor solderless set-screw type lugs approved for copper conductors.

.4 Neutral bus and main lugs at the same end, and a removable cover for main lugs.

.5 The panelboards and breaker type combination shall allow for installation of three pole breakers with amperage rating no less than 50% of the panel rating without use of special purpose breaker kit and not requiring more than three single pole breaker spaces.

.6 A manufacturer's nameplate which indicates panelboard characteristics including the fault current that the panelboard, including breakers, has been constructed to withstand.

.2 Panelboard Enclosures: Panelboard enclosures, unless otherwise specified, are to be EEMAC 2 sprinkler-proof, flush or surface mounted as indicated, constructed of Code gauge galvanized sheet steel, equipped with drip shields, and factory cleaned, primed, and finished with ASA-61 light gray equipment enamel. Each enclosure is also to be equipped with:

.1 Wiring gutter space on all sides in accordance with CAN/CSA-C22.2 No. 29 requirements.

.2 Space for future breakers as applicable and as per the drawing schedule.

.3 A concealed hinged door and flush latch with keyed alike lock, and a frame with acetate cover and a circuit directory card on the inside face of the panel door.

.4 Mylar circuit breaker identification strips secured in place.

.3 Circuit Breakers: Breakers are to be moulded case, bolt-on breakers in accordance with CSA/C22.2 No. 5, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures, rated 75^0C, calibrated for operation in a 40° C (105° F) ambient temperature, sized in accordance with the drawing schedules, and as follows:

.1 Branch circuit breaker interrupting capacity is to suit the panelboard voltage and be as scheduled, or in accordance with Code requirements to suit the application.

.2 Minimum size of mains shall be governed by size of fuse or breaker protecting the panel. Panels shall be rated at a minimum 10 KA IC for 208 volt and minimum 18 KA IC for 600V. Tenders to be based on prospective fault level delivered by the Utility.
Note, where the panels are located in the main electrical room, and not fed from a separate transformer, the fault level rating will be minimum 35 KA on the 347/600 volt panels and minimum 22 KA on the 120/208 volt.

.3 Odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.

.4 For ground fault breakers, CSA Class A, Group 1 combination thermal magnetic trip breakers with solid-state ground default interrupters.

.5 For breakers 225 amperes and larger, a solid-state adjustable trip unit with long time, short-time, and instantaneous time functions and time delays, set at ratings in accordance with the distribution coordination study.

.6 For dedicated breakers, handle lock devices.

.7 As scheduled or shown, spare breakers or space for future breakers.

.8 Two pole and three pole breakers shall have common trip; tie handles will not be accepted.

.9 "Duplex, 13mm" or "twin" series rated breakers will not be accepted.

.10 Circuit loads shall be balanced across phases as closely as possible.

.11 Complete typewritten legend shall be provided on the inside of the door of each panel mounted in a metal frame and covered with transparent plastic.

.12 Circuit breakers feeding weatherproof receptacles and heat tracing shall be ground fault interrupter type.

.13 Panels shall contain number of branch circuits breakers shown on the drawings plus 20% spare breakers and 25% spare space.

.4 Modification and Accessories: Where indicated on the drawings or scheduled, panelboards are to be factory equipped with modifications and accessories as follows:

.1 Insulated ground bus assembly.

.2 Sub-feed lugs.

.3 Through-feed lugs.

.4 A non-automatic or automatic (as schedule) main breaker.

.5 A shunt trip for the main breaker.

.6 Isolated ground bus.

.5 Acceptable Manufacturers: Acceptable Manufacturers are:

.1 Eaton Canada

.2 Schneider Electric Canada

.3 Siemens Electric Canada

2.02 DISTRIBUTION PANELBOARDS

.1 General Re: Panelboards: Distribution panelboards are to be dead front, factory assembled panelboards designed for sequence phase connection of branch circuit devices, as per the drawing schedule and plans, and in accordance with requirements of CAN/CSA- C22.2 No. 29, Panelboards and Enclosed Panelboards Industrial Products.
Comply with OESC Rule 14-014 series rated combinations of over-current protective devices and ensure that equipment in which the lower rated devices are installed are marked with a series combination interrupting rating minimum 50% higher than the available fault current.
Distribution panelboards shall be fully rated, minimum 22 KA IC for 208 volt and 25 KA IC for 600V. Tenders to be based on prospective fault level delivered by the Utility.
Note: where the panels are located in the main electrical room, and not fed from a separate transformer, the full fault level rating will be minimum 42 KA on the 347/600 volt panels and minimum 25 KA on the 120/208 volt.
Each distribution panelboard is to be complete with:

.1 Silver plated, electrical grade, 95% conductivity copper bus mains for the full length of each enclosure.

.2 Main and branch circuit conductor solderless lugs approved for copper conductors.

.3 Neutral bus and main lugs at the same end, and a removable cover for main lugs.

.4 For panelboards in Elevator and/or Escalator Machine Rooms, hardware to permit padlocking the switch or breaker in the open position.

.5 The panelboards and breaker type combination shall allow for installation of three pole breakers with amperage rating no less than 50% of the panel rating without use of special purpose breaker kit and not requiring more than three single pole breaker spaces.

.6 A manufacturer's nameplate which indicates panelboard characteristics including the fault current that the panelboard, including breakers, has been constructed to withstand.

.2 Panelboard Enclosures: Panelboard enclosures, unless otherwise specified, are to be EEMAC 2 sprinkler-proof, constructed of Code gauge galvanized sheet steel, equipped with drip shields, and factory cleaned, primed, and finished with ASA-61 light grey equipment enamel. Each enclosure is also to be equipped with:

.1 Wiring gutter space on all sides in accordance with CAN/CSA-C22.2 No.29 requirements.

.2 Space for future breakers/switches as applicable and as per the drawing schedule, and where spare beaker space is scheduled, breaker connector kits.

.3 For panelboards in areas other than secure Electrical, etc., Rooms, a concealed hinged door and flush latch with keyed alike lock.

.4 For free-standing floor mounted panelboards, reinforcement as required for a rigid enclosure.

.3 Circuit Breaker Panelboards: Breakers are to be moulded case, bolt-on breakers in accordance with CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches, and Circuit Breaker Enclosure, rated 75^0C calibrated for operation in a 40° C (150° F) ambient temperature, sized in accordance with the drawing schedules, and complete with:

.1 A top main breaker.

.2 For breakers 225 amperes and larger, a solid-state adjustable trip unit with long time, short time, and instantaneous time functions and time delays, set at ratings in accordance with the distribution coordination study.

.3 Handle lock devices.

.4 As scheduled or shown, spare breakers or space for future breakers.

.5 Panelboard loads shall be balanced across phases as closely as possible.

.4 Switch and Fuse Panelboards: Fusible switches are to be quick-make, quick-break, visible contact bolt-on switches in accordance with CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches, and Circuit Breaker Enclosures, sized in accordance with the drawing schedules, and complete with:

.1 A top main switch.

.2 Operating handles which protrude through the dead front enclosure, interlocked with the switch mechanism, and equipped with facilities for padlocking in either the “ON” or “OFF” position.

.3 Fuse clips, and HRC fuses as per the drawing schedule.

.4 Where downstream equipment rating is dependable on fuses, fuses, fuse holder equipment shall be selected to provide series rating.

.5 Modifications and Accessories: Panelboards are to be factory equipped with modifications and accessories as follows:

.1 200% rated neutral

.2 insulated ground bus assembly

.3 isolated ground bus assembly

.4 sub-feed lugs

.5 through-feed lugs

.6 entry plates for Corflex cable

.7 a barriered main breaker or switch

.8 a main breaker/switch through the cover key interlock

.9 a shunt trip for the main breaker

.10 undervoltage release for the main breaker

.11 an alarm switch for the main breaker

.12 a surge protection package with audible alarm, counter, and silence button, from “C” relay contact, and EMI/RFI filtering providing 50 dB noise attenuation at 100 kHz

3 EXECUTION

3.01 INSTALLATION OF BRANCH CIRCUIT PANELBOARDS

.1 Provide breaker type branch circuit panelboards where shown. Ensure adequate operation and maintenance clearance on all sides of each panelboard as per Code requirements.

.2 Unless otherwise specified, supply panelboards from a single manufacturer only.

.3 Wall mount panelboards independent of connected conduit. Accurately install with reference to wall finish and confirm exact locations prior to roughing-in.

.4 Where 2 or more panelboards are installed in 1 enclosure equip the panelboards with double lugs and increase gutter capacity to accommodate additional cabling.

.5 In addition to load circuit breakers scheduled and indicated for each normal power panelboard, provide five 15A-1P additional breakers for small power and miscellaneous mechanical loads, each connected with 30 m (100') of 12 mm (½") diameter EMT and two # 12 AWG plus ground, with terminations as directed during construction.

.6 In each panelboard adjacent to mechanical equipment spaces, provide a dedicated 15A-1P breaker with lock-on device, and 12 mm (½") diameter EMT and two #12 AWG plus ground terminated in an identified junction box (BAS) in the equipment space.

.7 Provide additional devices and accessories for panelboards as indicated and/or scheduled.

.8 Test each surge protection device in accordance with the manufacturer's instructions.

.9 For each GFI breaker demonstrate in the presence of the Consultant that the protected circuit will trip when a simulated ground fault is applied to the "load" side of the breaker, and meggar the "load" side neutral to ensure that the neutral is not grounded on the "load" side of the GFI.

.10 Circuit loads shall be balanced across phases as closely as possible. Provide written report identifying loading per phase. Include to rework wire connections to improve on panel loading where required.

3.02 INSTALLATION OF DISTRIBUTION PANELBOARDS

.1 Provide distribution panelboards where shown. Ensure adequate operation and maintenance clearance on all sides of each panelboard as per Code requirements.

.2 Wall mount panelboards independent of connected conduit.

.3 Secure each free-standing panelboard, level and plumb, to a concrete housekeeping pad.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

.5 Identify each panelboard and each panelboard component with an engraved Lamacoid nameplate in accordance with requirements of the Section entitled Basic Electrical Materials and Methods. Confirm nameplate wording with the Consultant prior to manufacture. Include a printed circuit directory card in a frame with acetate cover.

.6 Test each surge protection device in accordance with the manufacturer's instructions.

.7 Circuit loads shall be balanced across phases as closely as possible. Provide written report identifying loading per phase. Include to rework wire connections to improve on panel loading where required.

3.03 DISTRIBUTION EQUIPMENT MOUNTING

.1 Where required based on selected distribution panelboards provide 4" housekeeping pad.

3.04 INSTALLATION OF LOAD CENTRE PANELBOARDS

.1 Provide load centre type panelboards where shown. Ensure adequate operation and maintenance clearance on all sides of each panelboard as per Code requirements.

.2 Wall mount panelboards independent of connected conduit. Accurately install with reference to wall finish and confirm exact locations prior to roughing-in.

.3 For each GFI breaker demonstrate in the presence of the Consultant that the protected circuit will trip when a simulated ground fault is applied to the "load" side of the breaker, and meggar the "load" side neutral to ensure that the neutral is not grounded on the "load" side of the GFI.

3.05 EQUIPMENT SPRINKLER PROTECTION

.1 Electrical equipment located in area with fire protection sprinkler shall be provided with suitable protection against water flow from sprinkler heads. This protection shall be of a type acceptable to the Local Electrical Inspection Department.

3.06 EQUIPMENT MOUNTING

.1 Panels shall be flush mounted except in electrical rooms and closets where they shall be surface mounted. All panels shall be sprinkler proof and shall have copper bus bars.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Product Data: Submit product data sheets for wiring devices. Ensure that the sheets indicate colours and faceplate finishes.

1.02 QUALITY ASSURANCE

.1 All wiring devices are to be CSA certified as a minimum, in accordance with the following standards, as applicable:

.1 CAN/CSA C22.2 No. 42, General Use Receptacle, Attachment Plugs and Similar Wiring Devices

.2 CAN/CSA C22.2 No. 42.1, Cover Plates for Flush Mounted Devices

.3 CSA C22.2 No. 111, General Use Snap Switches

.2 Wherever possible, all wiring devices are to be supplied by the same manufacturer.

.3 Acceptable Manufacturers: Unless otherwise specified in this Section or on the drawings, acceptable manufacturers are:

.1 Hubbell Canada LP

.2 Cooper Industries (Arrow Hart)

.3 Legrand/Pass & Seymour

.4 Leviton Canada

.5 Cooper Crouse-Hinds

1.03 WIRING DEVICE AND PLATE COLOURS

.1 Unless otherwise specified, wiring device colours will be as specified in Part 3 of this Section.

2 PRODUCTS

2.01 SWITCHES

.1 Unless otherwise specified, Specification Grade, Premium Quality, back and side wired, 20 ampere, 120-277 volt A.C. quiet action toggle switches, single pole, 2-pole, 3-way, or key type as indicated on the drawings, each complete with a nickel plated steel ground terminal, brass power wiring terminals and screws, silver cadmium oxide contacts with a moveable brass contact arm, and nylon toggle with colour as specified below. Switch types are as follows:

.1 Standard Wall Toggle Switches: As above.

.2 Illuminated Handle Standard Wall Toggle Switch: As above for standard switches but with a clear red or green polycarbonate toggle which is illuminated when the switch is on or off. Confirm toggle colour and position when illuminated prior to ordering.

.3 Decorative Wall Rocker Switch: Generally, as specified above for standard toggle switches but rectangular decorative rocker type with rocker handles.

.4 Illuminated Decorative Wall Rocker Switch: Generally, as specified above for decorative toggle switches but with a rocker type illuminated handle.

.5 Door Switch: Box, switch and plate assemblies with a 125-volt 3 ampere illuminated switch which is on or off when the door is open (confirm prior to ordering), a 34 mm x 94 mm x 40 mm (1 11/32” x 3 11/16” x 1½”) box, cover plate, and mounting screws.

.6 Motor Control Snap Action Switch: Illuminated handle snap action horsepower rated switch, CSA certified for motor control and sized to suit the application.

.7 Occupancy Sensor Switch: Digital passive infrared and ultrasonic sensor type – dual technology, 120–277-volt A.C. with integral photo sensor and selected to suit the area and occupancy of the room served.

2.02 SPECIFICATION GRADE STANDARD RECEPTACLES

.1 Back or side wired, U-ground, 2 pole receptacles as follows:

.1 15 Amp. 125 Volt Duplex Receptacle: 3-wire receptacles, NEMA configuration 5-15R

.2 15 Amp. 250 Volt Duplex Receptacle: 3-wire receptacles, NEMA configuration 6-15R

.3 20 Amp. 125 Volt Duplex Receptacle: 3-wire receptacles, NEMA configuration 5-02R

.4 20 Amp. 250 Volt Duplex Receptacle: 3-wire receptacles, NEMA configuration 6-20R

.5 30 Amp. 250 Volt Simplex Receptacle: 3-wire receptacles, NEMA configuration 6-30R

.6 30 Amp. 125/250 Volt Simplex Receptacle: 3-wire receptacles, NEMA configuration 14-30R

.7 50 Amp. 250 Volt Simplex Receptacle: 3-wire receptacles, NEMA configuration 6-50R

.8 50 Amp. 125/250 Volt Simplex Receptacle: 4-wire receptacles, NEMA configuration 14-50R

2.03 SPECIFICATION GRADE LOCKING RECEPTACLES

.1 Specification Grade, back or side wired, U-ground 2-pole, 3-wire locking type receptacles as follows:

.1 15 Amp. 125 Volt Duplex Receptacle: NEMA configuration L6-15R

.2 15 Amp. 250 Volt Duplex Receptacle: NEMA configuration L6-15R

.3 20 Amp. 125 Volt Duplex Receptacle: NEMA configuration L5-20R

.4 20 Amp. 250 Volt Duplex Receptacle: NEMA configuration L6-20R

2.04 SPECIFICATION GRADE ISOLATED GROUND RECEPTACLES

.1 120 Amp. 125 Volt Duplex Receptacle: Back and side wired, duplex, U-ground, 2-pole, 20 ampere, 125 volt, 3-wire, orange colour, surge suppression isolated ground nylon construction receptacles, NEMA configuration 5-20R.

2.05 SPECIFICATION GRADE GROUND FAULT RECEPTACLES

.1 Heavy-duty, 15/20 ampere, 125 volt, ULC Class A, Group 1. automatic ground fault circuit interrupting duplex receptacles with a 10 kA short circuit current rating automatic self-test diagnostics, green power on LED, and red ground fault LED. Ground fault receptacles for indoor climate controlled and outdoor or non-climate-controlled areas are to be as follows:

.1 indoor climate-controlled areas: equal to Hubbell Canada No. GFST15/GFSTt20 “AUTOGUARD”

.2 outdoor areas and indoor non-climate areas: equal to Hubbell Canada No. GFR5262TR/GFR 4362TR “AUTOGUARD”

2.06 SPECIFICATION GRADE TAMPER-RESISTANT DUPLEX RECEPTACLES

.1 Specification Grade, back or side wired, U-ground, 2-pole, 3-wire tamper-resistant duplex receptacles as specified above, 15 ampere or 20 ampere, 125 volt as indicated on the drawings, each with thermoplastic shutters to limit access to energized contacts.

2.07 CLOCK HANGER RECEPTACLES

.1 Equal to Legrand/Pass & Seymour #S3713W 15 ampere, 125-volt white recessed simples receptacle with smooth white wall plate.

2.08 PHOTO ELECTRIC SWITCH

.1 Equal to Tork 2105 Series weather-proof, 12 mm (½”) dia. conduit mounting photoelectric SPST control switch with model number to suit the voltage and connected load, complete with an adjustable slide for on-off adjustment, a turn-on of one to five fc and a turn-off of three to five fc without the slide in position, a die-cast zinc gasketed enclosure, cadmium sulphide epoxy coated cell, normally closed contacts which fail in the open position, a delay of up to four minutes to prevent false switching due to light from vehicles, lightning, etc., three colour coded 150 mm (6”) # 16 AWG leads, a fixed base for conduit connection, and, if required, an accessory bracket for wall mounting the device.

2.09 TIME SWITCH

.1 Flush wall mounting Honeywell RPLS740B1000/U 7-Day Programmable Light Switch Timer Series.

2.10 DEVICE FACEPLATES

.1 Device faceplates are to be ULC listed, and CSA certified and, unless otherwise specified, supplied by the device manufacturer. Where two or more devices are installed in a common box, a common one-piece faceplate is to be used. Faceplate colours are specified in Part 3. Faceplates, unless otherwise specified, are to be as follows:

.1 Phenolic switch and receptacle faceplates, complete with matching screws

.2 "Decorator" type Phenolic switch and receptacle faceplates

.3 type 302 stainless steel switch and receptacle faceplates, brush finish or satin finish as directed, with stainless steel screws

.4 high impact smooth finish switch and receptacle faceplates

.5 hot dipped galvanized steel switch and receptacle faceplates

.6 NEMA 3 rated, single gang, horizontal/vertical mounting, weather-proof in use, gasketed cast aluminium, receptacle faceplates to suit the type of receptacle used

.7 weather-proof, gasketed, water-tight single gang type 302 stainless steel switch plate with clear silicone rubber bubble over the switch toggle

2.11 FIRE RATED GASKETS

.1 Intumescent Technologies, LLC and PyroPhobic Systems, Ltd. - FireBløk™ Gasket, RECTORSEAL "Bio Fireshield or alternative equal. single highly intumescent component fire rated gasket for use with electrical boxes located in fire rated construction, UL listed to UL 263/ASTM E-19, Fire Tests of Building Construction and Materials.

3 EXECUTION

3.01 GENERAL RE: INSTALLATION OF WIRING DEVICES

.1 Provide all required wiring devices and faceplates

.2 Confirm exact locations, including mounting heights prior to roughing-in.

.3 For barrier-free mounting heights for devices, conform to requirements of the governing code or regulation.

.4 Ensure that switches located adjacent to doors are located at the strike side of the door. Confirm door swings prior to roughing-in.

.5 Install single throw switches with the handle in the up position when the switch is closed.

.6 Confirm all switch, receptacle and faceplate types, colours, and finishes prior to ordering

.7 Provide a separate insulated ground conductor for each isolated ground receptacle.

.8 Faceplates for computer equipment receptacles are to be permanently identified with “Computer Equipment Only” wording.

.9 Faceplates for housekeeping receptacles are to be permanently identified with “Housekeeping Only” wording.

.10 Do not install faceplates for flush devices until wall, etc., finishing work is complete

.11 Where devices are to be installed in casework, millwork, or similar construction, carefully coordinate device installations and device openings with the trade providing the casework, millwork, etc.

.12 In areas accessible to public, all devices and their supporting hardware shall be flush mounted where applicable.

.13 Device locations indicated on the drawings are approximate, and, if requested, relocate the device up to 3 mm (10’) away from the location shown at no additional cost.

3.02 WIRING DEVICE AND FACEPLATLE TYPES AND COLOURS

.1 Unless otherwise specified, wiring devices colours and faceplate types and colours are to be confirmed with Architectural division prior ordering or as follows:

.1 “Decorator” switches & receptacles in finished areas-non-essential circuits: white or ivory, with white or ivory “Decorator” Phenolic faceplates

.2 switches & receptacles in finished areas-non-essential circuits: ivory, stainless steel faceplates

.3 switches & receptacles in unfinished areas-non-essential circuits: ivory, stainless steel faceplates

.4 switches & receptacles in finished areas-essential power circuits & isolated power switches: red, with stainless steel faceplates

.5 isolated power receptacles: cast aluminium gasketed weather-proof faceplates to suit the type of receptacle installed

.6 weather-proof switches: weather-proof stainless-steel faceplates with clear silicone bubble over the switch toggle

.2 Notwithstanding the above wiring devices and their respective faceplates shall be selected to closely match the colour of the wall finishes in areas exposed to public and shall be stainless steel finish type in back of house areas and utility room areas.

3.03 INSTALLATION OF FIRE RATED GASKETS

.1 Provide fire rated gaskets in outlet boxes for single and double switches and receptacles located in fire rated construction. Install in accordance with the manufacturer's instructions.

3.04 TESTING

.1 When installation is complete, test operation of all devices.

.2 Devices installed in patient care facilities shall be subject to commissioning scope as specified in Z32.

3.05 ADJUSTMENTS AND SETTINGS

.1 When installation is complete, adjust operation of all devices sensor type devices to time and settings desired by final user.

.2 Coordinate and take leadership in order to organise meeting with Stakeholder user group to set all sensor control points as required by final user.

3.06 LABELS

.1 Provide lamacoid label 12mm x 40 mm to identify circuit number and panel fed by.

.2 Apply labels to all outlets.

.3 Outlets in public areas shall have label attached to the wall area behind the faceplate.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Product Data: Submit product data sheets for products and accessories.

1.02 QUALITY ASSURANCE

.1 Fuses are to be CSA certified and marked in accordance with the following Standards:

.1 HRC fuses – CAN/CSA C22.2 No. 106, HRC – Miscellaneous Fuses

.2 plug and cartridge fuses – CSA 248-14, Fuses for Supplementary Overcurrent Protection (600 Volts, Maximum)

2 PRODUCTS

2.01 GENERAL RE: FUSES

.1 HRC fuses are to have an interrupting capability of 200,000 amperes symmetrical.

.2 Unless otherwise specified, fuses are to be the products of 1 manufacturer.

.3 Fuse type references L1, L2, J1, R1, etc., have been adopted for use in this Specification.

2.02 FUSE TYPES

.1 Fuse types are to be as follows:

.1 HRC-J fuses (formerly Class J):

.1 type J1: time delay, capable of carrying 500% of its rated current for 10 s minimum

.2 type J2: fast acting

.2 HRC-L fuses (formerly Class L):

.1 type L1: time delay, capable of carrying 500% of its rated current for 10 s minimum

.2 type L2: fast acting

.3 HRCI-R fuses (formerly Class R – for UL Class RK1 fuses, peak let-through current and 12t values are not to exceed limits of UL 198E table 10.2):

.1 type R1: (UL Class RK1, time delay, capable of carrying 500% of its rated current for 10 s minimum to meet UL Class RK1 maximum let-through limits

.2 type R2: same as R1 however, 100,000 interrupting capacity based on RK5, time delay, capable of carrying 500% of its current for 10 s minimum

.3 type R3: (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits

.4 HRCII-C fuses (formerly Class C)

2.03 FUSE STORAGE CABINET

.1 Wall mounting #12-gauge aluminium, 750 mm x 600 mm x 300 mm (30" x 24" x 12"), complete with a piano hinged and key lockable door, a black baked enamel exterior finish, and a 300 mm x 100 mm (12" x 4") black-white-black engraved "SPARE FUSES" Lamacoid nameplate as per the electrical work Section entitled Basic Electrical Material and Methods, secured to the door with stainless steel screws.

3 EXECUTION

3.01 INSTALLATION OF FUSES

.1 Provide fuses for secondary distribution equipment in accordance with equipment specifications and drawing requirements. Ensure that the correct fuses are assigned to each electrical circuit.

.2 Generally, fuses are to be as follows:

.1 Motor Loads, Elevators: Type R1 or R2 for up to and including 600 amperes and type L1 for ratings above 600 amperes

.2 Transformers: Type J1 for up to and including 600 amperes and type L1 for ratings above 600 amperes

.3 Service Entrance Feeder Circuits: Type J2 for up to and including 600 amperes and type L2 for ratings above 60 amperes

.4 Other Service and Equipment: A type either indicated on the drawings, specified with the equipment, or required for the purpose

.5 Specialty Fuses: For specialty application and equipment that has specialty fuses manufactured for such as Solar – Photovoltaic fuses or Wind DG systems, TVSS, Telecommunication, DC fuses, etc including and not limited to the notes and other similar application fuses shall be selected to be the type specially manufactured for its given application.

.3 Ensure that circuit fuses are fitted to physically matched mounting devices. Provide Class R rejection clips for HRCI-R fuses.

3.02 INSTALLATION OF FUSE STORAGE CABINETS

.1 Provide a spare fuse storage in each electrical room housing fused distribution equipment. Confirm exact locations prior to installation.

3.03 OVERCURRENT COORDINATION

.1 Interchange fuses at no cost to client in order to achieve selective coordination.

.2 Fuse procurement shall be completed upon coordination study completion. Specified fuses are guidance for general selection, type of fuse, and its speed performance shall be confirmed with the coordination study.

3.04 SPARE FUSES

.1 Supply a complete set of spare fuses in original packaging for all fused secondary distribution equipment.

.2 Unless otherwise specified, store the spare fuses in fuse storage cabinets.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Product Data: Submit product data sheets for disconnect switches and accessories.

2 PRODUCTS

2.01 DISCONNECT SWITCHES

.1 All disconnect switches shall be heavy duty, horsepower rated, Quick-Make/Quick-Break operating mechanisms Load-Make/Load-Break rated.

.1 Three poles (3P) or four poles (4P) rated, unless indicated on the drawings disconnect switches shall be three poles rated, suitable for the Voltage and Amperage indicated on the drawings.

.2 Service entrance rated as required.

.3 Non-fusible safety switches may carry 100 percent of the nameplate current rating.

.4 Fusible safety switches shall carry 80 percent of the nameplate current rating, unless otherwise noted.

.5 AC and DC horsepower rated.

.6 Up to 200 K RMS Symmetrical Amperes Fault Current.

.7 Shall include:

.1 lock-off guard

.2 internal barrier kits switch wiring diagram

.2 General Purpose: Heavy-duty, CSA certified, front operated switches each in accordance with CAN/CSA – C22.2 No. 4, Enclosed Switches, each complete with a red handle suitable for padlocking in the “off” position, and a NEMA/ EEMAC enclosure. Fusible units are to be complete with fuse clips in accordance with CSA-C22.2 No. 39, Fuseholder Assemblies and to suit fuse types specified below.

.3 Specialty Application: Disconnect switches shall be selected to be suitable for its purpose, elevator and VFD style shall include a shun trip switch, distributive generation disconnect switches shall include a viewing window allowing to see the switch blade position.

.4 Fuses: Unless otherwise scheduled or specified fuses are to be equal to Bussmann. Current limiting fuses, Low Peak Time Delay, Class "J" for constant running equipment and Fusetron (Dual-Element, Time-Delay) Class "RK5" for equipment that cycles on and off and equipment with high inrush such as transformers.

.5 Enclosures: Unless otherwise specified, enclosures are to be in accordance with the following NEMA/EEMAC ratings:

.1 all enclosures located in sprinklered areas – Type 2

.2 all enclosures exposed to the elements – Type 4R, constructed of stainless steel

.3 all enclosures inside the building in wet areas – Type 4R, constructed of stainless steel

.4 all enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application

.5 all enclosures except as noted above – Type 1

.6 all enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate

.6 Acceptable Manufacturers: Acceptable manufacturers are:

.1 Rockwell Automation (Allen-Bradley)

.2 Eaton Canada

.3 Siemens Canada

.4 Schneider Electric Canada

3 EXECUTION

3.01 INSTALLATION OF DISCONNECT SWITCHES

.1 Provide all required disconnect switches in accordance with drawing plans, schedules, details, and requirements of the Specification.

.2 Provide fuses for fusible disconnects.

3.02 OVERCURRENT COORDINATION

.1 Interchange fuses at no cost to client in order to achieve selective coordination.

.2 Fuse procurement shall be completed upon coordination study completion. Specified fuses are guidance for general selection, type of fuse, and its speed performance shall be confirmed with the coordination study.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

.1 Shop Drawings/Product Data: Submit product data for ballasts, drivers, lamps, lenses, and louvres with the data sheets for the lighting fixtures they are associated with. Include:

.1 Lamp type wattage, base type, rated life, and lumen rating in accordance with CSA IESNA testing procedures.

.2 Ballast data such as input voltage, temperature range, maximum THD, power factor, noise rating, and confirmation of compatibility with the lamps they operate.

.3 Drivers data as input voltage, temperature range, maximum THD, power factor, noise rating, and confirmation of compatibility with the lamps they operate, control protocol options, dimming options.

.2 Lighting Fixture Colour(s): For all lighting fixtures where the colour is to be selected after award of the Contract, submit colour charts, and obtain fixture colour information in writing prior to ordering.

.3 Extended Ballast Warranty: Solid-state ballasts are to be covered by a four year extended parts and labour warranty. Submit a signed copy of the extended warranty.

.4 Extended LED Driver Warranty: Solid-state drivers are to be covered by a five year extended parts and labour warranty. Submit a signed copy of the extended warranty.

.5 Extended LED Chipset Warranty: LED chipset are to be covered by a five year extended parts and labour warranty. Submit a signed copy of the extended warranty.

.6 Extended Fluorescent Lamp Warranty: Fluorescent lamps are to be covered by a lamp replacement warranty (no labour) as specified in Part 2 of this Section. Submit a signed copy of the extended warranty.

.7 Spare Lamps: Submit spare lamps as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 All lighting fixtures are to be ULC listed and/or CSA certified and labelled.

2 PRODUCTS

2.01 GENERAL RE: LIGHTING FIXTURES AND LAMPS

.1 Lighting fixtures and lamps are scheduled on the drawings.

.2 Lighting Fixture Construction: Unless otherwise specified the following requirements apply to lighting fixture construction:

.1 bodies are to be constructed of minimum #20 gauge cold rolled prime coat steel, of rigid construction and complete with knockouts as required

.2 fixtures are to be suitable in all respects for the mounting locations indicated on the drawings, and are to be complete with all required mounting hardware

.3 any fixture located in a high humidity area, i.e., swimming pool areas, must be gasketed and corrosion-resistant, regardless of what is selected on the fixture schedule

.4 unless otherwise specified, any fixture operated by means of a ballast must be equipped with its own ballast

.3 Lighting Fixture Finish: Unless otherwise specified, lighting fixtures are to be finished in two coats of spray applied baked white enamel applied to chemically degreased and neutralized surfaces. Reflecting surfaces are to be white with a reflectance of minimum 85%. Confirm exact colour and finish of fixtures at the submittals stage and prior to ordering.

.4 Light Emitting Diodes (LEDs) Drivers and chipset

.1 Quality Assurance: Fixture ballasts, as applicable, are to be in accordance with requirements of (latest editions):

.1 IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers, IEEE 1789

.2 UL8750, Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

.3 CSA C22.2 NO. 250.13

.4 ANSI C82.77-10 American National Standard for Lighting Equipment--Harmonic Emission Limits & Related Power Quality Requirements

.5 IES LM-84 Measuring Luminous Flux and Colour Maintenance of LED Lamps, Light Engines, and Luminaires

.6 IES LM-86 Measuring Luminous Flux and Colour Maintenance of Remote Phosphor Components

.7 TM-16 Solid State Lighting Sources and Systems

.8 TM-30 IES Method for Evaluating Light Source Colour Rendition

.9 LM-80 Measuring Luminous Flux and Colour Maintenance of LED Package, Arrays and Modules

.10 LM-79 Electrical and Photometric Measurements of Solid State Lighting Products

.2 Quality Assurance: It is manufacturer and supplier responsibility to advise compliance ahead of procurement of the specified fixtures with the above minimum standards.

.3 LED Chipset and Driver: provide manufacturer cross-reference testing to confirm components certified and tested performance in accordance to specified references and no less than confirmation for flickering and colour stability when dimming.

.4 LED Driver, shall include minimum following options:

.1 Dimmable to from 100% to 10% while maintain IEEE 1789 published performance. Applicable methods of dimming:

.1 0-10 Volt

.2 Phase cut

.3 DALI

.4 DMX 512

.2 Maintain THD-V < 5%

.3 Maintain THD-I < 20%

.4 Power factor >0.9 at 100～277Vac 50/60Hz input, with 50%～100% load conditions

.5 LEDs: Current technology LEDs with a minimum colour temperature of from 2700K, to 6500K, a minimum CRI > 80 with R9 > 50, a rated life of from 50,000 to 70,000 hours based on 70% lumen depreciation level, and heat sinks to remove heat from the bottom of the semiconductors.

.1 Colour Consistency: < 2 Step MacAdam Ellipse

.2 All electric lights (except decorative lights, emergency lights and other special-purpose lighting) used in regularly occupied spaces meet at least one of the following requirements for flicker:

.1 A minimum frequency of 90 Hz at all 10% intervals from 10% to 100% light output.

.2 LED products with a “low risk” level of flicker (light modulation) of less than 5%, especially below 90 Hz operation as defined by IEEE standard 1789-2015 LED.

.3 Acceptable manufacturers are:

.1 Philips Colour Kinetics

.2 OSRAM Opto Semiconductors

.3 Cree Inc.

.4 Nitchia Corp.

.5 Philips Lumileds Lighting Co.

.6 Xicato

.7 Citizen

.6 Heat sink shall be mechanical type, no active electrical fan components. Include for thermal protection of the driver/chipset.

.7 Glare Control, unless otherwise selected, shall be Semicutoff—The luminous intensity at or above an angle of 90° above nadir does not numerically exceed 5% of the luminous flux of the lamp or lamps in the luminaire, and the luminous intensity at or above a vertical angle of 80° above nadir does not numerically exceed 20% of the luminous flux of the lamp or lamps in the luminaire.

.5 Ballasts

.1 Quality Assurance: Fixture ballasts, as applicable, are to be in accordance with requirements of:

.1 ANSI/NEMA C82 Series, American National Standard, for Lamp Ballasts

.2 UL 935, Standard for Fluorescent Lamp Ballasts

.3 CAN/CSA-C654, Fluorescent Lamp Ballast Efficiency Measurements

.4 CAN/CSA-C22.2 No. 74, Equipment for Use with Electric Discharge Lamps

.5 ANSI/ASHRAE/IESNA 90.1, Final Determination Quantitative Analysis Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 Acceptable Ballast Manufacturers: Unless otherwise scheduled or specified, acceptable ballast manufacturers are:

.1 Philips Advance

.2 OSRAM Sylvania Ltd.

.3 G.E. Lighting

.4 Universal Lighting Technologies

.5 Keystone Technologies LLC

.6 Sola Canada Lighting & Power Inc.

.7 Lutron Electric Co.

.3 Fluorescent Fixture Standard Ballasts: Instant start electronic ballasts designed for the voltage indicated and for use with the lamps they operate. Ballasts to be controlled by sensors are to be programmed start type. Non-sensor-controlled ballasts are to be instant start type. Each ballast is to be totally encased and designed for 40° C (104° F) ambient temperature, contain no PCB, is to be capable of starting lamps at temperature as low as -18° C (0° F), and is to be complete with:

.1 a Class A sound rating

.2 total harmonic distortion not greater than 10%

.3 a minimum power factor of 0.98 and a minimum ballast factor of 1.0 for primary lamp applications

.4 a maximum lamp current crest factor of 1.7

.5 anti-striation provisions

.6 frequency of operation between 20 kHz minimum to 60 kHz maximum, but not between 30 kHz, and lamps are not to flicker

.7 EMI/RFI filtering

.8 a permanent nameplate indicating the ballast manufacturer, model number, type, voltage and frequency, sound rating, CSA certification, the number, and types of lamps the ballasts will operate, power factor value, and a schematic wiring diagram

.9 automatic re-start circuitry to re-start lamps without re-setting power

.10 a 5 year (four year extended) replacement warranty

.4 Fluorescent Fixture Dimming Ballasts: Generally as specified above for standard ballasts but compatible with the dimming equipment and lamps to be dimmed, and capable of dimming lamps from 100% to 5% of output.

.6 Lamps

.1 Acceptable Lamp Manufacturers: Unless otherwise specified, acceptable lamp manufacturers are:

.1 Philips Lighting

.2 OSRAM Sylvania Ltd.

.3 G.E. Lighting

.4 Venture Lighting International Inc.

.2 T8 Fluorescent Lamps: Equal to Philips Lighting “ALTO II” T8, rapid start, high efficiency, low mercury content (maximum 1.7 mg) lamps with “Cathode Guard” for 95%, lumen maintenance throughout the life of the lamp and reduced lamp end blackening, and the following:

.1 a minimum colour temperature of 3500k which is to be confirmed prior to ordering

.2 a minimum colour rending index (CRI) of 85

.3 a rated average life of 36,000 hours (with programmed start ballasts and 12 hour cycling per start), and minimum initial lumen of 2950 for a 1.37 m (4’) lamp

.4 for non-climate-controlled areas, high output and suitable for reliable starting and operation at -29° C (-20° F) when equipped with a low temperature ballast

.5 a 30-month replacement warranty

.3 T5 and T5-HO Fluorescent Lamps: Equal to Philips Lighting “ALTO Silhouette” T5, rapid start, high efficiency, low mercury content (maximum 1.7 mg) lamps with “Cathode Guard” for 95% lumen maintenance throughout the life of the lamp and reduced lamp end blackening, and the following:

.1 a minimum colour temperature of 3500K which is to be confirmed prior to ordering

.2 a minimum colour rendering index (CRI) of 85

.3 a rated average life of 20,000 hours (with programmed start ballasts and 12 hour cycling per start)

.4 for non-climate-controlled areas, T5-HO high output and suitable for reliable starting and operation at -29° C (-20° F) when equipped with a low temperature ballast, and an average life of 25,000 hours

.5 a 24-month replacement warranty

.4 Light Emitting Diodes (LEDs): Current technology LEDs with a minimum colour temperature of from 2700K, to 6500K, a minimum CRI > 80 with R9 > 50, a rated life of from 50,000 to 70,000 hours based on 70% lumen depreciation level, and heat sinks to remove heat from the bottom of the semiconductors.

.5 Quality Assurance: Fixture ballasts, as applicable, are to be in accordance with requirements of:

.1 IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers, IEEE 1789

.2 UL8750, Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

.3 CSA C22.2 NO. 250.13-17

.4 ANSI C82.77-10-2014 American National Standard for Lighting Equipment--Harmonic Emission Limits & Related Power Quality Requirements

.5 IES LM-84-14, Measuring Luminous Flux and Colour Maintenance of LED Lamps, Light Engines, and Luminaires

.6 IES LM-86-14, Measuring Luminous Flux and Colour Maintenance of Remote Phosphor Components

.7 Colour Consistency: < 2 Step MacAdam Ellipse

.8 All electric lights (except decorative lights, emergency lights and other special-purpose lighting) used in regularly occupied spaces meet at least one of the following requirements for flicker:

.1 A minimum frequency of 90 Hz at all 10% intervals from 10% to 100% light output.

.2 LED products with a “low risk” level of flicker (light modulation) of less than 5%, especially below 90 Hz operation as defined by IEEE standard 1789-2015 LED.

.3 Acceptable manufacturers are:

.1 Philips Colour Kinetics

.2 OSRAM Opto Semiconductors

.3 Cree Inc.

.4 Nitchia Corp.

.5 Philips Lumileds Lighting Co.

.6 Xicato

.7 Citizen

.9 Incandescent Lamps: Unless otherwise specified or scheduled, incandescent lamps are to incorporate the following features:

.1 rated for a 125-volt power supply and for use with a 120 volt nominal power supply

.2 clear or frosted as scheduled

.10 suitable for operation in any position

.11 a minimum life of 2000 burning hours for reflector lamps and 1000 burning hours for conventional filament lamps

.12 a colour temperature of 2700K

.6 Compact Fluorescent Lamps: Twin or quad tube configuration compact fluorescent lamps, each with a rated burning life of minimum 12,000 hours, a colour temperature of 4100K, a minimum colour-rendering index of 80, and an electric energy saving rapid start ballast in the base.

.7 Lenses/Louvres: Unless otherwise specified, lenses/louvres are scheduled with the fixtures they are associated with. Lenses/louvres are specified in the Section entitled Ballasts, Lamps, Lenses and Louvres.

2.02 DISCONNECTING MEANS – FLUORESCENT FIXTURES

.1 Each fluorescent lighting fixture connected to a branch circuit with a voltage exceeding 150 volts-to-ground is to be equipped with a disconnecting means integral with the fixture that simultaneously opens all circuit conductors between the branch circuit conductors and the conductors connecting the ballast(s). The disconnect device is to be identified in a conspicuous, legible, and permanent manner.

3 EXECUTION

3.01 INSTALLATION OF LIGHTING FIXTURES

.1 General Installation Requirements: Provide lighting fixtures and lamps where shown. Include for all required site assembly and provide all required installation and support hardware. Additional requirements are as follows:

.1 confirm exact lighting fixture locations prior to roughing-in

.2 in finished areas, refer to architectural reflected ceiling plans and/or wall elevations

.3 in equipment rooms, shafts, and similar unfinished areas, install fixtures after the equipment is roughed-in, and shelving and similar items are installed, and do not suspend fixtures from piping, ductwork, conduit equipment, or similar items

.4 prior to roughing-in for lighting fixture installations, examine drawings and site conditions to determine that suitable space is available for the fixture installation as shown. If sufficient space is not available, notify the Consultant immediately and, if required, relocate the fixtures within reasonable distances without additional cost

.5 locate recessed downlights, troffers, and surface mounted fixtures in or on suspended tile ceilings in or on full tiles, and where ceiling tile openings are cut for fixtures, cut to exact sizes so that there are no gaps, and fixture trim completely covers the perimeter of the opening

.6 provide plaster frames for fixtures in suspended plaster or drywall ceilings

.7 use clean gloves when handling reflector cones, louvres, halogen lamps, glass sconces, and all exposed surfaces of fixtures

3.02 SUSPENDED LIGHTING FIXTURES

.1 Support all lighting fixtures in suspended ceilings from the slab or building construction above, independent of the suspended ceiling construction. Support 1.2 m (4') fluorescent fixtures with a minimum of 2 aircraft type cable supports or 2 #3 Tenso Chains. Support HID or incandescent fixtures with 1 #3 Tenso Chain or 1 aircraft type cable. All supports are to be in accordance with requirements of governing Codes and Regulations.

.2 Support continuous rows of fixtures at minimum 1.2 m (48") centres.

3.03 LIGHTING FIXTURES IN FIRE RATED CEILING CONSTRUCTION

.1 Where lighting fixtures penetrate a fire rated ceiling, they are to be enclosed in an enclosure with a rating to match that of the ceiling. The enclosure is to be constructed by the trade constructing the ceiling. Ensure that conductors connecting the fixtures are fire rated type and that ceiling penetrations for conductors are properly sealed with fire stopping and smoke seal material. Fixtures installed in the fire rated enclosures are to be equipped with thermal overload protection.

3.04 LIGHTING FIXTURES ALIGNMENT

.1 Align lighting fixtures mounted in continuous rows to form straight uninterrupted lines. Alignment variation is not to exceed 6 mm (¼") in any 5 m (15') run.

.2 Align lighting fixtures mounted individually parallel and/or perpendicular to building lines.

.3 Aim accent and spot lighting as indicated and/or as directed by the Consultant and secure the fixture positions after the Consultant's approval.

3.05 BALLASTS

.1 Unless otherwise shown, specified, or scheduled, ballasts are to be integral with the lighting fixture they are associated with.

.2 Install remote ballasts on proper racks as close to the fixture(s) as possible and, unless otherwise specified, connect with type TEW cable in conduit. Remote ballasts are to be black and properly identified.

3.06 LAMPS

.1 Provide new lamps for each lighting fixture.

.2 Include a full listing of lamps in O & M Manuals.

.3 At Substantial Performance, replace all lamps used for construction lighting.

.4 Supply 15% of spare lamps for each fixture type (rounded out to a full carton if more than ⅔ of a carton), and hand to the Owner at Substantial Performance as specified in Part 1 of the Section. Identify all lamp packaging with the associated fixture type.

.5 Operate all high-pressure sodium and metal halide lamps for a “settling down” period of a continuous 100 hour burn or by 10 hour continuous burns, unless otherwise recommended by the lamp manufacturer, in which case follow the lamp manufacturer’s recommendations. After the “settling down” period, take luminance measurements to confirm design specifications.

3.07 INSTALLATION OF LENSES/LOUVRES

.1 Unless otherwise specified or scheduled, lenses/louvres are to be integral with the fixture they are associated with.

3.08 LIGHTING FIXTURES CIRCUIT WIRING

.1 Connect lighting fixtures to circuits indicated with wiring as shown/specified.

.2 Minimize the number of splices required.

3.09 EXISTING LIGHTING FIXTURES

.1 Where existing lighting fixtures are to be reused, examine the fixtures during the bidding period and include for replacing faulty ballasts, broken lenses, and any other obvious damage, include for replacing all lamps at Substantial Performance, and conform to the following requirements:

.1 disconnect existing fixtures to be reused, safely store where directed, relocate, and reinstall

.2 unless otherwise directed, disconnect, and remove obsolete fixtures, identify, and make wiring safe, and dispose of the fixtures off-site in an approved manner

.3 if existing fixtures to be removed are equipped with ballasts that contain PCB’s, engage the services of a disposal company licensed by the MOE to remove and destroy PCB ballasts, to remove the ballasts and destroy them off-site at an approved facility, and the disposal company is to be fully insured, registered, and in good standing with the WSIB, and is to issue a Certificate of Destruction upon completion of the work

3.10 CLEANING

.1 When all lighting fixture installation work is complete, clean all fixtures and lamps, and any ceiling, wall, etc., surfaces soiled as a result of the fixture installation work.

.2 If wall and ceiling surfaces are damaged as a result of the fixture installation, replace the wall or ceiling surface to the Consultant's approval.

3.11 OWNER SUPPLIED LIGHTING

.1 The Owner supplied luminaires will be supplied and delivered to site by others. Electrical Contractors shall include as part of their base bid the following:

.2 Attendance on the supply of the fixtures in lieu of mark-up.

.3 Liaise with manufacturer.

.4 Check shop drawings.

.5 Coordinate delivery schedule and expedite as required.

.6 Receive on site.

.7 Off-load and check for damage.

.8 Store and later place in position.

.9 Unwrap and dispose of packing material off site.

.10 Assemble fixtures.

.11 Erect, install, connect, and lamp.

.12 Provide all warranty services as if the Electrical Contractor had supplied these luminaries.

END OF SECTION

27.1 Network and Telephony Cabling

a. Only first class workmanship will be accepted, not only in regards to durability, efficiency and safety, but also in regards to neatness of detail. Present a neat and clean appearance on completion to the satisfaction of the Engineer. Any unsatisfactory workmanship will be replaced at no extra cost.
b. Data cables to be Cat6 with dark blue outer sheath.
c. Phone cables to be Cat6 with dark blue outer sheath.
d. PA speaker cables to be Cat6 with white outer sheath.
e. All cable to be FT6 rated when used in plenum spaces.
f. All data drops to be home-run to nearest appropriate Communications Room.
g. The maximum cable run length is not to exceed 91.4m (300'). If this cannot be met, contractor must consult with Owner to determine a suitable alternative.
h. All products shall be new, of the latest version at time of bid, and brought to the job site in original manufacturer's packaging. Used equipment and damaged material will be rejected.
i. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.
j. In renovations/refreshes, Ethernet TIA cabling standard to be maintained consistently throughout school. For example, if TIA standard "A" is prevalent in the school, continue with "A" standard for all new cabling in the school.
k. All cabling to be run within existing conduit/raceways/cable trays/cable hooks/paths wherever possible.
l. Plenum cables are permitted in accessible ceilings. Provide 'J' hooks in these locations.
m. Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 3.2 mm (1/8 in) nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.
n. Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30 m (100 feet) in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:-
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

o. Firestopping is required in all penetrations to fire rated assemblies according to Code.
p. All data and telephony drops and corresponding cables removed in construction, which are not re-used immediately as part of the project, are to be fully removed and un-terminated from the patch panel to which it connects. This includes full removal of the redundant cable from

applicable ceilings/walls/conduits/raceways/cable trays/cable hooks, and the removal of labels at the patch panel. If pulling the wire all the way out is not feasible, Owner may accept just un-terminating the affected cables from the patch panel and orphaning the cable in the ceiling.

q. BIX (including 'Gigabix') connectors are not acceptable for network cables. If a cable run is too short to reach the required termination point, a new home-run cable must be installed.
r. All existing data and telephony drops are to remain, unless explicitly stated otherwise. If any drops are removed, they must not be orphaned in the ceiling; they must be removed from the BIX panel or patch panel as applicable. For example PA speakers and Wireless Access Points shall re-use existing cabling, unless it is otherwise damaged.
s. Existing PA, phone, and network cables are not to be replaced, if functioning properly.
t. If construction is occurring inside a Communications Closet, contractor must protect the equipment by sealing it off from (i.e. by tarping it off). In cases in which this is not possible, contractor to engage with Owner to arrange for alternative measures.
u. All copper cabling to follow standards as required by TIA 568.0-D, 568.01-D, 568.02-D in each respective scenario.
v. Cabling systems to meet or exceed the specifications of the T1A-568A standards and ISO/IEC IS 11801, if applicable.
w. All cabling to be grounded and bonded as required by TIA 607-D standards.
x. All cabling to be concealed and protected in appropriate cable trays or conduit or raceway, unless otherwise safely and aesthetically hidden in ceiling or wall space.
y. Modular jacks to be Category 6 compliant.
z. Marettes are not to be used with any network or telephony cabling. Bean "B" connectors are acceptable when properly used.

27.2 Faceplates

a. Faceplates shall be UL Listed and CSA Certified.
b. Faceplate material and colour to match electrical faceplates.
c. Faceplate sizing to match electrical faceplates.
d. Faceplates shall be available to mount up to six in a single gang, and up to twelve in a double gang configuration.

27.3 Backbone Cable

a. Provide fibre optic backbone cables from the main Communications Room to all new or relocated secondary Communications Rooms, each as a dedicated home run.
b. Except where VoIP phone systems are in place, provide 25 pair cat3 backbone cable from the main Communications Room to all new or relocated secondary Communications Rooms, each as a dedicated home run.
c. Provide 12 pair cat3 cable from Phone BIX panel to 12 port patch panel in the Communications Rack, labelled as phone lines. Install in separate U from data patch panels.

27.4 Fibre Optic Connectors and Adaptors

a. Fibre Optic connectors shall be LC style multimode.
b. Fibre Optic Adapters shall be LC duplex multimode with ceramic sleeves.
c. All fibre optic cabling to follow standards as dictated by TA 569-E.

27.5 Communications Rooms and Patch Panels

a. No Communications Rooms or IT equipment within, are to be moved, added, or removed without explicit approval from Owner.
b. Communications Rooms moved or added must include fibre optic backbone cable to primary Communications Room.
c. Each secondary Communications Closets is to have a dedicated multimode LC fibre connectivity back to the primary Communications Closet
d. In schools with analogue phone systems, a 25 pair cat3 or cat5 or cat6 cable is required between closets.
e. Contractor to supply one floor mounted rack for each Communication Rooms.
f. Communications Rooms to have floor mounted racks, ideally installed 36" from back wall, and minimum of 24" from the back wall, as space allows.
g. Floor mounted racks to be 2-post, 45RU, and 19" module compatible, manufactured in steel (not aluminum). Example is the Panduit model R2P6S.
h. Patch panels to be mounted in 19" rack(s) and/or cabinets.
i. Racks must have 10/32" size screw holes.
j. Racks and patch panels must be black in colour.
k. Patch panel jack modules to be Panduit, such as model CJ688TGBL.
l. Racks to include hinged steal vertical cable management on each side, examples are the Panduit PR2VD06 and WMPV45E.
m. Racks to include to include four horizontal cable management 2U trays required per rack spaced with 1U gap between each tray. Example is the Panduit CMPHH2.
n. Racks much have top 2U must be reserved for patch panels.
o. All Patch panels should meet or exceed industry standards, fit into a 19" rack and be 1RU in height, black in colour, and flat style (not angled). Example of this is the Panduit model CPP24FMWBLY.
p. Panel shall have an adapter tray that accepts 6 six-pack adapter plates with LC multimode adapters. The panel adapter tray shall be removable from the front of the panel by sliding the tray forward. Panel shall have built in patch cable management incorporated into the front of the adapter tray and hold 12-24 fibre connections.
q. Raceway, conduit, J hooks, and other cabling accessories may be of other brands; so long as they can meet the required quality of TIA standards.

27.6 Labelling

a. Supply and install labels at each terminated location. Labels shall be affixed to the faceplate on the space provided by the manufacturer.

b. Labels shall be mechanically or digitally printed. Handwritten labels are not acceptable.
c. For Data and Voice cables, labelling at the faceplate (or on keystone for Wireless Access Points) on the client end and the network rack patch panel to be in the format *"ROOM# {dash} COMMUNICATIONS CLOSET LETTER {dash} DROP#".* For example, a cable terminating in Room 101 wired to Communications Room 'A' into patch panel drop 12, is to be labelled as "101-A-12" at both ends.
d. PA cables are to be labelled in the format *"ROOM# {dash} COMMUNICATIONS CLOSET LETTER".* For example, a PA speaker terminating in Room 101 wired to Communications Room 'A' is to be labelled as "101-A" at both ends.
e. BIX panels are to be labelled with corresponding room numbers.
f. PA cabling for speakers in hallways may use "HallA" and "HallB" instead of a room number. For example, Hall1-A for the first chain of speakers going to Hub A, Hall2-A for the second chain.
g. Port numbers within a room should be sequential and maintain sequential numbering across adjacent rooms.

27.7 Phone Systems

a. New voice jacks for existing digital (non-VoIP) systems are to be run and patched to main phone system. Confirm this location with Owner, as it is not always in the main Communications Room.
b. New voice jacks for new or existing VoIP phone systems are to be installed as a standard data drop to the nearest appropriate Communications Room.
c. All new voice cabling, whether for Digital or VoIP systems, are to be installed as cat6 with a dark blue outer sheath.
d. For all existing digital (non-VoIP) phone systems, a 25 pair cable must be terminated at the Voice Patch Panel into a 24 port loaded patch panel, with the other end terminated at the BIX1A punch down blocks mounted in BIX10A at phone system.
e. All new phone system installs are to be the 'Avaya IP Office 500v2' VoIP phone system with the following features (part number in brackets):
    I. IP Office R10+ IP Endpoint LIC (383110, minimum 8 per school)
    II. IP Office R10+ 2Channels Lic (383127)
    III. IP Office R11 LIC (396445)
    IV. Power Cord 18AWG (700289770)
    V. Rack Mounting Kit (700429202)
    VI. V2 System SD Card (700479710)
    VII. IP Office 500 Version 2 Control Unit (700501510)
    VIII. IP500 V2 Combo Card ATM4 V2 TAA (700504897)
    IX. J139 IP Phone (700513916, minimum 4 per school)
    X. J179 IP Phone (minimum 3 per school)
f. Contractor to collaborate with Owner to configure new phone systems and moves/adds/changes to existing phone systems.
g. For VoIP systems, Avaya J179 handsets are to be used for Principals, VPs, and secretaries; with Avaya J139 handsets in all other locations.

h. For all Digital (non-VoIP) phone systems, Avaya 9508 digital telephones are to be used for Principals, VPs, and secretaries: with Norstar Cat. #T-7208 handsets for all other locations.
i. For all phone systems (both VoIP and Digital) an 'emergency' phone is to be installed on the wall near the secretary or principal's desk. This is to be connected directly with an RJ11 cable back to dial tone from the provider, bypassing the phone system.

27.7.1 Elevator Communications

a. Install phone cable (Cat6 cable with dark blue outer sheath) from elevator room directly to the main phone system.
b. In coordination with Owner, connect elevator call number to an existing line with a line seizure device. This method will guarantee an outgoing connection for the elevator without requiring an additional phone line for the school.
c. Owner's preferred line seizure device is the Viking LSR-1: https://www.vikingelectronics.com/products/lsr-1/
d. Owner requires two pauses before the number to allow the line seizure device time to seize the lines prior to starting to dial.
e. Self-test of elevator communications is to be done only between 6pm and 6am. This prevents phone calls/lines in the school from being interrupted during regular operating hours.
f. Elevator communications self-test to be configured to self-test once each day per TSSA requirements: https://www.tssa.org/en/elevating-devices/resources/Documents/ED-290-20---Elevator-Phones---Various-Technologies.pdf

27.8 Wi-Fi & Wireless Access Points (APs)

a. Wherever possible mount APs in middle of room on dropped ceiling.
b. APs are not to be mounted greater than 15ft AFF, whether ceiling or wall mounted. Purpose is to allow for easy maintenance and optimal RF performance.
c. When installing APs in a dropped ceiling, cut discrete hole for the data cable to come through, allowing the ceiling tile to lay flat.
d. Owner's required AP model for most areas (including classrooms) is the Meraki MR36 . High density areas (including but not limited to gymnasiums and auditoriums) require the Meraki MR46. Outdoor Aps require the Meraki MR76 or the Meraki MR86. Substitution of a higher powered or newer model is acceptable with Owner's permission.
e. All Meraki licensing is to applied to the Owner's existing 'KPRDSB' Organization in Meraki dashboard.
f. Contractor to install/reinstall (mount) all APs.
g. Mounting instructions for MR42can be found here: https://documentation.meraki.com/MR/Installation_Guides/MR42_Installation_Guide . Mounting instructions for MR36 are here: https://documentation.meraki.com/MR/MR_Installation_Guides/MR36_Installation_Guide . Refer to the 'Installation Instructions' heading.

h. When mounting APs in T-Rail ceilings, the manufacturer's mounting kit must be used. The mounting kit can be provided by Owner, upon request. Mounting kit specs: https://meraki.cisco.com/product/wi-fi/wireless-accessories/wireless-accessories-mount-kits/wireless-accessories-mount-kits-ap-mount-kits/ma-mnt-clg-1/
i. Data drops for APs to be terminated as a fully contained data jack. An example is the Panduit CBX1WH-A surface mount box (link: https://www.panduit.com/en/products/copper-systems/faceplates-boxes/surface-mount-boxes/cbx1wh-a.html) with the Panduit CJ688TGBU UTP Jack Module (link: https://www.panduit.com/en/products/copper-systems/connectors/jack-modules/cj688tgbu.html).
j. APs that are temporarily removed during construction must be re-installed back to their original location, unless otherwise specified by Owner or the plans.
k. APs that are 'existing to be removed' must be safely removed by the contractor and returned to Owner.
l. When APs are being removed (to be reinstalled), APs must be securely stored by contractor and be temporarily labelled (i.e. with masking tape) with room number, and in cases with multiple APs per room to also include coordination N, E, S, W marking.
m. APs must always remain below or mounted on T-Rail ceilings, they must never be left or installed above a T-Rail ceiling. If a new T-Rail ceiling is installed under an existing AP, the AP must be moved to mount onto the new ceiling.
n. For APs that are damaged or not returned, a charge back cost of $1,000 will be applied.
o. For new APs not already existing, contractor must be provided a minimum of 5 business days notice to Owner, allowing Owner to prepare and supply APs to the contractor.

27.9 Public Address (PA) System

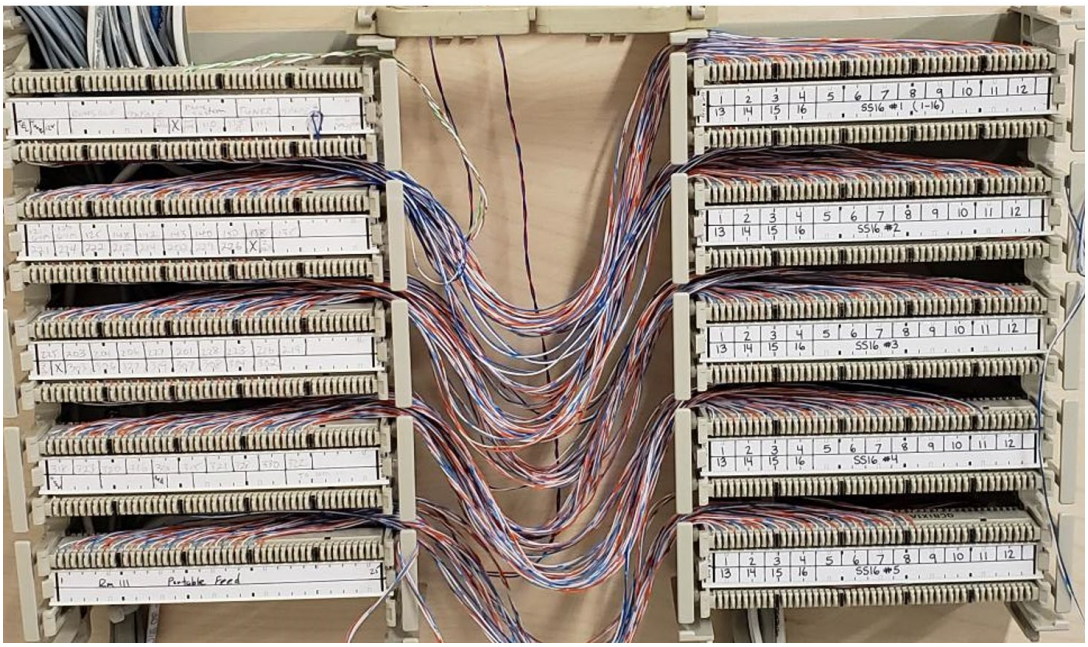
a. Contractor to collaborate with Owner to configure new PA systems and moves/adds/changes to existing PA systems.
b. All new or moved PA cables must be run back to the main PA system. Confirm this location with Owner, as it is not always in the main Communications Room.
c. Control Panels: For new builds and school refreshes, the Carehawk 'Classroom Phone' is to be installed in or on the Control Panel of each classrooms, shop, and meeting space. Call button installation is also required in Control Panel.
d. Control Panels require round speaker with round grill.
e. Where handsets exist for PA speakers, they must remain or be replaced with new compatible handsets.
f. All new or moved PA cables must be terminated on a 36D BIX or BIX1A or similar modular Jack which must be installed 4'-6" A.F.F. where space permits.
g. All new PA Systems to be Carehawk model 'CH1000-2I-2A-2PG' with the following hardware features (part numbers in brackets): Email Alert Module (EAM), Switch Security Cards as needed (SS16), Administrative Phone (AC1) with PA-AP1 Power Supply, Telephone Communications Card (TC2-KIT), Digital 100 Watt Class D Paging/Power Amplifier 25V with enclosure (DAF100-25) as needed, Attenuator 25V (AT1) as needed.

h. Each 'SS16' to have a dedicated homerun, via cat6 cable, to the main PA system and terminated as a data jack next to the main PA System, then use a patch cable to plug it into the PA System.
i. PA system to include providing and connecting a mixer with the following inputs: XLR mic , 3.5mm input. CD players and FM tuners are not required for PA systems. To be in the main office.
j. Each room to be configured as its own dedicated channel.
k. Each hallway to be configured as a single channel but can be adapted as needed for specific circumstances. All hallways programmed to the hallway zone (Zone 2).
l. Hallways are to have speakers throughout, no more than 10 meters apart.
m. Require Cat6 cable run from main PA system to PA console (microphone or phone). The console is usually located in the main office.
n. Require a shielded 4 wire 18-gauge cable from main PA system to the tuner box. Note the tuner box is usually located in the main office near the secretary.
o. Configuration of PA system to include bells on school's schedule, pre-recorded messages including but not limited to lockdown messaging. If configuration is not able to be completed, contractor must work with Owner to arrange alternative.
p. PA horns to be TOA brand, model SC-630. Horns are not to be used interior.
q. Outdoor horns to be mounted no more than 10ft above ground level.
r. Speakers to be installed on the ceiling T-bars with 25 Volt transformers.
s. Speaker part number with transformer and white square grill: 8229/25/25 link: https://mcbrideloudspeaker.com/images/specs/8LS82219.pdfhttps://mcbrideloudspeaker.com/McBride-8229-25-25-Assembly.html . Speaker on its own is the McBride 8LS822-19 https://mcbrideloudspeaker.com/McBride-8LS822-19.html . Transformer on its own is the McBride MCT25 https://mcbrideloudspeaker.com/McBride-MCT25.html
t. In suspended ceilings, speaker rails must be supported by ceiling rails.
u. Ceiling mounted speakers are not to have call buttons.
v. Speakers in the following spaces to be programmed for emergency paging only: calming / quiet rooms and spaces used primarily by third-party facility partners (i.e. daycares).
w. Gyms and hallways require multiple speakers each, spaced approximately 20' apart.
x. In offices speakers are to be tapped to 0.25 Watt.
y. In all other applications speakers to be tapped to 1 Watt.
z. In shop classes, gyms, and mechanical rooms; a quantity of at least two (upwards of 4) McBride 8LS822-19 speakers are required, spread throughout the room to provide coverage throughout the room, tapped to 1 Watt each.
aa. Shops, Gyms, and Auditoriums to have speakers wall mounted approx. 10 to 15 AFF, rather than ceiling mounted.
bb. Shop classes to include 1 Carehawk HS100 "Handset Station" connected to the PA speaker.
cc. All classrooms to have a standard call button (in addition to above Classroom Phone).
dd. All existing handsets are to remain or be replaced with new HS100 handset or Carehawk Classroom Phone.
ee. Main cable from the PA system is to be wired to the handset. A separate cable is to be wired from the handset to the PA speaker in the room.

ff. There must be a white toggle call button installed in every classroom, meeting room, resource room, staff room, and office.
gg. In gyms, install a white toggle call button in a recessed box with cover.
hh. In shops install a white toggle call button as well as a PA handset.
ii. Do not connect to privacy switch in any room.
jj. Service loops are required at all terminated ends.
kk. PA systems to be installed in a clean, well organized, and thoroughly labelled manner. A proper backboard and cable management is required. Example pictured below.
ll. All wires not used on a speaker are to be taped individually or cut and taped so that the wires do not touch metal or each other.
mm. PA wiring should be fed first to the handset/call-button and a separate cable from there to the speaker itself. The white/blue pair is to be terminated to the speaker and not continue down to the call button. The white/orange pair is to be terminated to the call button. Leave service loop.
nn. Marette connectors are not acceptable. B-connectors are standard.
oo. Any spare speaker wires must have the bare ends cut off and taped together with electrical tape to avoid inadvertent contact with other parts or wires.
pp. BIX panels must have reasonable clearance to provide access to maintain.
qq. Final terminations to PA and Phone system may be completed by Owner, when/if consulted in advance.

Figure 1: PA system cabling and termination to BIX panel, with service loops and neat cabling

Figure 2: Labelling on BIX panel after cross-connects



27.10 Operational Technology

a. For purposes of this document Operational Technology (OT) includes, but is not limited to, Building Automation Systems, Card Access Systems, Irrigation Systems, Security Cameras, and Electronic Signs.
b. All data connections for Operational Technology to be installed under the same standards as all other data cabling, including cat6 cabling and a home run to the nearest Communications Room.
c. OT network connectivity is to be wired (ethernet) only. Wi-Fi connectivity for OT is not permitted. If a vendor would like to request Wi-Fi connectivity for OT, they must formally request it through Owner's ICT department and request an exemption.
d. Network drops and interfaces for all operational technology are to be configured in collaboration with Owner and with an IP address, Subnet Mask, and Default Gateway determined by Owner, to ensure network security requirements are met.

27.10.1 Electronic Signs

a. Electronic signs must utilize cloud-based (internet) management consoles.
b. The cloud-based management must be compatible with Chrome and Edge modern browsers and must not require the installation of additional software or plugins.
c. Sign management systems requiring locally installed software are not permitted.
d. Sign management systems requiring layer 2 network access are not permitted.
e. Remainder of Electronic Signs are provided in the appropriate Division.

27.10.2 Security Cameras

a. Security cameras must be Verkada brand and licensing applied to Owner's existing Verkada Command account (or purchased through Owner) and installed to the manufacturer's specifications with applicable mounting accessories such as the ACC-MNT-2, ACC-MNT3, ACC-MNT-8, and ACC-MNT-10 as required.
b. Owner's required model for outdoor dome cameras is Verkada CD52-E.
c. Owner's required model for outdoor bullet cameras is Verkada CB62-TE.
d. Owner's required model for standard indoor dome cameras is Verkada CD52.
e. Owner's required model for indoor and outdoor fisheye/360-degree cameras is Verkada CF81-E.

27.10.3 Card Access

a. Card Access hardware must be RBH brand utilizing model RBH-UNC-500-422M as the primary panel and RBH-RC-2 for secondary panels as required.
b. Card readers (aka access points) to be the RBH-FR-360N-SWPL.
c. Panels are to be installed in a RBH approved enclosure such as the ENC1.
d. Power for panels is to be supplied through appropriate transformers, connected to a surge protected power bar.
e. Panels to be installed within approved Communications Rooms
f. All hardware to be wired as one Axiom network per building.
g. Configuration of card readers and panels to be done in collaboration with Owner, into Owner's existing Axiom enterprise system.
h. Other door hardware, such as strikes, crash bars, and accessibility operators to be determined in collaboration with other door & entrance specifications in the appropriate Division.

27.10.4 Synchronized Clocks

a. Carehawk's synchronized clock system to be utilized with the Master Clock (24ZBMC100) with DC Clock Power Supply (AL600ULPD8).
b. Each room to have Carehawk brand clock, model 14" Analog Secondary Clock (24ZBM14R).
c. This system is to be integrated with and installed in the same room as the CH1000 PA System as specified in section 27.9.e, per manufacturer's recommendations.
d. Configuration and integration of system to be done in collaboration with Owner.

27.11 Third-Party Facility Partners

All other standards within this document are to be adhered to in these spaces. Specific additional requirements for these spaces are listed here.

a. The priority for location of third-party IT equipment is to utilize a space within the rented area. If no reasonable space exists for the operator/renter's IT equipment they may, where space allows, place their equipment in Owner's Communication Room. In these cases, the Facility Partner's cabling is to be connected to their own independent data rack, keeping it separate from Owner's equipment, creating both a logical and physically separate entity for the networks.

b. Facility Partner is responsible for supplying and paying for their own internet and telecommunications access and infrastructure.
c. Facility Partner may choose to have their service providers install their modem/demarcation equipment into KPR's Communication Room but must connect to the Facility Partner's own data rack.
d. Facility Partner is responsible for the setup and maintenance of their own network, telecommunications, and other technology infrastructure.
e. Any cabling required for network connectivity, telephone systems, point of sale systems, et al must be specified by Facility Partner.
f. Facility Partner's wireless communications equipment is not to cause interference with Owner's wireless communications. While the Owner may at times collaborate to assist, Facility Partner is responsible for any configuration and costs associated to ensuring this need is met.
g. PA speakers in these spaces to be programmed for emergency paging only.
h. If Facility Partner does not provide specifications for data and telecom infrastructure, the following defaults will be applied: 1x network drop installed in each room, 1x phone drop installed in each room, 1x network drop installed above ceiling in each room.

27.12 Testing and Documentation

a. All cables and termination hardware shall be tested for defects in installation and to verify cabling system performance.
b. All call buttons and speakers to be tested individually.
c. As-Builts to include all newly installed or moved telephone systems, PA systems, network closets, and back bone cable runs.

27.13 Audio-Visual Equipment

The following guidelines are for standard instructional spaces. Other instructional spaces require explicit coordination and consultation with Owner: low/high overhead spaces, dual screen configurations, and other rooms that are not considered a standard classroom.

a. All A/V equipment to be supplied and installed by owner unless otherwise noted (i.e projection screen).
b. A/V equipment not to be connected to emergency stop, power lockout mechanisms, timers, switches, or advanced controls.

27.13.1 Interactive Display [new builds only]

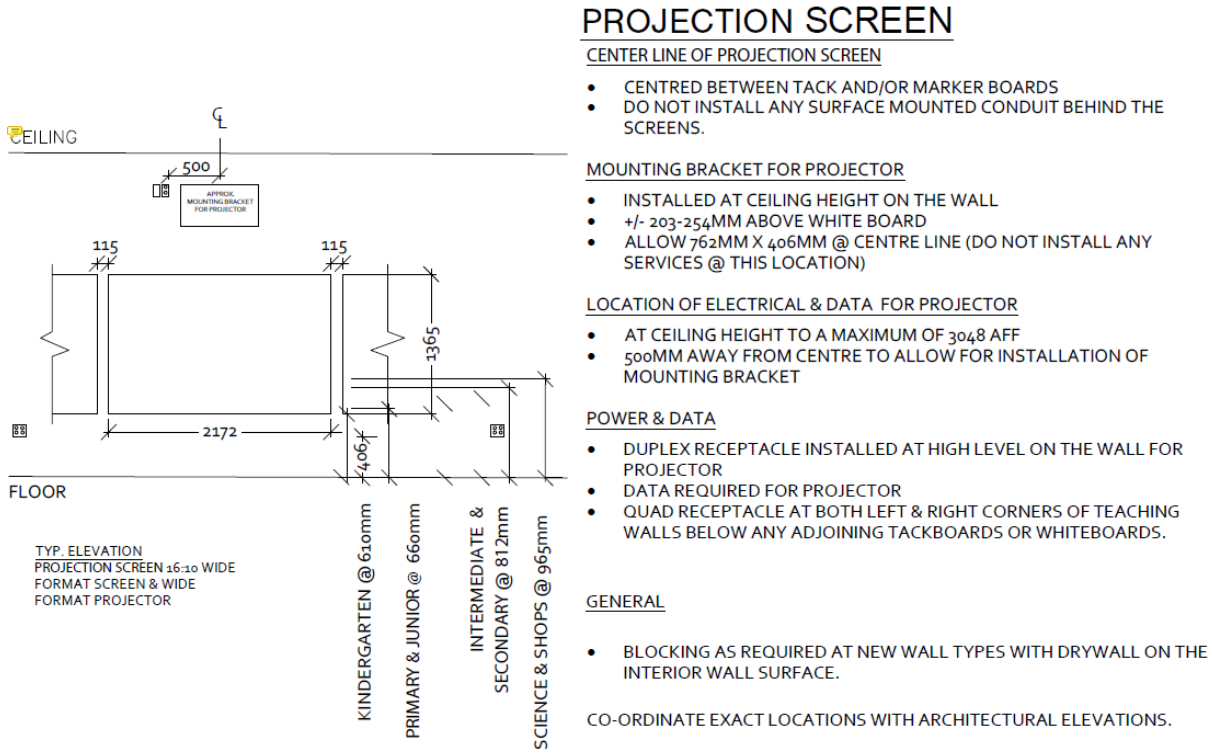
a. Kindergarten classrooms and collaboration spaces to have interactive displays, rather than a projector/projector screen.
b. Interactive displays in kindergarten classrooms to be 75" SMART Board GX075-V2 interactive display with embedded OS, 20 continuous points of touch. To be installed on the SMART Floor Stand Electric, FSE-410.

c. Interactive displays in collaboration spaces to be 65" SMART Board GX065-V2 interactive display with embedded OS, wall mounted.
d. Substitution of a higher powered or newer model is acceptable with Owner's permission.

27.13.2 Projectors in Classrooms

a. Projectors to be Epson brand, with the following specifications:
    I. Compatible with Epson Projector Management Software
    II. Minimum 4000 lumens
    III. Laser-interactive
    IV. Support aspect ratio of 16:10
    V. Ethernet network adaptor
    VI. 5-year warranty (as included from manufacturer)
b. An example of a product meeting these specifications is the Epson model 760wi.
c. Substitution of a higher powered or newer model is acceptable with Owner's permission.
d. Projector to be installed above projection screen +/- 203-254mm by Owner.
e. Allow 762mm X 406mm at centre line for projector mounting bracket
f. Do not install any services including surface mounted conduit at this location.
g. Blocking required behind new drywall at location of projector install.
h. Blocking required over existing drywall at location of projector install.
i. Duplex receptacle and data for projector to be installed at high level to a maximum of 3048mm AFF and 500mm from centre of projection screen.
j. Where existing conduit does not exist, cabling for projector and speaker(s) to be surface mounted and run through channel between projection screen and adjoining whiteboard/tack board ending in surface mounted control box.
k. Per below drawing (*Figure 3*) projection screen to be installed at specific height AFF based on room use.
    - Kindergarten @ 610mm
    - Primary & Junior @ 660mm
    - Intermediate & Secondary @ 812mm
    - Science and Shops @ 965mm

Figure 3: Projection Screen Installation for Classrooms



27.13.3 Projection Screens for Classrooms

Screen specifications to include:

I. projection quality whiteboard compatible with ultra short throw projectors
II. 100-inch diagonal measurement
III. support 16:10 aspect ratio
IV. magnetic
V. dry erase
VI. 5-year warranty (as included from manufacturer)

a. Example of a product meeting these specifications is the DA-Lite Screen 16:10 Wide Format model 25940. Substitution with newer model is acceptable with Owner's permission.
b. Height of whiteboard installation to be confirmed by Owner under the guidelines shown in *Figure 3* below.
c. No services (i.e., surface mounted conduit) are to be installed where whiteboard is to be installed.
d. Whiteboard to be installed on teaching wall between whiteboards/tack boards with a minimum 115mm gap between boards.
e. Grade 1 – 12 Classrooms to have Projector and Whiteboard, rather than an interactive display.

27.13.4 Speakers and Amplifiers in Classrooms

a. Classroom Audio Kit to be the TOA brand IR-800 Classroom System #3.
b. Speaker to be installed in T-Rail ceiling in centre of Classroom.
c. Amplifier & microphone to be installed using wall mount bracket, next to projection screen and power receptacle.
d. Substitution of a higher powered or newer model is acceptable with Owner's permission.
e. Exception to these specifications is listed below in27.14.5.

27.13.5 Charging Towers/Mobile Technology Storage

a. Charging towers to be included in all elementary instructional spaces.
b. No services, including surface mounted conduit (new or existing), are to be run behind space where charging tower is to be installed.
c. Space of 355mm W must be available on wall for installation and door opening.
d. Require a duplex receptacle within 250mm of the charging tower.
e. Towers to be Powergistics brand, model CORE20 USB.

27.13.6 Science and Shop Classrooms

All above standards for classroom technology and infrastructure apply, with the following exceptions;

a. Projection screen to be installed at 965 mm to provide students with clear view of board above science/shop bench.
b. Projector to have conduit at 2" (51mm) from projector location to science/shop bench at side of shelving. The run for this conduit is not to exceed 30' (9144mm). Runs beyond the limit of 30' must be communicated to Owner to determine suitable alternative.
c. Science/shop bench to have duplex receptacle installed inside bench for other Owner purchased peripherals (i.e., amplifier).
d. Shop classrooms to have the TOA IR-800 PLUS Classroom System KIT#2 with speakers equally spaced in the room, (instead of the IR-800 Classroom System KIT#3) with amplifier installed at the bench.

27.13.7 Learning Commons

Audio and visual systems for learning commons to utilize the same A/V systems as found Classroom technology standards above, including;

I. Projector
II. Projection screen
III. Two charging towers
IV. Speakers, microphone, and amplifier
V. Interactive display

27.13.8 Gymnasium A/V Equipment

Infrastructure for power and conduit for speakers and associated cabling to be supplied and installed by contractor.

Audio and visual systems for gymnasiums & stage to be selected and installed by owner.

- Da-Lite Rear Projection 1 1 Screen
- Epson Projector Epson L630U Laser Projector or equivalent
- Wall Rack
- Rack Storage Drawer
- Rack Lock Kit
- Dual Wireless Handheld Microphones
- Mixer
- Bluetooth Receiver
- Rack Connection plate
- Rack Surge Protector
- Rack Internal Cabling
- Active HDMI
- Speakers
- Speaker cabling

1 GENERAL

1.01 SUBMITTALS

.1 Shop drawings/product data: Submit shop drawings and product data sheets for the fire alarm system. Include the following:

.1 Identified wiring schematics with component identification and product/catalogue numbers for the central facility and all associated components.

.2 A complete, zoned block riser diagram identifying all components and circuits.

.3 A complete sequence of operation cross-referenced to the riser diagram.

.4 Single-line wiring diagrams complete with size and type of conductor, voltage drop for estimated loop and network wiring.

.5 Overall system riser wiring diagram identifying control equipment, initiating zones, signalling circuits; identifying terminations, terminal numbers, conductors, and raceways.

.6 Battery and load calculation for all components of the system, identify spare capacity of the system.

.7 A sample of graphic command centre screen displays.

.8 Detail assembly and internal wiring diagrams for control units and consoles or cabinets. Show all cabinet sizes.

.2 Submittals to fire authority: Submit to the local fire authority at the same time as submittal to the consultant, all items required by subparagraphs of paragraph .1 above.

.3 System review and confirmation: As specified in Part 3 of this Section, submit a letter from the system manufacturer/supplier which confirms that the system has been properly installed in accordance with issued installation instructions CAN/ULC-524, and an inspection and verification report in accordance with CAN/ULC-S537.

.4 Panel/enclosure keys: Submit a minimum of 3 identified keys for any panel or enclosure with a keyed lock door.

.5 Spare parts: Prior to substantial performance, supply, in identified original packaging and hand to the owner at the site where directed, the following spare parts:

.1 Pull stations, 10% of the number installed, minimum three, and, if pull stations use glass rods, 20 glass rods

.2 Smoke detectors, 10% of the number installed for each type, minimum 2

.3 Thermal detectors, 5% of the number installed for each type, minimum 1

.4 control switches, 2 for each type used

.5 EVAC speaker assemblies, 5% of the number installed for each type, minimum 2

.6 Visible and audible signals other than speakers, 2 for each type used

.7 Isolators, 5

.6 As-built record drawing requirements: In addition to all other “as-built” conditions, indicate on as-built record drawings the locations of all end-of-line resistors and all line isolation modules.

.7 Independent party testing and verification agency: Submit the name, qualifications, and certification of the independent party testing and verification agency proposed for the project.

.8 Certificate of insurance: As specified in part 3, submit a certificate of insurance covering testing and verification of the fire alarm system.

.9 Warranty: Submit a signed extended warranty in the name of the owner covering the entire fire alarm system for a period of 1 year after the contract warranty expires. The terms of the extended warranty are to be full parts and on-site labour as for the contract warranty.

1.02 REFERENCES

.1 Government of Canada

.1 NBC, National Building Code of Canada, latest edition

.2 TB OSH Chapter 3-3, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-3, Fire Protection Standard for Electronic Data Processing Equipment

.3 TB OSH Chapter 3-4, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-4, Standard for Fire Alarm Systems

.2 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524, Installation of Fire Alarm Systems

.2 ULC-S525, Audible Signal Appliances for Fire Alarm

.3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm

.4 CAN/ULC-S527, Control Units, Fire Alarm

.5 CAN/ULC-S528, Manual Pull Stations

.6 CAN/ULC-S529, Smoke Detectors, Fire Alarm

.7 CAN/ULC-S530, Heat Actuated Fire Detectors, Fire Alarm

.8 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems

.9 CAN/ULC-S537, Verification of Fire Alarm Systems

.10 CAN/ULC-S1001, Integrated System Testing

1.03 QUALITY ASSURANCE

.1 The fire alarm system and its installation and testing are to be in accordance with requirements of all CSA and CAN/ULC Codes and Standards governing fire alarm system components, and installation and testing of the system.

.2 In addition, the system must comply with requirements of CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

.3 System Components: All system components are to be ULC listed and labelled in accordance with standards listed above, and, unless otherwise specified, are to be supplied by a single manufacturer. All components must be suitable in all respects for conditions of the installation location.

.4 System Software: System software is to be open protocol and full custom programmed with the system sequence of operation.

1.04 MAINTENANCE PERIOD REQUIREMENTS

.1 Include for a 1 year no cost (to the Owner) maintenance period to commence at notification of Substantial Performance and which is to include 2 site inspections of the system with reports. Inspections are to be scheduled with the Owner and Consultant.

.2 Where the work is phased and completed phases will be accepted and occupied by the Owner, include for requirements of paragraph .1 above for each such phase.

1.05 SOFTWARE REVISIONS

.1 After successful testing, verification, and commissioning of the system, but prior to Substantial Performance, obtain a list of final room, area, and, if applicable, building names and revise system software to incorporate all required revisions.

.2 Include for an additional software update to suit any requirements of governing authorities.

.3 In addition to programming revisions specified above, include for, after Substantial Performance, another site visit to make any supplementary software revisions requested by the Owner.

.4 Include for coordination meetings with Stakeholders and governing authorities to deliver a turnkey product, number of meetings as required to deliver the above required.

1.06 SYSTEM DESCRIPTION

.1 Fire alarm system is existing to remain.

.2 Fully supervised, microprocessor-based, field programmable, remote monitored fire alarm system, utilizing CPU, and on-board memory.

.3 Zoned, non-coded single stage.

.4 Modular in design to allow for future expansion.

.5 Operation of system shall not require personnel with special computer skills.

2 PRODUCTS

2.01 SINGLE-STAGE FIRE ALARM SYSTEM COMPONENTS

.1 General Description: Modular, central data communications and processing type, fully supervised, 1-stage, zoned, addressable, field programmable fire alarm system using digital techniques for data control and digital and multiplexing techniques for data transmission, designed such that each data communication link is limited to only 70% of its total capacity at initial installation and capable of supporting 100% of its designed capacity, The system is to be as indicated on the drawings and is to be complete with:

.1 a central alarm and control panel with power supply and standby batteries, central processor with microprocessor and logic interface, main system memory, input and output interfaces for alarm receiving, annunciation/display and program controls/signalling, and all required switches and controls

.2 remote annunciator(s)

.3 network nodes/transponders

.4 a manual control station for control of building services

.5 alarm initiating devices

.6 alarm signalling devices

.7 input output interface to other equipment

.8 door hold open/release hardware

.9 all required wiring including end-of-line resistors and addressable circuit isolators

.10 interconnections to other building systems

.2 Sequence of Operation – Trouble Alarm: Trouble alarm initiating devices, other than circuit isolators and similar devices, will generally be supplied and installed as part of the mechanical work. The devices are as indicated on the drawings and include:

.1 fire protection system supervised shut-off valves,

.2 fire protection system piping mains pressure switches for low pressure indication,

.3 fire protection pump trouble,

.4 fire protection pump not in auto,

.5 carbon monoxide detection

.6 dry sprinkler system air compressor loss of power indicated device,

.7 emergency power generator trouble,

.8 emergency power generator low fuel or gas valve closed,

.9 emergency generator ATS trouble/not in auto,

.10 emergency lighting systems,

.11 other fire alarm detection system,

.12 and fire pump start contact, Input from other fire alarm domains or separate fire detection system.

.3 Unless otherwise specified, activation of a trouble alarm device is to initiate the following sequence of operation:

.1 audible and visual trouble alarm signals to be activated at the control panel

.2 audible and visual trouble alarm signals to be activated at all connected remote annunciators

.3 a trouble alarm signal to be sent to the Building Operations Department via SMS and Internet interface technology

.4 acknowledging the trouble alarm is to silence the audible alarm but visual trouble alarm signals are to remain illuminated until the trouble condition has cleared, and the system has been reset at the control panel

.5 a trouble alarm is to be supressed during the course of a fire alarm

.4 Sequence of Operation – Alarm: Activation of any of the fire alarm devices indicated on the drawings, including fire protection system alarm valves and devices, is to initiate the following:

.1 fire alarm signals to sound continuously and all visual signal to operate continuously at the control panel and throughout all zones until the alarms are manually silenced/stopped at the control panel, but only after the silence-inhibit timer has timed out

.2 fire alarm system is to initiate trouble to all other domains of the system

.3 fire sign devices to illuminate

.4 the address and zone of the alarm to be registered at the control panel and all remote annunciators

.5 the outside monitoring company or the Fire Department (as connected) to be automatically notified

.6 the colour graphic to indicate the layout of the floor, the zone, and the device(s) in alarm

.7 smoke and fire doors with hold-open devices to release and close the doors

.8 the assigned message and activated control-by-event functions with time and date for the monitored point in alarm to be printed at the CPU printer

.9 locked doors equipped with electric locks to unlock and remain unlocked until the fire alarm system is reset

.10 interconnected mechanical equipment to shut down, all units serving multiple fire compartments of suites

.11 activate all assigned control points through control-by-event functions

.12 other campus style interconnected fire alarm panels to receive trouble signal

.13 domain style networked fire alarm digital gathering panels to show details of the fire alarm conditions on own LCD display

.14 music shut down relay to activate to shut down music or PA systems in the facility

.15 activation of all assigned control points through control-by-event functions

.16 elevator and escalator interface shall be programmed in accordance to elevator and escalator safety code

.17 fire shutters and/or smoke evacuation equipment shall be activated

.5 Sequence of Operation – Supervisory Alarm: Activation of any system supervisory device is to cause an electronic latch to lock-in a supervisory state at the control panel and any connected node/transponder and initiate the following:

.1 indicate the respective supervisory zone at the control panel and all remote annunciators

.2 cause an alarm signal to sound at the control panel

.3 activate a common supervisory circuit

2.02 ALARM CONTROL PANEL

.1 The panel for control and monitoring of the system is to be a modular, programmable, shall contain a microprocessor based Central Processing Unit (CPU), configurable, and field expandable without the need for special tools, EPROM programmers, or PC based programmers, and replacement of memory IC's. The CPU shall communicate with and control slave microprocessor-controlled modules which provide the interface to initiating device circuits, notification appliance circuits and building control relays. The panel is to support up to 20 logic equations including "and", "or" and "not", or time equations to be used for advanced programming, and logic equations are to require the use of a PC with a software utility designed for programming. The panel is to be equipped with Form C alarm, trouble, supervisory, and security relays rated at minimum 2 amperes at 30 volts DC, signal circuits programmable to be synchronized with the signals installed, and operator interface control and annunciation panel with a backlit LCD display, individual colour coded system status LEDs, and an alphanumeric keypad with rubber keys for field programming and control of the system.

.2 The panel is to be a wall mounting, dead front, NEMA/EEMAC 2 panel with piano hinged front door with lock and a minimum of 3 identified keys, and full door glazing. All controls and instructions are to be visible through the door window, and the door is to facilitate access to all operator controls. All electrical connections are to be front access by means of a removable inner protective cover.

.3 The panel is to be capable of chronologically logging and storing a minimum of 300 events in an alarm log and a minimum of 300 events in a separate trouble log. The historical logs are to be stored in the CPU memory and protected with a lithium battery supervised for a low battery condition. Each log record is to indicate the time and date of the occurrence, and log reports are to be generated upon request.

.4 The panel is to be complete with:

.1 the required number of addressable monitoring points and control/signal points plus a minimum of 20% spare capacity

.2 priority reporting levels with fire alarm assigned the highest priority, supervisory and monitoring assigned a lower priority, and third part priority assigned the lowest priority, with the capability of assigning control priorities to control points in the system to guarantee operation or allow emergency override as required

.3 an integral power supply, battery charger, and batteries as specified below

.4 password protected field programmable basic life safety software stored in non-volatile CPU memory

.5 circuitry to continuously monitor communications and data processing cycles of the microprocessor, and, upon failure, activate audible and visual trouble alarms

.6 self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks

.7 cross-zoning with the capability of counting, 2 detectors in alarm, 2 software zones in alarm, or 1 smoke detector and 1 thermal detector in alarm

.8 circuitry to continuously supervise wiring between the control panel and any remote nodes/transponders, and, upon failure, activate audible and visual alarms at the control panel

.9 hardware to support the required number of RS-232-CI/O ports for a remote printer, etc.

.10 an 8-line, 21 character LED which is to continuously indicate all trouble and fire alarms

.11 the ability to display system reports, and print system reports at a remote printer

.12 the ability to communicate on a local area network (LAN), with a firmware package that utilizes a peer-to-peer inherently regenerative communication format and protocol

.13 integrated web server interface for e-mail notification

.14 integrated SMS text interface for notification via text messaging.

.5 Utility Power Supply Connection Facilities: Suitable for a minimum of 6 amperes of 120-volt AC, 60 Hz power for the panel and peripheral devices, with provisions to permit audio-visual power to be increased as required by adding modular expansion audio-visual power supplies. The power supply connection facility is to continuously monitor all field wiring for earth ground conditions and is to be equipped with a Ground Fault LED, and AC Power Failure LED, and notification appliance circuit on LED (4).

.6 Field Power Supply: Continuous duty, filtered and regulated 24-volt DC supply sized for present requirements plus a minimum of 20% future requirements, power limited within a range of from 20.4 to 32 volts DC, and with automatic "Brownout" transfer to standby batteries when the supply voltage falls below the set limit

.7 Standby Power: Sufficient standby power is to be provided to operate the entire system in a normal supervisory mode for a minimum of 24 hours upon loss of normal utility power, and immediately followed by system operation under full power for a minimum of 2 hours. Batteries are to be sealed, maintenance free lead-acid, nickel-cadmium, or gel-cell batteries supervised such that a low battery power condition or disconnection of the batteries will activate an audible and visual trouble alarm at the central control facility. The batteries are to be complete with an automatic charger capable of re-charging the batteries to 70% of ultimate capacity within 12 hours, and a transient voltage surge protection device as recommended by the system supplier is to be provided.

.1 battery load calculation to be provided at time of shop drawing submission to confirm batteries sized for entire system capacity

.2 batteries to be sized to provide 100% power sized for maximum system applicable output

.3 provide battery calculation to identify battery output capacity related to the presently connected load

2.03 NETWORK NODES OR TRANSPONDERS

.1 Generally, as specified above for the control panel but designed for remote mounting as a control panel and for interconnection to and interface with the control panel.

2.04 PRINTER(S)

.1 Desktop, 120-volt, 60 Hz AC, thermal head, 80 column printer to provide a hard copy of fire alarm system event, capable of receiving English language text from the control panel in ASCII format via an EIA RS-232-C connection and other standard communications protocols. Each printer is to include the following features:

.1 the dates and time on all printed information

.2 180 characters per second

.3 3 kilobytes buffer capacity

.4 cartridge type ribbon

.5 friction feed for cut forms, tractor feed for continuous 240 mm (9 7/16") wide pin-to pin fanfold paper

2.05 TROUBLE ALARM INITIATING DEVICES

.1 Generally, trouble alarm initiating devices other than those associated with fire alarm system equipment problems, will be supplied, and mounted as part of the mechanical work.

2.06 FIRE ALARM INITIATING DEVICES

.1 Fire alarm initiating devices are to be as indicated on the drawings and as follows:

.1 Manual Pull Station: Addressable manual pull stations in accordance with requirements of CAN/ULC S528, semi-flush or surface mounted as required and/or shown, constructed of red polycarbonate material, designed with a push-in pull-down handle that activates the normally open alarm switch and displays yellow "ACTIVATED" lettering, with special key operated reset. Each station's address will be set at the time of installation, and stations are to be complete with:

.1 clearly visible bilingual (English-French) operating instructions on the cover and minimum 25 mm (1") high "FIRE" white identification

.2 a steel back box for surface mounting stations

.3 3 sets of 2 reset keys

.4 auxiliary contact(s) as required to connect to items such as fire door release mechanisms

.5 where indicated or required, a ULC listed clear Lexan hinged cover with, if required by Code or local authorities, a tamper alarm (include for supply of 10 covers)

.6 for pull stations where indicated, explosion-proof facilities

.1 Sensor Bases: Addressable analogue smoke and thermal detectors specified below are to be complete with a white, surface mounting base to which the sensor twist-lock mounts to provide digital transmission of analogue sensor values via 2-wire communicating wiring. The base electronics are to constantly monitor the status of the detachable sensor, and each sensor's output is to be digitized and transmitted to the fire alarm control panel every 4 seconds. Bases are to mount to a standard 100 mm (4") square or octagonal box and are to be complete with:

.1 an address which remains with its programmed location

.2 automatic identification which provides default sensitivity if sensor types are substituted

.3 an integral red LED which pulses to indicate a normal condition and power on, and remains on to indicate an alarm or trouble

.4 a supervised LED relay which is activated when the base LED is on steady indicating local alarm or trouble, connected to a remote wall mounting LED alarm indicator with LED alarm and stainless steel faceplate

.2 Alarm Sensors: Alarm sensors are to be sealed against rear air flow entry, are to twist-lock mount to any of the sensor bases and are to be complete with EMI/RFI shielded electronics. Alarm sensors are to be as follows:

.1 Heat Sensors: Programmable self-restoring sensors with a rate compensating fixed temperature setting as indicted on the drawings

.2 Photoelectric Smoke Sensors: Stable, selectable sensitivity, 360° smoke entry design head with pulsed infrared LED light source and silicon photodiode receiver for constant and accurate low power smoke sensing, a 3 mesh insect screen, and, where indicated, and auxiliary contact for connection to an associated device

.3 Ionization Smoke Detector: Selectable sensitivity, 360° smoke entry design head with single radioactive source with outer sampling ionization chamber and inner reference ionization chamber for stable operation under fluctuations in ambient temperature and humidity, designed such that the presence of particles of combustion cause a change in voltage ratio between chambers which is measured by the sensor electronics and digitally transmit to the control panel for processing, and equipped with 30 mesh insect screen, and, where indicated, an auxiliary contact for connection to an associated device

.4 Duct Mounted Smoke Detectors: Addressable photoelectric type smoke detectors in an air-tight duct mounting housing and complete with:

.1 an air sampling tube of suitable length for insertion into the duct

.2 a test switch, or, for duct detectors in locations not easily accessible, a remote test station

.3 status LED's

.4 Form C auxiliary alarm relays

.5 a remote wall mounting alarm indicator with LED and stainless steel faceplate

.6 for detectors in ductwork as indicated on the drawings, and for air intake ductwork, a ULC listed ad labelled weatherproof housing with electric heater, thermostat control, and low temperature trouble alarm contact

.5 Combined Fire-Smoke Detectors: Multi-criteria sensors for twist-lock mounting to a sensor base as described above, complete with advanced algorithms to interpret, and respond to the multiple inputs, 6 levels of sensitivity, twin LED indicators for 360° visibility and which can be control panel controlled to blink, latch-on, or latch-off, an integral test switch, and the following 4 separate sensing elements:

.1 electrochemical cell technology that monitors carbon monoxide produced by a smouldering fire

.2 infrared sensing to measure ambient light levels and flame signatures

.3 photoelectric smoke detection

.4 thermal detection for temperature monitoring

.6 Reflected Beam Smoke Detectors: Equal to BEAM1224A(SA), ULC listed single-ended reflected design beam smoke detector with a 5 m to 100 m (16' to 330') protection range, ±10° horizontal and vertical adjustment angles with optical gun sight and integral signal strength indication with 2 digit display, 6 user selectable sensitivity levels, local red LED and remote alarm indication, local yellow LED and remote trouble alarm, local flashing green normal condition LED, integral sensitivity test filter, sensitivity filter, local alarm test switch, local alarm reset switch, remote test and reset switch with test station, and all required mounting and connecting accessories.

2.07 AUDIBLE ALARM SIGNALS (BELLS)

.1 In accordance with CAN/ULC-525 and as follows:

.1 Bells: Minimum 200 mm (8") diameter, polarized, low operating current, under-dome design, synchronized, with the input polarized for standard reverse polarity supervision by the fire alarm system control panel, each complete with a low frequency aluminium shell, integrated RFI suppression, permanent magnet DC motor with steel striker, wiring screw terminals, and the following:

.1 for surface mounting interior and exterior bells, a suitable red enamelled steel back-box

.2 for semi-flush mounting interior bells, a trim plate and a standard 100 mm (4") square box

.3 for flush mounted interior bells, a proper back-box, and a brushed stainless steel grille

.2 Exterior and Unfinished Area Horn Speakers: Surface mounting red horns, weather-proof where required, with 2 sound levels of 90 and 95 dBA at 3 m (10') and equipped with a back-plate for mounting to an outlet box.

2.08 VISUAL ALARM SIGNALS

.1 In accordance with CAN/ULC-S526 and as follows:

.1 Strobe Lights: Wall or ceiling mounting as indicated, low current design, synchronized, with the input polarized for standard reverse polarity supervision by the firm alarm control panel, complete with a universal mounting plate suitable for mounting on a standard 100 mm (4") square outlet box, and equipped with:

.1 a flash rate of 1 flash per second over the regulated voltage range, with a LED enclosed within a lens

.2 for installation in low ceilings a minimum of 4 field selectable strobe intensities of 15, 30, 75 and 110 candela, with tamper-proof selector switch

.3 for installation in high ceilings (higher than six (6) meters) a minimum of 4 field selectable strobe intensities of: 135, 150, 177 and 185 candela, with tamper-proof selector switch

.4 synchronization modules that will not permit the strobes to drift out of synchronization at any time during operation, and if the sync module fails to operate the strobe is to revert to non-synchronized flash rate

.5 a cover plate for strobes located in finished area, white or red selection applicable at no cost

.6 for strobe lights in non-climate controlled areas, a weatherproof back box and weatherproofing for the light assembly

.7 Listed for ceiling or wall mounting

.2 Beacon Lights: Surface mounting LED beacon light assemblies, each approximately 165 mm (6 ½") diameter by 150 mm (6") high and complete with a polycarbonate base, amber, red, or blue colour as selected by the Consultant, ten selectable "strobing" flash patterns which completely fill the lens, a synchronization or alternate flash feature, and a mounting plate and hardware to suit the application.

.3 Fire Signs: Illuminated, LED, flashing, 24 volt DC "FIRE DO NOT ENTER" sign with a black face and red letters which are not visible until the sign is energized. Each sign is to be complete with a satin finish aluminium housing, 2 rows of long life LEDs rated for minimum of 100,000 hours of life, a flasher, and Lexan guard. FIRE lettering is to be 50 mm (2") high. DO NOT ENTER lettering is to be 40 mm (1½") high.

2.09 AUDIBLE ALARM SIGNALS (HORNS)

.1 In accordance with CAN/ULC-S525 and as follows:

.1 Horns: Wall or ceiling mounting as indicated, low current design, automatic selection of 12- or 24-volt operation, horn tones, shall have three audibility options and an option to switch between a temporal three pattern and a non-temporal (continuous) pattern, and three volume options enable installers to easily adapt devices to meet requirements, complete with a universal mounting plate suitable for mounting on a standard 100 mm (4") square outlet box, and equipped with:

.1 White or red selection applicable at no cost

.2 Rotary switch for horn tone and three volume selections

.3 Horn rated at 88+ dBA at 16 volts

.4 Plug-in design with minimal intrusion into the back box

.5 Tamper-resistant construction

.6 Listed for ceiling or wall mounting

.7 Nominal Voltage Regulated 12 DC/FWR or regulated 24 DC/FWR1

.8 Operating Voltage Range 8 to 17.5 V (12 V nominal) or 16 to 33 V (24 V nominal)

.2 Horn Strobe Combination:

.1 Shall comply with all provisions related to stand alone strobe and horn devices.

.2 Where require, four-wire products shall be used to allow the strobe to be powered independently of the sounder. The horn or horn strobe models shall operate on a coded or non-coded power supply.

2.10 END-OF LINE RESISTORS

.1 Sized to ensure correct supervisory current flows in alarm signal circuits and secured to a stainless-steel plate for mounting to a single gang outlet box.

2.11 SHORT CIRCUIT ISOLATORS

.1 Addressable short circuit isolator with input and output wiring terminals, designed to automatically isolate wire-to-wire short circuits on a SLC loop, send an address to the control panel, and only disconnect devices connected to the short circuit loop while all other devices connected to the isolator loops will remain in operation. Each isolator is to mount in a standard 100 mm (4") outlet box and is to be equipped with an identified stainless steel faceplate with LED that flashes when all circuits are normal and remains illuminated when a short circuit condition has been detected and isolated.

2.12 WIRING

.1 In accordance with CSA C22.2 No. 208, CAN/ULC-S524, and governing Codes and Regulations, all electrically supervised, and as follows:

.1 Power wiring to control panel and between panel and transponders, annunciators, etc.: Tyco "Pyrontenax" type MI 2-hour fire rated, mineral insulated, copper sheathed, copper conductor cable

.2 Risers between network transponders: To include single #18 AWG twisted shielded cable for each riser, in Class A style 6/7 identified loops, in addition to other fire rated conductors

.3 All other wiring unless otherwise specified: Minimum 105° C (220° F) rated with copper conductors and colour coded insulation, and, unless otherwise shown or specified, sized in accordance with the fire alarm system manufacturer's instructions but, in any case minimum No. 16 AWG

.4 Fire alarm system shall be wired as class A for all initiating and signalling devices.

.5 Class "A" loop riser with class "B" connected field devices is applicable only when connecting field devices in an enclosed space (utility room) where End-Of-Line devices are terminated to a final equipment such as sprinkler switches, generator equipment elevator equipment and similar.

.6 If Class "A" loop riser with class "B" connected field devices wiring is used at a specific area fault line isolator shall be installed at entrance and exit of the noted area.

3 EXECUTION

3.01 INSTALLATION OF FIRE ALARM SYSTEM

.1 Provide a complete fire alarm system in accordance with the Contract Documents, requirements of CAN/ULC-S524, and governing authorities.

.2 Generally, install components where shown but confirm exact locations prior to roughing-in. In finished areas with suspended ceilings, refer to architectural reflected ceiling plans but do not support devices from the suspended ceiling. Ensure that all devices in “wet” non-climate controlled areas and all exterior devices are weatherproof.

.3 Power Connection Requirements: Ensure that all system control panels, annunciators, and transponders are connected with fire rated power conductors sized for the application and extended from a dedicated fused disconnect circuit which is supervised such that any power failure will be audibly and visually alarmed at the transponder(s) and remote annunciator(s).

.4 “Head End” Equipment: Locate the control panel, annunciators, displays, and other “head end” equipment where shown and carefully coordinate installation with adjacent work. Wall mount transponders so as to be accessible and ensure that each transponder is properly identified.

.5 Manual Pull Stations: Install pull stations in standard outlet boxes, galvanized steel for recessed stations. “Condulet” type cast metal boxes for surface mounted stations. Comply with governing mounting height requirements, including barrier-free height requirements.

.6 Alarm Initiating Detectors: Install the base for each alarm initiating detector to an outlet box, galvanized steel recessed type for devices in finished areas, surface mounted cast metal “Condulet” type boxes for devices in unfinished areas. Secure detector heads to the base.

.7 Duct Smoke Detectors: Carefully coordinate installation of duct smoke detectors with the trade installing the ducts. The sheet metal trade will drill a hole for the sampling tube. Install the tube and secure the detector to the duct. Provide stand-off mounting for detectors on insulated ducts. Provide remote LED indicator assemblies for duct detectors which are not clearly visible from the floor.

.8 Patient Room/Area Detectors: Interconnect patient room/area detectors with annunciator to the local Nurse’s Station and to the room/area nurse call dome light.

.9 Computer Room Detectors: In the Computer Room(s) where shown and/or specified, cross-zone connect detectors and remote indicating devices as indicated.

.10 Audible Alarm Signal Devices: Audible device locations are indicated on the drawings; however, the exact quantity and locations of audible signal devices is to suit the results of a site audibility coverage test performed by the system supplier using approved instrumentation and experienced test personnel. Relocate audible signal devices and/or provide additional audible signal devices as required by results of the test.

.11 Visual Alarm Signal Devices: Visual alarm signal device locations are indicated on the drawings. Unless otherwise indicated, locate wall mounted devices 2.4 m (8') above the floor and ceiling mounted devices 300 mm (12") below the finished ceiling. Provide a minimum of 2 circuits per floor and connect the devices in an alternating scheme.

.12 Fire Signs: Confirm exact location of fire signs prior to roughing-in and connect such that activation of the fire alarm system illuminates the sign, and, when the fire alarm system is reset, the sign is de-energized.

.13 Door Hardware: Carefully coordinate wiring connections to door hold-open hardware or electrical door locks with the installation of the hardware such that hold-open devices release the doors and electric locks are de-energized upon fire alarm system activation as specified.

.14 Wiring Connections to Other Building Systems and Equipment: Provide supervised wiring connections from fire alarm system components to building systems as shown and/or specified on the drawings.

.15 Wiring Requirements: Do all system wiring. Except for fire rated cable, install wiring in minimum 20 mm (¾") conduit. Conform to the following requirements:

.1 connect all wiring to colour code, identified and numbered terminal strips in junction boxes or at equipment

.2 ensure that colour coding is consistent for the entire length of each run

.3 provide all wiring in accordance with requirement of governing Codes and Regulations

.4 install alarm indicting circuits and alarm receiving circuits in separate conduit

.5 provide end-of-line resistors to electrically supervise all wiring

.6 ground and bond all system cabinets and other work to the building grounding system

3.02 SYSTEM PROGRAMMING

.1 Arrange for all required system programming to be done by the system manufacturer's technical representatives.

3.03 SYSTEM TESTING CERTIFICATION, AND VERIFICATION

.1 The system manufacturer or an independent third-party testing company are to test and verify the completed system. The third-party testing company or manufacturer is to have primary responsibility for testing and verification.

.1 System Manufacturer's Testing and Verification: Accompanied by qualified personnel of the system manufacturer, visually inspect the system for completeness, then test system operation, including all alarm initiating devices, signal devices, and all other system operation and functions. When the system manufacturer confirms that the system is operating as intended, obtain from manufacturer, and submit copies of signed test and inspection sheets, and a signed letter from the system manufacturer certifying that the system has been checked, tested, operated, adjusted, and is operating as intended, all as per CAN/ULC-S536. Qualified personnel system manufacturer's personnel are also to be available on-site to accompany independent third-party personnel testing and verification.

.2 System Testing and Verification: Accompanied by qualified personnel of the system manufacturer, visually inspect the system for completeness, then test system operation, including all alarm initiating devices, signal devices, and all other system operation and functions. Check wiring for fault, open circuit and ground condition, check conductor size, type of conductor, insulation and shielding where applied and necessary. When the system manufacturer confirms that the system is operating as intended, obtain from manufacturer, and submit copies of signed tests and inspection sheets. Provide signed letter certifying that system has been verified, checked, tested, operated, adjusted, and is operating as intended. Obtain record of wiring and performance verification documentation as governed by ULC.

.3 Retain and pay all cost for testing and verification of the system in accordance with CAN/ULC S537 and CAN/ULC S1001. The fire alarm system provider testing agency is to be a qualified and experienced testing agency with personnel trained in accordance with the Fire Alarm Technology Program of the Canadian Fire Protection Association, or Certified Fire Alarm Electricians certified by the Electrical Contractors Association of Ontario. All such personnel are to carry identification cards at all times while on-site.

.4 Include in contract and be responsible for all aspects of testing and verification of the fire alarm system, all required coordination with owner, governing authorities, and other trades and:

.1 coordinating attendance at the site of all required fire inspection personnel so as to obtain their approval of testing and verifying work

.2 coordinating attendance at the site of system manufacturer's technical personnel to advise as required

.3 written confirmation that all alarm initiating devices, signals, paging, telephone, and all other components have been tested and operate properly

.4 written confirmation that all supervised wiring is properly installed and operating and is in accordance with all applicable requirements

.5 written confirmation that the overall system and sequences of operation, including operation of communication equipment, mechanical equipment, elevators, similar equipment a specified, battery power and charging have been tested and are in accordance with all requirements and meet with the approval of local governing authorities

.6 submittal of signed test report sheets and a signed Verification Certificate and approval documentation issued by the local Fire Authorities

.5 Independent Fourth Party System Testing and Verification: After the verification of the fire alarm system is complete, the Contractor shall engage the services of an independent testing organization to verify the fire alarm. Retain and pay all cost for independent fourth party testing and verification of the system. The independent fourth party is to be a qualified and experienced testing agency with personnel trained in accordance with the Fire Alarm Technology Program of the Canadian Fire Protection Association, or Certified Fire Alarm Electricians certified by the Electrical Contractors Association of Ontario. All such personnel are to carry identification cards at all times while on-site.

.1 Provide independent written report equivalent to the report provided by the fire alarm system provider. Report shall follow ULC guidelines per CAN/ULC S537.

.2 The fourth party report shall be seal/stamp signed and dated by a Professional Engineer licensed to practice in the Province

.3 Independent fourth party testing agency may not be affiliated with the system manufacturer.

3.04 LIABILITY INSURANCE POLICY

.1 Within 15 days of written notification of award on contract, submit a Certificate of Insurance for a Commercial General Liability Insurance Policy from an insurer licensed to do business in the Province of the work and signed by an officer of the insurer covering public liability and property damage in a minimum amount of 2 million dollars inclusive in Canadian funds and insuring all services, operations, products, and fire alarm system work. The policy is to be extended to include bodily injury, property damage, personal and advertising injury, products and completed operations, contractual liability, Owners and Contractors protective liability and to a limit of not less than 2 million dollars Canadian per occurrence.

.2 The policy is to:

.1 include a cross liability clause and be endorsed to include the Owner

.2 include non-owned automobile insurance to a limit of not less than 2 million dollars Canadian

.3 include automobile insurance (OAP1) for both owned and leased vehicles with inclusive limits of 2 million dollars Canadian

.4 be non-contributing with and will apply only as primary and not excess to any other insurance of self-insurance available to the Owner

.5 contain and undertaking by the insurers to notify the Owner in writing not less than 30 days before and material change in coverage or cancellation of coverage

3.05 SOFTWARE CHANGES

.1 Provide all software and programming changes as may be required by the Property Management or Authorities having Jurisdiction, at no additional cost to the Owner. Coordinate names of all devices with Property Management and Sprinkler Contractor, and Authorities Having Jurisdiction before final handover.

3.06 SPARE PARTS INSTALLATION:

.1 Include in tender all inclusive labour and material, including, installation, coordination, task management, testing and verification required to install the spare parts identified in the General requirements of this specification

3.07 TRAINING

.1 Allow to fully train the Property Management, Security and Maintenance Staff and the Local Authority with the operating of the system.

.2 Allow for at least 3, four-hour training sessions.

3.08 WORK IN EXISTING BUILDING SUBJECT

.1 Interface with existing building.

.2 The expansion/renovation shall be tied into the existing building fire alarm.

.3 Due to the phased nature of this project, include for a fully operational and verified fire alarm installation for the separate phase one construction. Include a temporary annunciator at a location to be approved by governing authorities.

.4 The manufacturer shall supply to the contractor reasonable amounts of technical assistance with respect to any changes necessary to conform, the work to paragraphs above. During the period of inspection by the manufactures electricians, they shall check that the system is installed as designed by the manufacturer.

.5 After the verification of the system is complete, the Contractor shall engage the services of an independent organization to verify the fire alarm. Every new device shall be checked for correct operation, address, and display. This verification shall be sealed by a registered Professional Engineer. The selection of the fourth party verifier is subject to prior approval by the Consultant.

.6 Due to the phase nature of the project, carry out a total ULC S536 inspection at the end of the project

END OF SECTION